

**Adaptive Clothing Designing for Special Needs
of Physically Challenged Hemiplegia Patients**



By

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Statement of Submission

My research dissertation titled, “Adaptive Clothing Designing for Special Needs of Physically Challenged Hemiplegia Patients” is being submitted in partial fulfillment of the requirements for the degree of PhD in Textile from School of Textile and Design, University of Management and Technology, Lahore, Pakistan.

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Declaration

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Abstract

Current action research is an interpretive/qualitative research; it was conducted as exploratory case study research with mix methods of data collection along with one dress trial intervention to develop a holistic understanding of the research issue. The research comprised of four phases of progressive data collection and interpretations to meet the given objectives of study. The phase one of this research was a survey for quantitative need assessment with respect to five major guiding aspects of adaptive clothing designs for hemiplegia patients and specialized caregivers to such patients. Phase two comprised of in-depth qualitative need assessment with respect to five major guiding aspects for adaptive clothing designs for hemiplegia patients from selected case study participants. Along with this, the detailed information was also collected by semi structured interviews from specialist doctors. Analysis of data of phase one and two of study led to phase three that comprised of designing and construction of adaptive garments for comfort and ease of movement. In the light of quantitative and qualitative adaptive clothing needs of hemiplegic adult patients, three designs were drawn and discussed, material was selected as per its performance requirement characteristics. A prototype was created to ensure design details encompassing detailing of construction, location of openings, number and type of fastenings, and structural design of garments. Two sets of final design of adaptive clothing were stitched. For fourth phase of study a dress trial intervention was exercised to assess effectiveness of proposed adaptive clothing design and results were compiled.

Keywords: *adaptive clothing, user centered design, functional design, physically challenged*

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Chapter 1

Introduction

Clothing is one of basic human needs hence holds a large-scale design implication (Candy, 2007). Among the current concepts of product design much focus is laid upon human aging. Continuous progression of clothing needs begins at birth and concludes in demise, with one requiring special clothing because of experiencing incidences of disease, chances of accidents and a progressive decline in physical and sensual capacities (Cookman & Zimmerman, 1961; GI&FDED, 2004). All these changes impair independent lifestyle as well as put restriction on types and range of various activities. Thus, individuals facing physical challenges develop a special set of needs which are different from the needs of normal people. Special clothing needs arise from different medical situations. In all such conditions supply of suitable clothing commodities holds much importance (Jon, 1977; Candy, 2007). Hemiplegia is paralysis of one lateral side of the human body or loss of motor functions ranging from severe to complete on one side of individual (Moses, 2008). When someone experiences a hemiplegia stroke, along with other physical restrictions the act of getting dressed becomes an agonizing suffering for patient; it affects one physically as well as emotionally. Adaptive clothing is a clothing design concept that is focused on decreased joint movement while dressing which results in reduction in pain and discomfort for patient as well as for caregiver (Katherine & Kevin, 2010). Adaptive clothing solutions allow patients to maintain dignity, comfort, and familiarity. Decisions about clothing products are mostly based on their perceived social gains and functional benefits (Deepti, 2011). Physical, social, psychological, and personal needs are simultaneously fulfilled by clothing (Katherine E. C., 2001). In contemporary complex socio-technical systems of human society, activities of design have a diverse range of applications (Beamish, 1999). User-centered designing is considered as a planned problem-solving

activity, involving multi-stage decision making where needs of users dominate the ultimate design (Jan, et al., 2003).

Explicit nature of every kind of physical challenge and its accompanying unique characteristics require individualized attention, basic principles of user centered designing can be incorporated to probe deeply and to gauge precisely the particular everyday clothing requirements which can be accurately mapped in adaptive clothing solutions (Katherine & Kevin, 2010). Within this conceptual logic rests the deliberation of integrating user centered design practices while designing adaptive clothing focusing on special needs arising from physical challenges due to hemiplegia.

1.1 Clothing Designing

Clothing designing is specifically related to the application of design principles to dress making and accessory designing. Clothing is an essential need of all and is an area of global consideration (Behrens, 1963). This specific area of study has a diversified and multidimensional application. Among the contemporary concepts of clothing product design much focus is laid upon special needs of users (Kristie, 2013). All such probable changes bring restrictions and cause impairment on independent activities of life. Hence, individuals facing any physical challenge develop a special set of clothing needs which are different from the clothing needs of normal people (Katherine & Kevin, 2010; Meinander & Varheenmaa, 2002). The interrelationship of physical and sensual vulnerability in aging and accompanying special needs is also brought into limelight by following four facts:

- 1) Young individuals change to old persons,
- 2) Young individuals may turn to incapacitated individuals,
- 3) Aged individuals may turn to incapacitated individuals,

4) Incapacitated individuals may age.

Varied physical challenges result in numerous impaired lifestyles which require special clothing, which can explicitly cater to novel requirements (Jon, 1977). Explicitly special clothing needs may arise from diverse medical situations (Katherine & Kevin, 2010). Satisfying clothing needs of such people suffering from various medical disorders, causing restricted or no movement of joints is challenging (Cookman & Zimmerman, 1961). Within each situation that impairs independent lifestyle, users expect availability of appropriate everyday clothing products (Jan, et al., 2003). Complete knowledge of novel physical characteristics of disease and awareness of problems of the patients, while they are performing everyday clothing tasks, is needed to propose meaningful clothing solutions (Kernaleguen, 1978). For effective designing of everyday clothing products for these individuals, their specific needs must be properly investigated (Behrens, 1963). In all such conditions supply of suitable daily clothing commodities which accommodate of special needs holds much importance (Beamish, 1999). Continually emergent magnitude of contemporary clothing product designing has directed its attention to explore probabilities of adaptive clothing designing for various explicit special requirements (Kidd, 2006; Candy, 2007; Yassi & Hancock, 2005; Ali, 2004).

1.2 Adaptive Clothing Designing

Adaptive clothing is a clothing design concept that is focused on decreased joint movement while dressing leading to reduction in pain and discomfort for patient, as well as for caregiver (Yep, 1977; Standifer, Caleb, & Hope, 2003; Valley & Court, 2003). Adaptive clothing designing is the specific manner of bringing modifications to basic layout of clothing for provision and accommodation of deliberated requirements (Newman, Springer, & Dee, 2004; Deepti, 2011). Adaptive clothing solutions aim to

allow patients to maintain dignity, comfort, and familiarity (Reich & Shannon, 1980). Multiplicity of adaptations requires contemporary fashion designers to effectively determine particular functional requirements of the adaptive clothing, according to specific constraints and problems experienced by wearer, as a set of explicit modifications needed in structure of standard clothing patterns (Boettke & Zook, 1956; DBMAS, 2012).

1.3 Major Aspects of Adaptive Clothing Designing

An effective adaptive clothing design needs to meet certain essentials. Five salient factors which effect the process of adaptive designing are schematically presented in Fig 1 (Candy, 2007; GI&FDED, 2004; Katherine E. C., 2001). For attainment of desired outcomes while creating adaptive clothing designs these features are to be given importance.

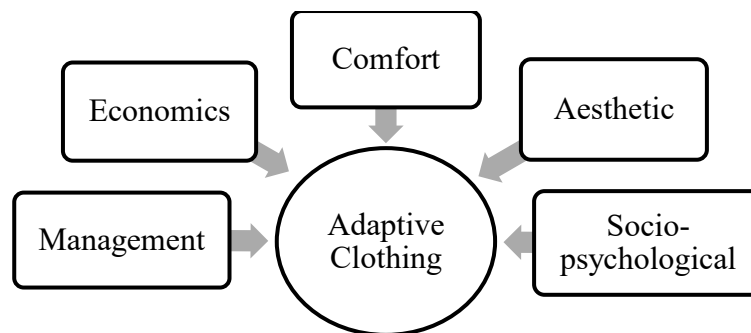


Figure 1.1: Major Aspects of Adaptive Clothing Designing

A successful consolidation of all these aspects positively results in anticipated outcomes of any specific need based adaptive clothing design research (Na, 2007; Ali, 2004). In socio-psychological aspect, adaptive clothing can provide immense self-confidence and boost among individuals with special needs (Newton, 1984-1985). In aesthetic aspect, it should be attractive and fashionable. In management aspect, everyday easy care and storage should be addressed. In economical aspect, it should be within the reasonable price range so that individuals with special needs can afford it

(Reich & Otten, 1991). Comfort and ease must be considered to make dressing easier and less painful and frustrating (Yassi & Hancock, 2005; Kernalleguen, 1978; Wojciechowski, 2003). As far as physical utilization of adaptive clothing is considered it must provide comfort to the wearer in all respects, including the comfort of the textile material used and comfort due to altered structure of the garment (Bartels, 2011; O'Mahony, 2006; Horrocks & Anand, 2000).

Among important considerations when adaptive clothing is designed are to reduce patient pain by minimizing joint movements and to decrease the amount of manual repositioning of the patient by the attendant (Garg & Owen, 1992; OHSAH, 2003). The dignity of the patient is also a consideration, clothing is an essential part of one's appearance, and shows wearer's personality, thus it is essential that the adapted clothing should not make the patients feel institutionalized or embarrassed in any way (Kidd, 2006). The sense of self-assurance, feeling of wellbeing and an impression of public reception is acquired by wearing such clothing solutions which are simultaneously aesthetical, appropriate, economical, manageable, and functional (Kottke, 1982). Designing special clothing for specific requirements can deliver an enormous socio-psychological enhancement amongst the individuals with special needs (Ranu, Madhuchanda, & Pratiti, 1995). This clothing outcome is important to everyone, but it becomes significantly important to those who are with some special need (Lamb, 1993; Campbell, Maxey, & Watson, 1995). Ethics dictate that the exceptional requirements of this population have to be premeditated in order to provide them some opportunities of better life (Reich & Shannon, 1980). Pragmatic efforts in the arena of clothing designing are focused to provide optimum satisfaction to wearer with special needs in daily life situations (Yep, 1977; Naheed, Muhammad, & Samia, 2012; Meinander & Varheenmaa, 2002). Improved physical appearance through

enhanced clothing designs can help such segment of society to have self-assurance and social confidence (Boettke & Zook, 1956; Katherine E. C., 2001).

1.4 Design Thinking

Design is recognized as a problem-solving activity (Jan, et al., 2003). Recently investigations of design philosophy, design methods and design processing graduated as scientific studies in social sciences (Donald, 1990; Kidd, 2006). Design is found in everything around us, natural as well as man-made. Success of man-made design effort is gauged by how strongly it affects the quality of life of the user (Nigel, 2011). Innovative, effective, efficient, inspiring, ethical, and stimulating designing is much needed now than ever before (Parsons, 2009; Nigel, 2011). Herbert Simon: “everyone who devises courses of action, to change existing situations into preferred ones, is doing design” (Herbert, 1988)

Design thinking is fundamental to design practice. Features of design thinking are transitory. Contemporary design methods evolve with novel and emerging zones of concern (Babbie, 1992; Jan, et al., 2003). Design thinking forms multidisciplinary design practice, and at times this thinking is also molded by practice (Herbert, 1988). In the domain of design there is exceptionally less empirical research available on design thinking and abundance of research is found on design methods and design processes (Donald, 1990). Surprisingly despite the importance of good designs, design activities have always been considered as an activity needing no special abilities. It is only very recent that possession of some exceptional talent is regarded as a basic ingredient in pursuing successful designs (Nigel, 2011). The traditional craft-based activities need no separate prior activity like drawing and modeling before the activity of making, on the contrary the modern industrial production indulges in a complete design process before the activity of making or production (Herbert, 1988; Nigel, 2011).

It is worth knowing that these design activities are necessarily based on one of diverse formal methods, each design method is chosen for its appropriateness in particular purpose (Buchanan, 1992). As a result, growing number of academic and professional bodies of knowledge are now emerging to bring into limelight nature of different design methods and core features or aspect of particular design mannerism (Nigel, 2011; Kronenburg, 2006). Usually, design is a problem-solving activity, but it definitely is not a search for the optimum solution of any given problem alone, but it is an exploratory process comprising of the interpretations proposed by the designer after understanding the design brief to reach to something new rather than reaching to some existing optimal point (Morley & Tinero, 2006). Instead of understanding designing as a mysterious activity it has to be comprehended that it is one of highest forms of human intelligence, expert designers utilize enhanced forms of certain tacit, deep-seated cognitive skills which can be unraveled in terms of the context of the task (Donald, 1990). The tricky relationship between the problem (what is required) and its solution (how to satisfy that) is endorsed by almost all designers across all domains of design. One unanimous consensus across all types of design is placing greater emphasis on clearly defining the design problem, any attempt that fails to fulfill this fundamental step usually results in ambiguities not only during the other steps of design process but same is evident in resulting solution (Nigel, 2011). All attempts made to set out models of an ideal design-process and suggestions for the methodologies as well as structured-approaches to efficiently lead the designers towards a good solution base their debate anchored to true identification of design problem. The main objective was to reveal and articulate the apparently ambiguous cognitive and creative abilities of designers, that are common across many domains of designs (Beamish, 1999),

1.5 User Centered Designing

In contemporary complex socio-technical systems of human society, activities of design evolved in a varied range of applications (Deepti, 2011). Among most recent evolutions is user centered designing approach which emphasizes that the purpose of any design is to serve the user, not to use a specific technology or not to create an elegant piece (Buchanan, 1992). User-centered designing involves extensive attention to the requirements, the needs, and the restrictions of real end handlers of merchandise or service at each stage of design process (Donald, 1990; Kronenburg, 2006). User-centered designing is considered as a planned problem-solving activity involving multi-stage decision making. In these course of actions needs of users dominate the ultimate design (Herbert, 1988; Parsons, 2009; Jan, et al., 2003).

The ease with which one can do things can dramatically affect our view of our self, our society, and our world (Donald, 1990). Revolutionary design theorist Donald Norman is considered as the father of user-centered design concept who laid larger emphasis on design thinking for specialized problem-solving mannerism. As a result of this transformation user interests and needs were preferred on the mere usability tests. Favor of end-user control and humanized approach to the entire process of designing was first extended by Norman, but it was latter incidentally endorsed by various designers from broad area of industry and practice. The role of users elevated from being guineapigs to co-developers of the design system. All these changes paved path for opening of a holistic perspective to design process. Acceptance of user role resulted in shift of techno-driven focus to humanized one throughout entire stages of design (Nigel, 2011). This human-centered design approach appears to hold larger potential for resolving wider societal issues of modern life. Current century adapted well to the transformed approach to design methodology across different fields. This new wave was now more than only a method rather it emerged as the new mindset for

interpretation of wicked problems of design for twenty first century. It is strongly aimed at introduction of element of humanity and empathy of all stakeholders in the whole process of design (Parsons, 2009; Kronenburg, 2006).

User centered design approach often requires a great deal of involvement from the users during the process. Carrying out this approach often includes collecting end users' opinion right before the start of the project, as well as during the design process, and designing with them. The objective of this is to allow the designers to have a good understanding of the subjects who will use the product. Therefore, good interaction between designers and users is the key under this approach (Donald, 1990; Campbell, Maxey, & Watson, 1995; Buchanan, 1992).

User centered designing is widely recognized and there is an international standard which serves as a benchmark and a guideline. International standard ISO 13047: Human-centered design process outlines the 5 stages of a typical user centered design, which are identifying need for human centered design, specifying the context of use, specifying requirements, creating design solutions, and evaluating designs (Donald, 1990; Nigel, 2011). These steps define only general procedures but not exact methods. In fact, these standards do not outline how each phrase should be carried out. For instance, specifying the context of use can be done by surveys, observations, interview, and many other methods

1.6 Designing for Special Population

Divergence from average physical anthropometry creates a larger challenge for designers (Cookman & Zimmerman, 1961). Although such population constitute only about 5 percent of total population, but when translated to real numbers this segment is not negligible. The challenge of design is more pronounced when special problems of the aged, infirm, and handicapped arise for solutions (Donald, 1990). Adaptive clothing

options are primarily focused on the functional aspect of design and are aimed to accommodate the altered needs of users (Candy, 2007). Such special purpose designing emphasizes more the need of efficiency, simplicity, and affordability (Deepti, 2011). We experience decrease of physical agility, reduction of reaction time and deterioration of visual skills as we age. Such challenges cannot be met by simple solutions, these require a higher level of designer cognition, and a focused strategy to bring about real ease for the special user (Meinander & Varheenmaa, 2002; Donald, 1990). In such cases only those design solutions earn appreciation where usability dominates over the aesthetics and manufacturability (Buchanan, 1992) Functional aspect of success full adaptive clothing solution must adhere to comfort, ergonomics, and protection of user in a manner which cannot be fulfilled by the regular clothing options already available (Kidd, 2006). Including excessive esthetic featurism and following false image from stylist's own personal instincts are two deadly temptations for the designers (Nigel, 2011). Adaptive clothing campaigns are usually denoted as high on budget and lacking in desired styles. Another important factor can be negligence on part of users about sufficient information about the availability of special purpose clothing (Lamb, 1993). The urge to be identified to one's own culture is seen similar even if one is suffering from some physical challenge, thus the importance of adherence to cultural aspect becomes very important while making clothing designs for population with special needs. Some studies highlight that users of adaptive clothing usually prefer solutions which are comfortable, stylish, and economically appropriate (Newton, 1984-1985). It was brought into limelight by Watkins (1988) that many adaptive clothing lines which were proposed without consideration of emotional, physical, and cultural needs of real end user met very low response from target consumers. Enhanced usability and effectiveness of adaptive clothing designs can be attained by keeping consumer needs a preference while design process (Candy, 2007).

1.7 Special Needs of Hemiplegia

Hemiplegia is paralysis of one lateral side of the human body or loss of motor functions ranging from severe to complete on one side of individual. When someone experiences a hemiplegia stroke, along with many physical restrictions the act of getting dressed becomes an agonizing suffering for patient; it affects sufferer physically as well as emotionally. Hemiplegia affects people in many ways and in different degrees. Such state of impairment is usually caused due to certain neuro disorders which affect the opposite cerebral hemisphere than the apparent side of weakness. Occasionally the manifestation of hemiplegia symptoms may be caused by some other conditions like peripheral nervous system illnesses or cervical spinal cord illnesses or brain stem lesions. The hemiplegia grades are used indicating severity of hemiplegia attack according to the loss of control of movement in the muscles (Moses, 2008).

- 0/5 level: Patient shows no contraction
- 1/5 level: patient shows muscle flicker, but body produces no movement
- 2/5 level: Some body movement is possible, but patient can make no movement against gravity (for this the joints are tested horizontally)
- 3/5 level: Body movement is possible even counter to gravity, but no movement is possible against the physical confrontation imposed by the assessor

Changes and physical limitations that occur after onset of hemiplegia are very pronounced and people with such special needs experience great difficulty finding garments that are comfortable, which fit correctly, are economical and can be used and stored easily (Meinander & Varheenmaa, 2002). Complete dependence on others for clothing purpose is emotionally discouraging for such patients. It is equally important for such individuals to be able to find everyday clothing which allows them to dress easily and quickly. Adaptive Clothing Designing concept can suggest clothing solutions

that can have the distinct features premeditated and constructed in a special manner to facilitate the patient as well as doctors, nurses and care giving family member. Successful incorporation of desired functional features in an adaptive design pave way to enhanced self-esteem, self-respect, and dignity

Ever expanding services of textiles encompass countless applications in everyday consumer textiles. The distinctiveness of challenges in the field of textile utilization focuses the importance to comprehend and utilize the strict principles of textile science and technology along with the same of design and manufacturing to propose solutions which are technological revolutions as well as most suitable designing and manufacturing solutions. The increasing prominence on the measurability of textile performance characteristics in any specific arena of textile application encompasses the broadened horizon of textile professional's intellect that must include an elaborated acquaintance of fibers and technology but also a thorough understanding of textile product development process (Bartels, 2011; O'Mahony, 2006; Horrocks & Anand, 2000). Within this conceptual logic rests, the deliberation of integrating user centered design practices while designing adaptive clothing focusing on special needs arising from physical disability of user.

1.8 Theoretical Framework

User centered design approach or Function-Behavior-Structure ontology conceptualizes design objects in three ontological categories: function (F), behavior (B), and structure (S).

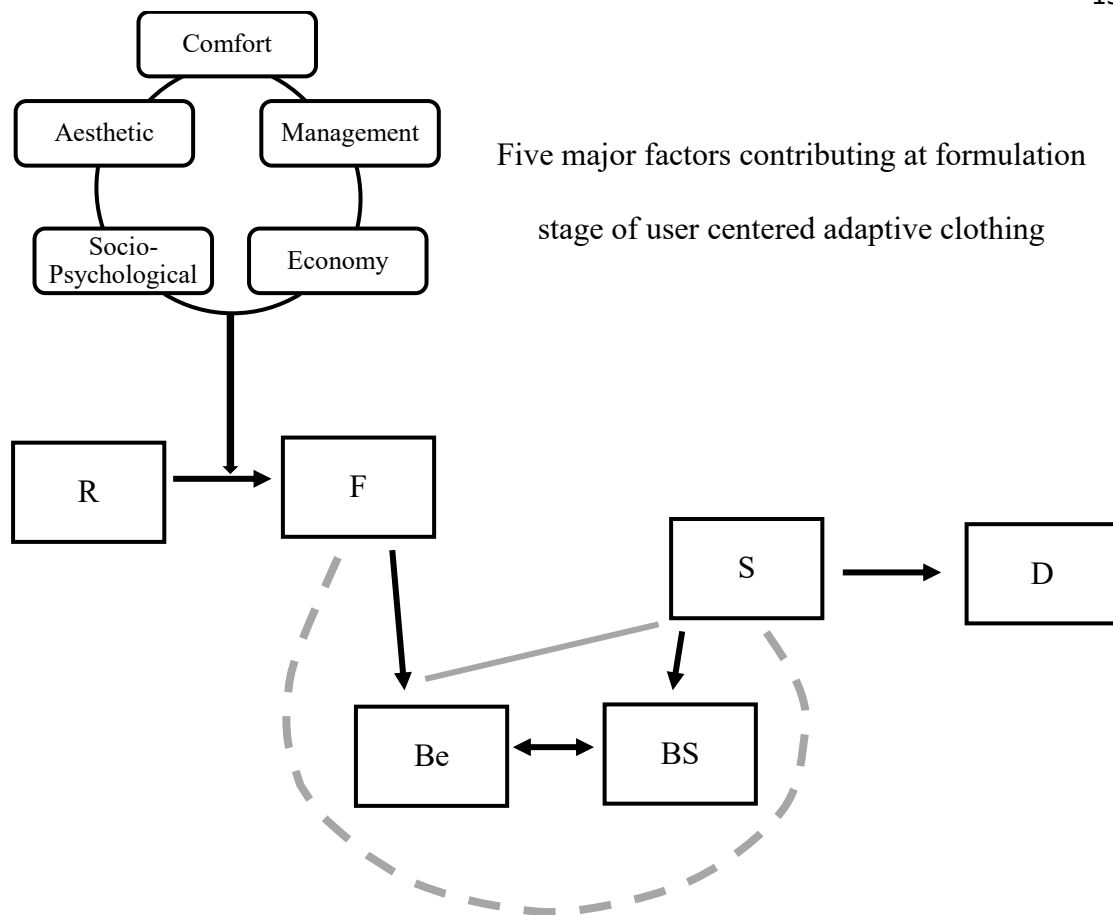


Figure1.2: The Function Behavior Structure Framework

1. Formulation: formulates by transforming requirements into a function

$$(R \rightarrow F \rightarrow Be)$$

2. The stage of Synthesis: $(Be \rightarrow S).$

3. The stage of Analysis: $(S \rightarrow Bs).$

4. The stage of Evaluation: $(Be \leftrightarrow Bs).$

5. The stage of Documentation: $(S \rightarrow D).$

6. The stage of Reformulation 1,2,3

The Function-Behavior-Structure ontology has been utilized in the design science as a base for exhibiting the procedure of designing as a set of discrete actions (Parsons, 2009; Herbert, 1988; Donald, 1990; Buchanan, 1992). It was the working model for this exploration outlining five basic factors contributing at the formulation stage

Chapter 2

Literature Review

Current section provides a framework of prior research in areas relevant to specialized adaptive clothing design development process. A chronological review of related literature is collected here to bring into limelight various research approaches which have been historically used in the field of designing clothing to incorporate special needs.

2.1 Evolution of Design Concept

Design thinking is inherent within human cognition, it is a key part what makes us human (Nigel, 2011). It is a historical truth that everybody can and does designing (Donald, 1990). Long history of design thinking can be traced back in the evidence of artifacts of previous civilization s as well as in practices of contemporary design and time-honored crafts (Beamish, 1999). Last two decades of previous century showed a greater rigor in the discovery of new methods for the improvement of designs and services for ultimate progress of business (Buchanan, 1992). Evolution of different design methods did not follow a clear linear progression of methodologies, but analysis of evolutionary changes can be traced through history (Herbert, 1988). Since the time of Plato's republic exercise of participatory design methodology can be traced. Deep rooted democratic approach of Greek society was an ideal platform for the nurture of participatory methodologies in designing. The explosion of technological advancement by the mid of last century led to the popularity of engineered system designs, giving priority to the introduction of latest technologies in designs across all domains. By nineteen eighty the developing design philosophy unfolded itself as interaction design, it borrowed many techniques from science. Despite resulting increased production due to engineered designing and incremental designing the negligence towards user

experience and stakeholder input was strongly realized (Parsons, 2009). Usability was the ultimate criteria of success and emotional reaction of consumer to gadgetry was largely ignored. In cases of conflicts between designers on one side and user and stakeholder's observations on the other hand preference was given to the designers engineered approach that based itself on success of usability. As a response to this total rejection of end user's experience an alternate design methodology emerged which was focused to transform the passive opinion of ultimate users into a collaborative co-design strategy. Design thinking was recognized as an emerging successful strategy across different faculties and industries by the end of twentieth century (Nigel, 2011).

Turn of new millennium witnessed emergence of higher-level design practices which complicated the traditional design areas commonly known as industrial/product design, graphic design, architecture, and fashion design. Designers across these sub-disciplines were unmistakably clear about the set of skills they were required to know in to proceed to a meaningful outcome design (Buchanan, 1992). Presence of clear technical rules and specifications needed to be adhered to were adequate to complete each traditional design practice. Higher level designing has become a wicked problem as it involves a larger number of diversified stakeholders who must work as co-creators to face challenges of complex design practice (Beamish, 1999; Nigel, 2011).

In today's world every one of us find him or herself surrounded by a large number of man-made items, most intended to make lives easy and pleasant (Donald, 1990). There is increasing probability among high level design solutions that claims of time saving, fast production and superior results turn to redundant consequence of increasing stress to life. Contemporary designers have to be more sensitive towards finding solutions to problems of life and consideration of the needs of people (Buchanan, 1992). Globalization has resulted in similar utilization of modern technology to all nations and industries (Nigel, 2011). The new trend of prioritizing

usability and understandability over aesthetics forms the first conceptualization of product got much appreciation among present designers of different domains. Inclusion of the principles of usability and understandability with consciousness of societal concerns and ethical norms has become an assurance of competitive edge for companies (Beamish, 1999). Instead of following personal instincts, successful designers need to study their direct clients to take into account their real needs and interests so that consumer can have best return of their investments. Mechanical ineptitude is increasingly mirrored among users of everyday products, globally. “Designing well is not easy” (Nigel, 2011). A close examination of structure of actions of a design activity reveals that it starts with identification of what is required, this defines the ultimate goal of the design venture that is to be achieved. Proposing, executing and evaluation are other three important milestones which successfully take place only if first step is acknowledged well (Donald, 1990). Designs are ruled by one of three philosophies: aesthetics, usability, easy and inexpensive manufacturing. Each consideration contributes towards addressing whole process of designing, but inadequate dominance of one contributes to the resulting dissatisfaction (Buchanan, 1992).

2.2 Account of Adaptive Clothing

The problem of finding suitable clothing for individuals with physical disabilities has been a topic of concern for clothing, medical, and rehabilitation researchers for over half a century (Behrens, 1993; Newton, 1985; Ali, 2009). Beginning in the 1940s, clothing and medical professionals started to examine the relationship between clothing and physical disability (Yep, 1997). The bulk of this research resulted in publication of various self-help guides for the handicapped and their caregivers, designed primarily to ease daily processes of dressing (Watkins, 2008; Valley & Court, 2003; Powers, 2008). Subsequent research in the latter part of the 20th Century explored the psychological issues of adaptive clothing, primarily by

assessing the importance of clothing as an appearance management tool (Kottke, 2002; Quinn & Chase, 2000; Moses, 2008; Reich & Otten, 2001). Some previous research was done from caregiver's point of view and resulting relief was also focused for the caregiver and not for the real user (Ali, 2009; Boettke & Zook, 2006; Garg & Owen, 2012). In the late nineteenth century psychologists, sociologists and anthropologists engaged in study of the social significance of clothing (Cookman & Zimmerman, 1999). It is now well established that clothing is an important facet of the human constructed environment, therefore has bearing on quality of life (Abraham & Staples, 2010; Meinander & Varheenmaa, 2012; Newman & Springer, 2010).

Such clothing design approach is presently more focused on technology centered designing (Lamb & Khallal, 2012), that involves invention of new technologies and their implementation into all aspect of life without recognition of real needs of end users. On the other hand, the user-centered designing approach not only requires designers to initially analyze real demands of end users and fore see how users are likely to use a product, but also to test the validity of their assumptions with regard to user behavior in real world tests (Yassi & Hanncock, 2009). User centered designing approach of all kinds is paying more attention on repurposing of existing technologies instead of just invention of new ones without real life applications. Thus, it is of much importance to understand the academic conceptualization of value oriented, adaptive clothing designing as a user centered design activity.

Investigation to reveal relationship of self-reliance and clothing among handicapped children was carried out by Jon in 1977. Her research focused on the urge of independence among handicapped children as it is in normal children. To have a good emotional, physical, and mental growth convenience in performing everyday tasks is very important. Handicapped child can have enhanced belongingness and acceptance if physical and psychological aspects of their clothing are thoughtfully

planned. Special features incorporated in dress which is easy to use and fit well lead to progress in learning of handicapped children. Jon (1977) found that there is no significant difference in the interest in clothing and desire to dress well among handicapped and non-handicapped children (Jon, 1977).

The challenge to bring children born with developmental disabilities like cerebral palsy to the mainstream of society was studied by Ranu, Madhuchhanda, & Pratiti, (1995) in India. They strongly recommended facilitation in everyday tasks to be an important factor in learning of children born with cerebral palsy than their intellectual growth. Consequently, for acquiring optimum improvement in such children as an integrated and interdisciplinary approach is needed. Parents and professionals were asked to team up to devise everyday management tasks to achieve desired results. Proper clothing was considered a salient feature which could contribute to bringing out best abilities of such children (Ranu, Madhuchhanda, & Pratiti, 1995).

Absence of adaptive clothing was consistently being felt and some informal activities were seen before Katherine (2001) presented her doctoral research addressing the lack of appropriate products for working women with physical disabilities. She emphasized that from viewpoint of physically disable consumer they want similar facilities of provision of goods that suit them as things are easily available for normal group of consumers. Katherine (2001) utilized the idea of universal design to product design to evolve such designs which are equally beneficial to all type of consumers regardless of disability. She successfully planned a research to reach out to all who are involved in the use and production of clothing. Her two-stage qualitative research comprised of multiple data collection and simultaneously analyses of gathered information. Nine study participants with various upper body physical limitations were part of the study to probe deeply the preferences and functional requirements of such consumers. She concluded that concept of universal design can be successfully utilized

by clothing manufacturers as well as clothing distributors to evolve design which are equally appreciated by all sort of clothing consumers (Katherine E. C., 2001).

The matter of appropriate clothing for disable people has been rigorously researched in this millennium. Clothing and textile requirements of elderly and disable were studied by Meinander and Varheenmaa (2002). They brought into limelight the probability of significant improvement in the lives of disable and elderly with availability of charming dresses with special functional features. Their research highlighted the special functional requirements expected from everyday clothing and textiles when one is challenged with some physical disability or due to old age. For them, the thermal and mechanical properties and durability of textile materials used in the specialized garments was very important. They concluded that not only the shape of garment but the material itself has to special to fully satisfy the needs of elderly and disable people (Meinander & Varheenmaa, 2002).

Efforts towards inclusion of disable people within the mainstream population were carried on in different regions of the world. A significant work was conducted by Californian health and Human Services agency (2003) regarding special type of care needed for children and adults with developmental disabilities. These Health notes published in 2003 pointed out the great diversity found among the group of people having developmental disabilities regardless of gender, age, and lifestyles. A case study research of five participants was conducted to understand the real challenges of this population and these health notes also pointed out the problems faced by health care practitioners and caregivers, while taking care of such people. All this information clearly stated the core issue of disabled people and proposals were made to create ease for the persons, their caregivers, and their health practitioners. Among the various challenges addressed in these health notes specific importance is given to the provision of specialized clothing to solve many issues (Standifer, Caleb, & Hope, 2003)

Adaptive clothing needs are also researched from the perspective of health care workers looking after resident patients. Occupational Health & Safety Agency for Healthcare (2003) worked to evolve adaptive clothing designs to minimize repositioning and handling of resident patients while dressing. These efforts were directed to minimize risk of low back injury among health workers. The research for finding the effect of adapted clothing of resident patients was conducted among two hospitals with the main focus towards reduction and prevention of musculoskeletal injuries among staff of the hospitals. Conclusions were based on real time. During this project, personal clothing of patients was modified to include new features which enabled quick dressing of them with lesser joint movement. Consequently, these new features in the clothing brought significant ease for patients and hospital staff (OHSAH, 2003).

Parallel to these academic researches some informal products were offered as medically assistive supplies. By 2004 a resource guide was published in Canada that not only defended strongly the efforts needed to develop such features in patient dresses which can provide ease both for patients and for care givers. This resource guide explores in detail the nature of needs of such patients and has outlined the specific functions required in the dress of physically challenged people not only to facilitate them but to provide a psychological boost among users (Newman, Springer, & Dee, 2004)

Similar efforts were extended in Turkey in 2004, exploring clothing needs of old age population. This Turkish study was focused to know the true needs of elderly people and convert these into a clothing design which is based on ergonomics. 120 study participants from Ankara responded to the questionnaire specifically defined to gather information about real needs. Study highlighted the natural changes which occur

in body due to aging. Study significantly contributed to ready to wear sector for production of adaptive clothing (GI&FDED, 2004).

Continuation of similar investigations was found in the study of Kidd (2006) which focused on the development of formal occasion fashionable clothing for special needs of young ladies. The participants of this study involved physical disability due to spina bifida or osteogenesis imperfect. The resulting techniques of the research can be applied to other populations with some physical disability (Kidd, 2006).

A similar research is conducted by Candy (2007) to explore relationship between wellbeing of women with arthritis and their wardrobe. Clothing can be acknowledged as a sensual mediator. It helps to mediate among personal and social life. This mediation may provide the probability to deliver understandings into wearers' feelings; the manner how they show distinctiveness, understand social patterns, and formulate for social collaboration. Qualitative research highlights the influence of good fitting clothing to the overall wellbeing of the patient. This project extends the theoretical boundaries of design theory and unfolds its immense potential to be used to fulfill special needs of people for dressing (Candy, 2007).

Furthering the understanding of this social issue, Katherine and Kevin (2010) tried to dig out the relationship among specific physical limitation with specialized clothing solution. They researched on 117 working women with diversified physical challenges. This quantitative data was analyzed by principal components factor analysis and multiple regression. Results brought three important factors into limelight. These factors were clothing, material, and act of dressing. This study focused on providing the real needs of this segment of users to apparel industry. They strongly recommended inclusive design model for adaptive clothing production (Katherine & Kevin, 2010).

Along with focused research in the field of development of adaptive clothing, stunning evolution in general textiles brought importance of the functional aspects of clothing design in focus. Deepti (2011) researched ever increasing boundaries of conventional clothing reaching towards medicine, physics, biotechnology, computing, and nanotechnology. She strongly emphasized need to completely translate the diverse and compound nature of user needs in clothing solutions for every type of user. She has successfully categorized functional clothing in six classes according to available uses but emergence of more fields is kept as probability with the contemporary advancement in the field of textiles (Deepti, 2011).

In the field of adaptive clothing research, the diversified nature of physical limitations requires specialized attention to every type of disorder individually. Naheed, Muhammad and Samia (2012) discovered the detailed needs of arthritis patients. Research process involved need assessment from small sample of real user as study participants, appropriate modifications were made in the regular clothing in light of input of participants. A dress trial was also conducted to the same study participants to evaluate the efficiency of adapted features of proposed clothing articles. Study successfully incorporated adaptations in three different dress solutions (Naheed, Muhammad, & Samia, 2012).

Similarly, adaptive clothing issues were explored for Dementia patients by dementia behavior management advisory service (2012) as use of clothing becomes a complex phenomenon for such patients. Clothing can play a vital role in behavioral and psychological aspects of dementia patients. Nature of clothing design can trigger aggressive, agitation, vocalization, and resistive behavior. Properly designed adaptive clothing solutions can significantly contribute to the preservation of the self-respect among dementia sufferers (DBMAS, 2012).

Focused research in the field of adaptive clothing proved to be more convincing to bring out the best solution according to the nature of each disability. Smith (2013) was inspired by the increasing number of hemodialysis patients in America. Researcher strived to find true clothing needs of these patients with specific requirements of some perceived functions in dress along with feeling of privacy, esthetics, and adherence to social norms. Sample consisted of 83 study participants contributing their input for this quantitative study. Study concluded in clear guidelines for production of specialized clothing satisfying these patients with asymmetric designs (Kristie, 2013).

Sister Callista Roy attempted to develop an Adaptation Model in 1976, a prominent nursing theory. According to Roy's model individual is seen as a set of interrelated systems. These interrelated systems are social, biological, and psychological. There exists no absolute balance among these systems but individual struggles to preserve a balance among these systems and their external world. Four dominant concepts construct this model comprising of environment, person, nursing, and health. She simultaneously emphasized four manners of adaptation including physiological, role function, self-concept, and interdependence. Roy's goal aims to enhance the person's quality of life, person's health, and a person's chance of dying with dignity and honor (Ali, 2004 ; Garg & Owen, 1992).

Such clothing design approach is presently more focused on technology centered designing (DBMAS, 2012), that involves invention of new technologies and their implementation into all aspect of life without detection of real needs of end users (Kernaleguen, 1978). On the other hand, the human-centered designing approach not only requires designers to initially analyze real demands of end users and fore see how users are expected to use a product (Jan, et al., 2003), but also to test the rationality of their expectations with respect to user behavior in real world tests (Na, 2007). user centered designing approach of all kinds is paying more attention on repurposing of

existing technologies instead of just invention of new ones without real life applications (Morley & Tinero, 2006). Thus, it is of much importance to understand the academic conceptualization of value oriented, adaptive clothing designing as a user centered design activity.

The following are some general inferences drawn from the present studies:

1. The major assumption behind designing clothing for special needs is that the suggested design of clothing must resolve the complications faced by the disabled person while dressing.
2. The underlying concern of creating special designs of clothing to meet specific needs is the bodily impairment and restriction, not the medical reason.
3. conclusively many clothing items can be evolved to contain numerous unusual structures that make such clothing items useful for diverse types of physical disabilities.
4. Successful adaptive clothing can provide greatest service to the disabled person only if it is improved for specific individual needs.
5. There is availability of many ideas and general design features but structural rules for bringing change in basic patterns or instructions for addition of specific detail or modification are lacking.

2.3 Statement of the Problem

A pragmatic exploration of adaptive clothing designing for special needs of physically challenged hemiplegia patients.

2.4 Rationale of the Study

There are a number of hemiplegia patients in Pakistan who have explicit clothing requirements due to specific physical limitations of this population; henceforth designing of adaptive clothing for them was felt strongly. According to an authentic estimation around 5500 patients with hemiplegia were reported in one year in only four major government hospitals situated in Lahore (appendix 3). A statistical projection of this figure may provide estimated number of people with this suffering who are in need of adaptive clothing solutions. A conservative estimation approximates this population to be between 20000 to 25000 in Pakistan. These special needs are not met by available conventional clothing. This study intended at facilitating patients suffering from hemiplegia by creating structural adaptations in clothing by remodeling the standard dress patterns of local style of dressing. Benefit of successful adaptive clothing for its users are multifaceted, ranging from physical comfort, durability, economy, safety, concealment of disability, psychological comfort, and conformity to surrounding cultural context. Adaptive clothing needs to bring harmony among the required functionality according to special needs and aesthetics, this leads to enhanced positive dimensions of body and provide distraction from the negative characteristics

The conceptual framework adopted for this study followed user centered design practices to impeccably meet the special clothing needs. This study was an effort to suggest adaptive clothing design solutions for this fraction of our community, addressing their special needs, oriented to the local style of dressing. This research helped in creation of a knowledge pool regarding the application of user centered designing methodology for proposing adaptive clothing solutions for the selected niche of users to deliver maximum satisfaction. In practical terms, the present action research provided real clothing solutions which directly met the special needs of this population in most efficient manner. It may also help future clothing designers in understanding

the significance of user centered designing methods for finding solution of any type of special need adaptive clothing designing. With the availability of efficient adaptive clothing designs such patients experience easier way of getting dressed enabling them to sustain their self-respect and to acquire a better life. The outcome of the study is equally beneficial for people having special concerns, including all with limited agility, either due to complications of their weight bearing or restriction of handiness or extreme weakness due to severe arthritis, Alzheimer's disease, stroke, frozen shoulder, or any similar physical disabilities.

This study was also helpful in promoting a philosophical shift of attitude among all who are around such patients and are directly or indirectly involved with the clothing used by such patients. The list of concerned individuals largely included the patients suffering from physical challenge, family members who act as care providers, doctors and nurses treating such patients. Other principal contributors are contemporary fashion and textile designers who can be an important potential catalyst of change for providing adaptive clothing solutions to individuals with special needs.

Current effort is a baseline for the future fashion design students exploring functional aspect of clothing designs. It opened venues for marketing of a new product line for manufacturers. The research output is also a valuable addition to the academia of medical professionals. Considering the findings of this research, researcher is determined to suggest fashion design institutes to implement policies, develop new curricula, and strategies which can enhance the scope and utility of adaptive fashion design practice. Future research can be planned for solving the everyday clothing issues addressing other variations of special needs. Apart from the primary contributions at the made-up stage of textile value chain, the outcome of this practice-led study was also beneficial as future research ventures to other segments of the textile value chain.

2.5 Local Circumstances of Adaptive Clothing

Availability of such adaptive clothing design possibilities were found scarce according to context of local dressing style. By formulating adaptive clothing design solution for special needs of this population, researcher has strived for structural modifications in standard patterns of everyday clothing products by using user centered designing approach to provide suitable consumer garments fulfilling unique needs due to hemiplegia in context of local style. Such adaptive clothing solutions could be equally useful for all other physical disability cases presenting similar physical limitations.

2.6 Scope of Study

This study is a contribution of academic and professional expertise of researcher herself in bringing forth innovative ideas and solutions to address the special needs of hemiplegic adaptive clothing users. Author's prior research explorations of Masters and M Phil level provided a solid intellectual base to devise novel adaptive clothing designs incorporating the valid needs of actual users. This research has explicitly seen this challenge with the viewpoint of a fashion designer and employed an exploratory qualitative research paradigm with mix methods of data collection strategy to explore and to seek most pertinent solution in the structural design of the clothing from most efficient and cost-effective materials available in local market. Fundamental aim was to bring agility while dressing for physically challenged hemiplegia people according to local context specially focusing functional comfort, aesthetics, social appropriateness, ease of maintenance and feasibility of proposed adaptive clothing solutions.

This research was an effort to unravel comprehension of the complex activity of design and developing an insight of the nature and methodology in which creative

thinking skills were put together in the user-centered mannerism of thriving contemporary design. Researcher herself had strong background of textile and fashion design skills, during this research she had primarily worked as fashion design researcher with an enhanced interest in specialized functional aspect of fashion designing that is needed to persuade societal concern chosen for this research. Although the onset of hemiplegia spans across all age groups among both gender but largest group is among the adults between ages of 40-65 years, so this study targeted adult patients as participants. From personal interaction with such patients, it was found that most patients try to remain active in their socialization among family. Based on researcher's observation of many years it was found that patients try to devise modification on self-help basis to bring ease and convenience as no such solutions are available in local market. The field work also revealed that most of them were unaware of the possibility of availability of adaptive clothing solutions. All reported substantiation came for observation, intervention, analysis, and reflection during the whole course of research. At the core of research were the case studies, each studied in depth as a complete reflection, latter cross case analysis helped to bring out supplementary generalized outcome. The case studies provided a focused resource for the investigation of a specialized user-centered design thinking.

2.7 Research Objectives

Despite the significance of adaptive clothing designing, there is exceptional scarcity of empirical research on it (Na, 2007). Additionally, literature review shows that the user centered designing approach has not been adequately incorporated in adaptive clothing designing framework. The objective of this research is to contribute to and extend the field of adaptive clothing designing by pragmatically examining the user centered design approach with particular kind of end users who suffer from physical challenge due to hemiplegia and require clothing other than the usual. The

dissertation focus initiated from the researcher's enquiring the absence of obtainability of appropriate clothing for such patients in local context. This ignored area was also brought to limelight as researcher felt it as her social responsibility.

It becomes very perplexing when amidst normal life routine someone unexpectedly faces the onset of such physical challenge that leads to explicitly specific requirements for everyday clothing which cannot be met by conventional clothing designs. Researcher's own field work and her reported base line research findings at the MPhil level brought into limelight the difficulty faced by such individuals due to non-availability of suitable clothing solution. According to her previous findings such potential users aspired to obtain clothing solutions which are both functional and visually likable to provide maximum user satisfaction.

More specifically, initial part of research was quantitative need assessment of adaptive clothing of hemiplegia patients. Study investigated do such physically challenged patients require adaptation in clothing for facilitation, if yes then what are different requirements for an adaptive clothing design.

1. To assess the specific needs regarding comfort in material and garment of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist medical doctors.
2. To assess the specific needs regarding economic feasibility of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist doctors.
3. To assess the specific needs regarding manageability with respect to care and storage of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist medical doctors.

4. To assess the specific needs regarding conformance to social norms of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist medical doctors.
5. To assess specific needs regarding aesthetics of design of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist medical doctors.

Latter part of study was an in-depth exploration of phenomenon of concern. A thorough understanding of the disease prognosis was sought from input of concerned medical specialists. The goal of this phase was to advance comprehension of this concept from the exclusive viewpoint of patients who were the real end users of adaptive design solutions. Expert opinion of a textile expert and a garment technology expert were also sought to extend theoretical and practical knowledge of adaptive clothing design while construction of specialized designs. The progression of this phase of exploratory research activities was conceptually planned as user centered designing activity, in this manner a holistic opinion pool was created around this wicked problem to comprehend special needs of these end users in most effective manner. The study concluded with evaluation of the intervention of dress trial to determine effectiveness.

6. To know about specific physical limitations due to which hemiplegia patients require special adaptations in their clothing.
7. To explore in-depth the special requirements expressed by hemiplegia patient for everyday clothing to acquire enhanced agility, with special focus on viewpoint about comfort in material and garment, management of care and storage, conformance to social norms, aesthetics, and cost effectiveness.

8. To incorporate specified requirements as expressed by hemiplegia patient in the structural layout of proposed everyday adaptive clothing design solution to acquire enhanced agility.

9. To assess the effectiveness of proposed structural modifications in every day adaptive clothing design solutions, incorporating special requirements expressed by hemiplegia patients to acquire enhanced agility.

2.8 Research Questions

The complex nature of this research investigation required a qualitative exploration with mix method data collection approach for multistage progression of research activities (Gay, Mills, & Airasian, 2006). Occasional published research on adaptive clothing was found during an extensive literature review. Thus, the goal of this study was to fill the void by exploring special clothing needs related to hemiplegic patients and proposing effective adaptive design solutions.

A survey was suggested at the first phase of study to quantitatively assess the special needs of this population. Researcher anticipated findings that participants would desire: 1) clothing that is comfortable and provides ease with decreased muscle movement while wearing; 2) clothing that is cost effective 3) clothing that is easy to manage, to store and to care for; 4) clothing that conforms to social norms; and 5). clothing that reflects aesthetical elements of design Research questions for this section of exploration include following:

1. What are the specific needs regarding comfort in material and garment of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist medical doctors?

2. What are the specific needs regarding economic feasibility of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist doctors?
3. What are the specific needs regarding manageability with respect to care and storage of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist medical doctors?
4. What are the specific needs regarding conformance to social norms of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist medical doctors?
5. What are the specific needs regarding aesthetics of design of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist medical doctors?

The latter part of research comprised of an in-depth case study investigation by studying closely the physical challenges faced by hemiplegic patients in their daily life context to propose suitable adaptive design solutions for hemiplegic patients, rooted in user centered mannerism of solving this design issue. Some guiding research questions for this part of study are as following:

6. Why hemiplegia patients require special adaptations in their clothing?
7. What are the special requirements expressed by hemiplegia patient for everyday clothing to enhance agility, with special focus on viewpoint about comfort in material and garment, management of care and storage, conformance to social norms, aesthetics, and cost effectiveness?

8. How to incorporate specified requirements as expressed by hemiplegia patient in the structural layout of proposed everyday adaptive clothing design solution to enhance agility?

9. What is the effectiveness of proposed structural modifications in every day adaptive clothing design solutions, incorporating special requirements expressed by hemiplegia patients to enhance agility?

2.9 Definitions of Key Terms

2.9.1 Design

Design is the discipline of generating solutions to problems and opportunities through the act of making something new (Beamish, 1999).

2.9.2 User Centered Design

User centered design is the discipline of generating solutions to problems and opportunities through the act of making something new, where the activity is driven by the need's desires and context of the people for whom we design (Jan, et al., 2003)

2.9.3 Adaptive Clothing

Adaptive clothing is clothing designed for people with physical disabilities, all who may experience difficulty dressing themselves due to an inability to manipulate closures, or due to a lack of a full range of motion required for self-dressing. Adaptive clothing typically offers such designs so that an individual can be dressed more easily (Katherine E. C., 2001).

2.9.4 Hemiplegia

Paralysis of one side of the body or severe or complete loss of motor function on one side of the body is called hemiplegia. This condition is usually caused by Brain Diseases that are localized to the cerebral hemisphere opposite to the side of weakness. Less frequently, brain stem lesions; cervical spinal cord diseases; peripheral nervous system diseases; and other conditions may manifest as hemiplegia. The grades indicating severity of hemiplegia attack according to the control of movement in the muscles which are focus of this study are as following (Moses, 2008).

- 0/5: no contraction
- 1/5: muscle flicker, but no movement

- 2/5: movement possible, but not against gravity (test the joint in its horizontal plane)

3/5: movement possible against gravity, but not against resistance by the examiner

Chapter 3

Research Methodology

The chapter articulates methodological overview of research process and involves all details how researcher intended to seek required knowledge. The argument is built around different aspects of study including study site selection, sample selection for different phases of study, creation of meaningful study data collection tools, specific steps taken while developing and editing questionnaires for assurance of reliability and validity of instruments, measures taken while pilot testing of different research tools for collection of reliable responses, selection and training of research team, field supervision and specific strategic approach for making decisions of data collection and of data analysis. Approval letters of proposed research plan were obtained from advance board and School of Textile and Design, University of Management & Technology (appendix 1, 2).

3.1 Study Design

This study was conducted as exploratory case study research. The study was designed to propose adaptive clothing solutions, according to local context of dressing mannerism, for specific needs of physically challenged Hemiplegia patients based in Punjab, Pakistan. For the exploration of any phenomenon which is not rigorously investigated, previously, and is needed to be considered in a manner that minute details can be uncovered, qualitative research methods are preferred. As explained by Babbie (1992), there are three main reasons to employ exploratory research in complex research cases like current study: (a) to enhance the understanding of researcher, (b) to open new venues of phenomenon of study which were unexplored before, and (c) to adopt new methods for the same research (Babbie, 1992). This tri-step validation of exploratory research proposed by Babbie (1992) is working logic for current study due

to following reasons : (a) the idea to evolve adaptive clothing in local context emerged from researcher's own interest and her past experiences in construction of specialized clothing, (b) current study brought into limelight some in-depth dimensions, significant for development of adaptive clothing concept of specific needs which may help future research questions in this area hence broadening the available base of literature for it (c) the proposed research methodology and integration of user centered designing approach was uniqueness of this study.

Current action research was an interpretive/qualitative research; it was conducted as exploratory case study research with mix methods of data collection along with one dress trial intervention to develop a holistic understanding of the research issue. The research comprised of five phases of progressive data collection and interpretations to meet the given objectives of study. The phase one of this research was a survey for **quantitative need assessment** with respect to five major guiding aspects of adaptive clothing designs for hemiplegia patients and specialized caregivers to such patients and specialist doctors. Phase two comprised of in-depth **qualitative need assessment** with respect to altered requirements of various physical locations on the body of hemiplegia patients due to onset of stroke, from selected case study participants. Phase three comprised of in-depth qualitative need assessment with respect to areas of regular clothing that required adaptation as result of new needs after onset of stroke, according to five major guiding aspects for adaptive clothing designs for hemiplegia patients from selected case study participants. Analysis of data of phase two and three of study led to phase four that comprised of **user centered designing and construction of adaptive garments**. In the light of quantitative and qualitative adaptive clothing needs of hemiplegic adult patients, three designs were discussed and drawn with the help of basic body block patterns and a local material was selected as per its performance requirement characteristics. A prototype was created to ensure

design details encompassing detailing of construction, location of openings, number and type of fastenings, and structural design of garments. Two sets of final design of adaptive clothing were stitched with the help of their respective specification sheets. For fifth phase of study a **dress trial intervention** was exercised to assess effectiveness of proposed adaptive clothing design and results were compiled.

Table 1: The List of Research Activities for the Completion of This Research

List of Activities Across Research	
Survey	
<i>Phase one:</i> Quantitative Need Assessment Research Question 1, 2, 3, 4, 5	• Selection of teaching medical hospitals in Lahore • Formal permission from the selected hospitals to conduct study • Informed consent of all selected study participants in the selected teaching hospitals • Group administered questionnaire survey from 140 hemiplegia patients • Group administered questionnaire survey from 140 caregivers/ nurses • Structured interviews from specialist doctors 9
Case Study	
<i>Phase Two</i> Qualitative Need Assessment according to location of physical limitation Research Question 6	• Research participant's structured in-depth interviews 6 • Research participant's observation of physical limitations 6 • Research participant's body measurements 6

<i>Phase Three</i> Qualitative Need Assessment according to restrictions in regular clothing Research Question 7	• Research participant's structured in-depth interviews (6) • Research participant's observation of regular clothing limitations (6) • Research participant's regular clothing dressing time (6)
<i>Phase Four:</i> User Centered Designing and construction of trial adaptive clothing solutions Research Question 8	• Research participant's review of adaptive clothing designed drawings from basic body block patterns • Construction of first prototype garment • Construction of second prototype as enhancement • Expert Opinion of prototype garment ○ Textile Technologist (1) ○ Garment Construction Expert (1) • Construction of one adaptive clothing design as trial garment with specification sheets (2 sets per participant)
<i>Phase Five</i> Dress Trial Intervention for Evaluation of trial garments Research Question 9	• Research participant's review structured interview. (6) • Research participant's review observations of adaptive garment utilization (6) • Research participant's dressing time of trial adaptive clothing (6)

3.2 Research Ethics

Ethics are conformance to the values of specific mannerism of any given occupation or group, in research, such standards are particular codes of conduct. (Babbie, 1992).

3.2.1 Ethical Principles Observed in Current Research

Research proposal of current study was approved after rigorous deliberation by renowned members of Board of Advanced Studies and Academic Research (BASAR) of University of Management and Technology, Lahore, Pakistan. Following are few significant research ethics which were acknowledged during approval of the study (Babbie, 1992).

Voluntary Participation and Harmlessness. Participants in this research project were made aware that their participation in the study was voluntary. The approved consent form contained relevant statement that participants had the freedom to withdraw from the study at any time without any unfavorable consequences, and they were not to be harmed as a result of their participation or non-participation in this research.

Informed Consent A formal consent form was essential part of the research proposal presented for approval that clearly described the right of participants to participate or not to participate and right to withdraw. It was emphasized that researcher will ensure that every type of research participant of this study has to agree to this consent form by signing it before their responses in the study can be recorded. Researcher assured the members of BASAR that these signed informed consent forms will be retained in a safe place for a period of time after the completion of the data collection.

Anonymity and Confidentiality. It was ascertained that to protect participant's interests and future well-being, their identity will be protected during this study. This was assured by using the dual principles of anonymity and confidentiality. Anonymity implies that the researcher or readers of the final research report or paper cannot identify a given response with a specific respondent. Under all circumstances, participants were

guaranteed confidentiality, so that researcher can identify a person's responses, but promised not to reveal that person's identity in any report, paper, or public forum.

Disclosure. It was considered an obligation to provide basic information in the participant consent form about this study so the potential participants could decide whether or not they wish to participate in the study before data collection.

Analysis and Reporting. As ethical obligation to the scientific community, researcher was committed to describe in detail how data was analyzed and reported in this study. Any additional findings were also fully disclosed.

3.3 Methodological Overview of Survey:

Phase One of Research for Quantitative Need Assessment

To study social phenomena, quantitative data collection methods are adopted to conduct an organized pragmatic investigation that involves collection of numerical data which can be mathematically analyzed (Babbie, 1992). For quantitative need assessment phase of this exploratory case study, a survey was planned.

3.3.1 Survey Research Design

The research design at first phase consisted of finding quantifiable answers to first five research questions by the survey queries from adult hemiplegic patients, during management phase with grade 0-3 magnitude of hemiplegia attack and their caregiver, who range in age, gender, socioeconomic background, educational background, and duration of disease. Semi structured interviews from the specialist doctors also brought into limelight relevant information. This collection of data helped to meet first five objectives of the research and assisted to analyze quantitative need assessment of adaptive clothing solutions with respect to comfort, management,

economy, socio-psychological and aesthetic parameters from patients, caregivers. Semi structured interviews with specialist doctors also provided meaningful insight.

First of all, to define the research site, few teaching medical hospitals based in Lahore were approached as per convenience of researcher and formal permission was obtained from three to conduct this approved research in these institutes (appendix 4,5,6). Potential participants were selected in these three research sites. For inclusion of a participant in this research the categorized physical challenges due to Hemiplegia were guiding tool, assistance of nursing staff was also taken before approaching any participant to offer to join the study. Hemiplegia is not discriminated by age, the largest age group of hemiplegic patients was between the ages 40-65, thus the largest number of participants was between the ages of 40-65. Likewise, hemiplegia does not discriminate by gender. In a field survey, 56% of patients with hemiplegia were male and 44% were female in one public sector hospital of Lahore. Hence, both males and females were surveyed. No specific religion or cast was excluded from the research. Safeguarding all these parameters the number of participants who agreed to participate in the survey were representative of urban and rural, male, and female hemiplegia suffering population of Pakistan.

3.3.2 Unit of Interest

The adult patients suffering from hemiplegia, who could be direct users of adaptive clothing designs were the unit of interest for this part of current research. The family care givers of such patients, specialist doctors and nursing staff who were caregivers to such patients in hospital were also chosen for survey.

3.3.3 Unit of Analysis

Adult patients on selected research sites, suffering from hemiplegia with grade 0 to 3 magnitude of hemiplegia attack, who were during the management phase, who could be direct users of adaptive clothing designs, were the unit of analysis for this survey research. Actual requirements for the five selected dimensions of adaptive clothing were dictated by the feedback of study participants. Family caregivers of some participants and nursing staff of selected hospitals who were caregivers to study participants were also surveyed. Some doctors were interviewed to seek same information.

3.3.4 Study Population

Study population comprised of adult, hemiplegia patients of grade 0-3, during management phase along with their family caregivers and nursing staff providing healthcare services to such patients in selected research sites and specialist doctors contributing their services towards this specific area of healthcare.

3.3.5 Survey Sample Size

Data are rarely collected from each unit of a population. Such census is usually not the way to find answer to research question and is only used in very specific studies where it is cost effective and takes manageable time. To obtain a meaningful answer for proposed research question, a selected sample from the study population is studied. This way money and time are also saved. For surveys, representative subsets of populations are a usual research tactic to gather data. Selection of proper sample becomes significantly important as data collected from them reflects the attributes and features of whole target population. Therefore for a proper selection of study sample after clear identification of population is very necessary and it is followed by a well

thought sampling frame that closely approximates characteristics of the target population (Babbie, 1992).

Actual sampling involves statistical procedure of choosing a subsection of the targeted population. Careful sample selection is needed for bringing out explanations and statistical inferences of focused population. This allows researcher to infer pattern of behavior within specific population. For survey research, it is common to sample 10% to 20% of the population. Efforts were made to minimize sampling error and sampling bias, and to match population parameters to sample statistics. In a true representative sample of a population, the projected sample statistics should be matching and conforming to theoretical population parameters. Based on spread of sampling distribution or sampling error it becomes possible to assess approximation of confidence interval which allows for prediction of targeted population parameter. In a carefully selected sample, give or take 2 standard errors, the sample statistics represents a 95% confidence interval for population parameter. The central limit theorem also states that for very large population 200 sample size is recommended with 100% response rate. For this research, an appropriate sample size was selected as referred by the board of advance studies and research (BASAR) of University of Management and Technology to ascertain a 95% confidence interval. In light of all this background information of appropriate sample size, a sum of 140 participants as patients and same of caregivers was selected for this study.

3.3.6 Survey Sampling Technique

Three teaching medical hospitals were selected from provincial capital city Lahore of most populated province Punjab of Pakistan, on basis of convenience sampling frame. After selection of hospitals on convenience basis and obtaining formal approval from concerned authorities, simple random sampling frame from probability

sampling types was utilized for the selection of survey participants as patients and caregivers, from each teaching hospital.

3.3.7 Questionnaire Survey

To acquire meaningful responses from research respondents in a standardized manner most commonly used research instrument is called questionnaire, invented by Sir Francis Galton, A questionnaire consists of a set of questions which are designed in such a manner that makes it easy for respondents to read, comprehend, and answer in a meaningful means (Babbie, 1992). Survey part of current study was a specialized form of group-administered questionnaire. Such surveys consist of groups from selected sample of study participants gathered at a venue at a time and while in that area each participant provides responses to the given questionnaire. During such survey, participants record their answers independently and do not interact with each other. Such format is not only convenient, but this also promises a high response rate. While answering the questionnaire if study participant does not comprehend any question, they can ask researcher for explanation. In current study the research setting was ideal to adopt this method, selected participants were not forced to gather in a room but their presence in the hospital along with the presence of researcher was assured to get expected high response rate.

3.3.8 Quantitative Data Collection

Permission to offer the survey to potential participants in the selected teaching hospitals was obtained from hospital authorities (appendix 4,5,6).

Table 2: Data Collection Tools for Survey

For phase 1-5	Participant Consent Form
Phase 1/ Research Question 1-6	Questionnaire for patients in English and Urdu

Phase 1/ Research Question 1-6	Questionnaire for caregivers in English and Urdu
Phase 1/ Research Question 1-6	Interview questions for doctors

Consent forms were completed by participants before initiating the questionnaire (appendix 7). As per exploratory nature of this research, initial list of questions was broadly based on some previous studies done for other populations, found while conducting literature review. Questionnaire for current study primarily focused on the need assessment of five dimensions of adaptive clothing designing (appendix 8). Revisions and additions in the initial draft of questionnaire were made under the comments of members of supervisory committee. The questionnaire was finalized after multiple consultations. The pool of questions was deliberated well before finalizing it. Comments of a medical specialist, an expert statistician and a textile expert were also sought, and necessary amendments were incorporated. The final draft of approved questionnaire was further processed for ecological validation and an approved version of Urdu translation was prepared to be used for this research (appendix 9).

Following the same manner, questionnaire was prepared for caregivers (appendix 10) and later it was also ecologically validated (appendix 11). The list of guiding questions was prepared for the interview survey from the specialist doctors following same methodology (appendix 12)

The survey questionnaire comprised of questions that tested identified objectives of this research. All five dimensions including comfort, management, economy, socio-psychological and esthetics were rigorously asked by the pool of questions under each dimension. Number of questions for all dimensions were kept same and at the end an overall review consisting of all dimensions was also incorporated. Questions were kept mutually exclusive with multiple choices answers, Likert-type response scale and very few open-ended choices. Additional, pertinent

research questions for demographic response parameters were included regarding the participant age, gender, income, educational background, duration of disease and side which is affected by hemiplegia. Same questionnaire was adapted for the care givers to know their perspective. The survey was administered in written (paper/pen) format. Upon verbal agreement from chosen individual at the research site to participate in the study, written consent to participate in the study was obtained before beginning the survey questionnaire. Participation in the survey study was voluntary and no penalties, punishment, or undue stress was inflicted on any participant if he or she chose not to participate in the survey. Research was once explained verbally by the researcher. All personal information, such as demographics, were confidential and only viewed by the researcher to compile cumulative research results.

3.3.9 Quantitative Data Analysis

After the participants completed the questionnaire it was saved for analysis. The number of prospective participants available at research site was unpredictable. So, few weeks were kept reserved for each research site to obtain desired number of participants as patients and as caregivers. Each response was numerically coded and was allotted a unique number for reference and data was analyzed anonymously. Data obtained from the survey questionnaires was coded and entered into SPSS statistical software for quantitative analysis. For statistical description and representation of constructs of interests the descriptive analysis was utilized. The findings were statistically and graphically presented as tables showing descriptive statistics of frequencies and percentage as well as bar graphs to interpret the outcomes of this part of study, recommendations were made. The findings guided the adaptive clothing need of the hemiplegic patients of the chosen representative sample of population of study.

3.4 Methodological Overview of Case Study:

Research Phase Two, Three, Four and Five for Qualitative Need Assessment, User Centered Designing and Adaptive Clothing Trial Intervention:

The qualitative aspects were an attempt to explore the *why* and *how* of adaptive clothing decision making by real users. For the intricate interpretations of experiences of human participants in complex settings of socio-cultural setups, qualitative manner of studying a research issue is preferred. Qualitative studies are significantly interpretive and try to bring into limelight an in-depth comprehension of human behavior and the reasons behind it in natural world setting. On the other hand, quantitative aspects of any research help to frame the *what, where, when* of inquiry (Gay, Mills, & Airasian, 2006).

3.4.1 Case Study Research Design

Exploratory case study design of research was used for widening of the viewpoint of this study. It helped to gain the most comprehensive understanding of the research issue by regarding unit of research as a holistic entity, the attributes of which were understood completely only when all were examined simultaneously. Case research was conducted as an in- depth inquiry of research problem in one or more actual life settings (case sites) over a long period of time. A combination of data collection methods was combined like interviews, personal observations, and timed dress trials. These salient features of case study method of research made it a suitable investigation technique for latter part of this study. (Kidd, 2006). Generalizability of case study was an issue that was enhanced by replicating and comparing the analysis in a multiple case design (Kumar, 2005). Purposively drawn small sample size of study participants helped to yield larger bulk of true in-depth data. In-depth multiple interviews revealed correct approach of real end users of adaptive clothing. This manner of qualitative interviews had also been found in related literature that helped to collect

exhaustive data in various details of clothing issues. For reduction of researcher's bias and maintenance of research design reliability, expert valuers were involved during whole process of research.

3.4.2 Unit of Interest

Development process of user centered adaptive clothing designs.

3.4.3 Unit of Analysis

Important participants as the unit of analysis for this part of this research on the subject of adaptive clothing designing included the adult patients with physical disabilities caused by onset of hemiplegia of grade 0-3 who were during management phase of disease. Understanding unit of analysis became important because the type of data that was collected and source from where it was collected had to be maintained to shape a strong study.

3.4.4 Study Participants

Adult patients of hemiplegia were the study participants.

3.4.5 Sample Size

For this case study 3 sets of participants were selected under the supervision of a qualified specialist doctor; each set comprised of a male and a female patient.

3.4.6 Case Study Sampling Frame

The sample population of the study consisted of adult hemiplegic patients. The sample of participants was purposively drawn. For selection of study participants various techniques were used. The preliminary selection of place from where participants were selected was through using a convenience method (Babbie, 1992).

From three selected research sites for quantitative data collection, hospital authorities were contacted to recommend the required cases. Inclusion criterion of the participants comprised of their age limit of above 25 years and their categorization as hemiplegia patient from the concerned hospital facility as research site. The sample size was small ($n=6$), this size represented a non-probability sample, this size was referred as useful, according to Bobbie (1992), when “one may wish to study a small subset of a larger population in which many members of the subset are easily identified, but the enumeration of all of them would be nearly impossible” (Babbie, 1992). In case of current study listings of individuals with hemiplegia was difficult to attain and, in many cases, it was unreliable because of variations in nature of disease. Thus, the only way to securely select possible study participants was to completely describe the research to doctors and nursing staff of selected hospitals and let the doctor and nursing staff identify and recommend patients having specific physical limitations due to hemiplegia who could graduate as study informants. Conclusively, for this study, a non-probability, small sample was the most precise means of gaining the depth and breadth of data required. Final participants were selected randomly by the researcher from suggested group of eligible patients willing to participate in the study.

3.4.7 Case Study Research

Primarily the last phases of research comprised of series of in-depth interviews with each study participant. Some data collection tools, evident from existing literature, were adapted to gather relevant true information from study participants. From selected research sites 6 participants were selected randomly out of pool of qualifying potential participants: with consultation of specialist doctors. Selected participants were contacted in person and were requested to participate in the in-depth case study; all six agreed to be part of the study. After their oral permission formal consent forms of study

were signed. These set of participants gave the researcher extended information into the specific nature of each informant's problem. This data served as a strong base for combining functional clothing solution with user centered preferences.

3.4.8 Qualitative Data Collection

Data collection of latter part of research for user centered designing methodology comprised of a linear progression of activities of data collection and analyses with all six participants, individually. The triangulation of observation, interview and questionnaire methods ensured removal of ambiguities and researcher's bias during qualitative data analysis. For ecological validation, all data collection data collection tools were kept in English and Urdu, which is prevalent language in the selected research region. Confidentiality was guaranteed to all research participants

Table 3: Data Collection Tools for Case Study Exploration

	Data collection tools
Phase 2/Question 7	Assessment of physical limitations
Phase 2/Question 7	Body measurement chart
Phase 3/Question 7	Assessment of potential clothing problems
Phase 3/Question 7	Timed dressing of regular clothing
Phase 4/Question 8	Basic body block patterns, male, and female
Phase 4/Question 8	Line drawing of adaptive clothing solutions
Phase 4/Question 8	Selection of material and construction of trial garment
Phase 5/Question 9	Evaluation of adaptive clothing wear trial
Phase 5/Question 9	Timed dressing of adaptive clothing

Phase two (research question six and objective six) focused on gathering data from case study participants to provide the necessary information about their altered set

of physical requirements after onset of hemiplegia. Emphasis was kept knowing the distribution of new needs across different body parts. Part of selected study instrument, taken from literature, was modified from the Enabler figure (Katherine E. C., 2001). To further enhance the list of physical limitations the Enabler figure along with opinion of a medical expert in this specific area of disability as well as approval of current research supervisory committee was considered. This particular instrument helped gather data about location of physical limitations after onset of hemiplegia (appendix 13). Body measurements of each participant were recorded (appendix 14).

Phase three (research question seven and objective seven) data was collected from same study participants, focused on special requirements expressed by hemiplegia patient for specific areas of every day regular clothing that needed to be modified to enhance agility. According to literature nine areas of possible physical limitations for dressing were identified along with special focus on viewpoint about comfort in material and garment, management of care and storage, conformance to social norms, aesthetics, and cost effectiveness (appendix 15). Time taken while dressing with conventional regular clothing was observed (appendix 16).

Phase four (research question eight and objective eight) focused on user centered designing of modified adaptive clothing, the information obtained from the study participants in phase two and three suggested a guideline for sketching adaptive clothing design which were most suitable for accommodating the specific needs. To make sketches basic body block patterns of female shirt and eastern trouser (appendix 17,18) and basic body block pattern of male shirt and trouser (appendix 19, 20) were used as orientation guides from which garment adaptations emerged. The standard basic body block pattern is a foundation configuration to reflect the individual human figure with respect to its size, shape, and posture; it is kept without the inclusion of style features. For further progression of adapted clothing design development some line

sketches were drawn to incorporate assessed changes in structural design of clothing. The adaptive clothing design sketching phase was also interactive, and participants were asked to make their comments while the adaptive clothing design sketches were being developed. After participant's approval of the adapted drawings supervisory panel was consulted for expert opinion. Three options in line sketch were proposed for female adaptive clothing (appendix 21, 22, 23), and similarly three options in line sketch were proposed for male adaptive clothing (appendix 24, 25, 26).

Material selection for the proposed adaptive clothing designs was done from the locally produced materials, keeping in mind the specific needs assessed in phase one, two and three. After detail deliberation and approval of supervisory committee locally produced combed mercerized cotton of 100gsm was selected that seemed fulfilling the indicated performance requirements and held best possible combination of required comfort properties. Standardized textile tests of the selected material were done in textile testing lab at the material manufacturing site (appendix 27). After approval of textile experts of advisory panel. the selected material was procured from a local production unit (appendix 28)

After the sketches were discussed with study participants and garment construction specialist a quarter scale prototype of one of proposed design was constructed to finalize the details of type of seam used and seam finishes applied along with most appropriate use of auxiliaries. Focus was held on the use of most suitable auxiliary materials and garment construction techniques for these dresses to provide maximum comfort and ease to the ultimate users. Approval of detailed features of quarter scale prototype led to the construction of real size adaptive clothing. Efforts were extended to incorporate assessed need in actual garments with most cost-efficient manner with respect to material and garment construction process. Garment specification sheets are the blueprint of garment design A garment specification sheet

is a technical document that contains the construction details of the selected garment design, a technical diagram/ sketch of the garment, individual measurements of different parts of garment as well as the type and position of auxiliaries used, stitch class and seam type. The details of clothing design are communicated through the specification sheet for regularization of construction process. Specification sheets were prepared for every piece of selected adaptive clothing design to ensure accurate outcomes (appendix 29, 30, 31, 32). Detailed specification sheet contained final dress measurements for each participant, comprehensive technical drawing of design, auxiliary materials consumed and construction method

Phase five (research question nine and objective nine) aimed at wear trial testing of constructed trial adaptive clothing to find their effectiveness. Three sets of trial adaptive clothing, made according to corresponding measurements, were provided to the same set of study participant, information was collected about their experience after three weeks of use (appendix 33). Evaluations were drawn regarding the performance of these adaptive clothing regarding comfort, reduced number of joint movements involved while dressing, cost effectiveness, esthetics, management, and social conformity. At final stage of this phase, a timed trial of adaptive clothing was also carried to gauge the difference (appendix 34).

3.4.9 Qualitative Data Analysis

The researcher documented responses to all interview questions, these interviews were also audio taped to help in later detailed writing of interview notes. All information was consolidated for each participant. Initially, data was compiled about the participant's specific physical restrictions and their individual clothing preferences. Each case was individually analyzed first to exclusively know each participant's real needs then their cross-case examination further elaborated similarities and differences

expressed by the real users. Cross case consolidation revealed the desired performance requirements of comfort, management, economy, socio-psychological and aesthetics with regard to nature of material and manner of structural design of garment. From the transcription and analysis of interviews at phase two and three, performance requirements were extracted. This data of phase two and three became the input for the user centered designed sketches of the adaptive garments.

3.5 Validity of the Data Collection Tools

Validity of study instrument assures the accuracy of all measures being used (Babbie, 1992). The interview instruments to be used in user centered adaptive designing research are extracted from existing literature about this research issue. Integration of a modified form of Enabler model; a recognized, precise, and convenient tool to describe type of physical limitations for formulation of designs in all applied art fields ensures that the problem under research is being authentically described (Beamish, 1999). This provides a strong base for the fulfilment of instrument validity criteria in the qualitative part of study (Newton, 1984-1985). Instrument is carefully developed from existing relevant literature on clothing issues specifically addressing individuals with physical disabilities due to diverse reasons. In allowing the study informants to co-design the line sketches of proposed clothing solution along with the opinion of researcher also provided instrumental validity for this research as such sketches represented the exact requirements and desires of participants.

3.6 Reliability of Data Collection Tools

In qualitative research, reliability (that is, whether two researchers using the same methods will come up with similar results) is generally assessed by transparency, consistency, coherence, and communicability of the study (Gay, Mills, & Airasian, 2006). Researcher has tried to maintain transparency of the processes of data collection

by clearly stating all the steps taken to ensure that measurements of specific concepts were the most precise according to the constraints of the researcher.

Reliability of qualitative study instrument ensures replicability of study (Gay, Mills, & Airasian, 2006). Instruments used during this study were presented along with a thorough protocol, describing all the necessary steps for successful completion of data collection while using the instrument. Pilot testing of study instruments was performed to guarantee precision and ease of instrument use. Expert opinion was sought throughout the process of design evolution of adaptive clothing to ensure that solutions address user needs and preferences. To maintain transparency, transcripts were made of all data collection processes and audiotapes made of participant interviews, and wear test evaluations. Expert in the clothing design field checked the sketches of proposed and co designed adaptive clothing solutions and specification sheets were made to maintain transparency in the construction of the trial adaptive garment.

Chapter 4

Results

The chapter brings together the compiled results of all data collected for various phases of this research. For clarity and ease of understanding the results of multiphase research are compiled according to the proposed plan research questions. Multiple methods of data collection and various types of information were obtained during study to search for results. Suitable analyses were conducted for proposed qualitative and quantitative data obtained from groups of participants. The proposed research questions guided every step of study including selection of sample, development of data collection tools, methods of data collection and finally data analyses of this research venture. The quantitative need assessment is compiled as descriptive statistic in tabulation and graphical presentation to show case the trends of responses of patients and caregivers followed by thematic analysis of medical expert opinion. The quantitative results indicate that among both groups of respondents difference of opinion was found of their preferences than similarity. Trend of preferences chosen by patients showed their greater desire for thorough fulfillment of needs arising from hemiplegia, on the other hand caregivers preferred for availability of suitable solutions for provision of speedy and complete care services.

4.1 Survey; Research Phase One

The objectives of initial part of the study comprised of exploration of adaptive clothing needs of hemiplegia patients. From selected research sites approximately 150 potential participants as patients as well as caregivers were requested to participate in the proposed survey; 140 among patients and same among caregivers agreed to complete the questionnaire. The response rate remained 100% as group-administered survey ensured to remove ambiguities at the time of data collection and every

questionnaire was 100% complete and valid for the study analysis. Inclusion criterion of the patient participants comprised of their age limit of above 25 years and their categorization as hemiplegia patient from the concerned hospital facility as research site. For ecological validation questionnaire was kept in English and Urdu, which is prevalent language in the selected research region. Important demographic information of patient participants as well as caregiver participant was gathered prior to the questions relevant to study objectives. Questionnaire data was coded and entered into SPSS as it was being collected from both groups. Before analysis multiple response rate categories were separately coded. Demographic details of both type of study participants were analyzed first to know the frequency distribution of different features. Descriptive statistics were computed separately for every response for both the patient participants as well as caregiver participants, this led to the overall evaluation of each section of questionnaire from patients as well as caregiver point of view. The following results section is discussed in order of frequency distribution of demographics first of both patients and caregivers, followed by descriptive statistics and graphical representation as bar graph of each response from patients as well as caregivers to highlight the probable outcome of each research question of initial phase of study. The overall interpretation of the input by doctors, extracted from their interviews, was included at end of each category.

4.1.1 Demographics of Survey Sample

The demographic data was compiled first to gather knowledge about significant dimensions. Table 4 shows the compiled demographic information of study sample of patients regarding gender, age, level of education, income, duration of disease, side of body affected by hemiplegia. Table 5 shows the demographic features of study sample of caregivers. Table 6 shows the demographics of sample of doctors who provided expert knowledge about manifestations of changes in human body due to hemiplegia.

Table 4: Demographic Characteristics of Study Sample of Patients

		N=140	100 %
Gender	Male	74	52.9%
	Female	66	47.1%
Age	>15	00	00%
	16-20	00	00%
	21-30	00	00%
	31-40	00	00%
	41-50	50	35.7%
	51-60	60	42.9%
	+60	30	21.4%
Educational	High School Certification	49	35%
Qualification	Undergraduate	48	34.3%
	Graduate	24	17.1%
	Postgraduate	6	4.3%
	Professional	13	9.3%
	Others	0	0%
Profession	Government Employment	0	0%
	Private Employment	0	0%
	Business	19	13.6%
	Staying at home	121	86.4%
	Others	0	0%
Monthly Income	>30000	6	4.3%
	30000-50000	19	13.6%
	50000-100000	49	35%

	100000-200000	36	25.7%
	200000-300000	30	21.4%
	300000-400000	0	0%
	400000-500000	0	0%
	+500000	0	0%
Marital Status	Married	91	65%
	Unmarried	12	8.6%
	Divorced	0	0%
	Widow/ widower	37	26.4%
Duration of Disease	12months	0	0%
	12-24 months	37	26.4%
	24-36 months	91	65%
	36-48 months	12	8.6%
	48-60 months	0	0%
	<60 months	0	0%
Affected Side	Left	55	39.7%
	Right	85	60.7%

Compilation in table 4 showed that out of 140 participants 52.9% were male and 47.1% were female. The largest group of participants, 42.9%. of his data, was found between 51-60 years of age. Most study participants 35% of this data had high school certification as highest qualification. According to professional engagement 86.4% of population was staying at home. Assessment of income level of participants indicated that 35%) of participants had monthly income between Rs. 50000-100000. About the marital status of the given population more than half of the sample, 65% were found married. The question regarding duration of disease revealed that majority of

participants were suffering from hemiplegia for 24-36 months. It was found that majority of the sample, 60.7% had their disability on right side of their body

Table 5: Demographic Characteristics of Study Sample of caregivers

		N=140	100 %
Gender	Male	38	27.1%
	Female	102	72.9%
Age	>15	00	00%
	16-20	01	0.7%
	21-30	60	42.9%
	31-40	59	42.1%
	41-50	20	14.3%
	51-60	00	00%
	+60	00	00%
Duration of Service	>1year	6	4.3%
	1-2 years	19	13.6%
	2-3 years	49	35%
	3-4 years	36	25.7%
	4-5 years	30	21.4%
	< 5 years	0	0%

Compilation in table 5 showed that out of 140 participants 72.9% were female and 27.1% were male. The largest group of participants, 42.9%. of his data, was found between 21-30 years of age. Most study participants 35% of this data had been acting as caregivers between 2-3 years. The participants belonging to this group of respondents comprised of few family caregiver members and some specialized nurses who were caregiver for hemiplegia patients while provision of medical services to them.

Table 6: Demographic Characteristics of Study Sample of Doctors

		N=6	100%
Gender	Male	4	66.6%
	Female	2	33.3%
Designation	Lecturer	2	33.3%
	Assistant Professor	3	50%
	Professor	1	16.6%
Length of Service	1-5 years	3	50%
	6-10 years	2	33.3%
	10-15 years	1	16.6%

Compilation in table 6 regarding demographics of expert doctors of the field showed that out of 6 participants 66.6% were male and 33.3% were female. The largest group of participants, 50% of his data, was found lecturers. Most study participants 50% had been imparting their services for 1-5 years.

4.1.2 Addressing Research Question One Corresponding to Phase One

R.Q. 1 What are the specific needs regarding comfort in material and garment of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist medical doctors?

1.1 Survey Question for Patients: (multiple response sets)

What changes do you feel in yourself after onset of hemiplegia (select all that apply)?

1.1 Survey Question for Caregivers: (multiple response sets)

What changes do you feel in patients after onset of hemiplegia (select all that apply)?

Table 7: Descriptive Statistics of Response 1; Research Question 1

Patient response		Caregiver Response	
N=140	100%	N=140	100%

Restriction in movement due to joint incoordination	104	74.3%	89	63.6%
Restriction in movement due to muscular incoordination	140	100%	140	100%
Feeling of numbness and cold	67	47.9%	124	88.6%
Difficulty in lifting	134	95.7%	72	51.4%
Difficulty in repositioning	134	95.7%	123	87.9%
Difficulty in turning	116	82.9%	107	76.4%
Difficulty in holding	140	100%	140	100%
Others-	0	0%	0	0%

Restriction in movement due to joint incoordination.

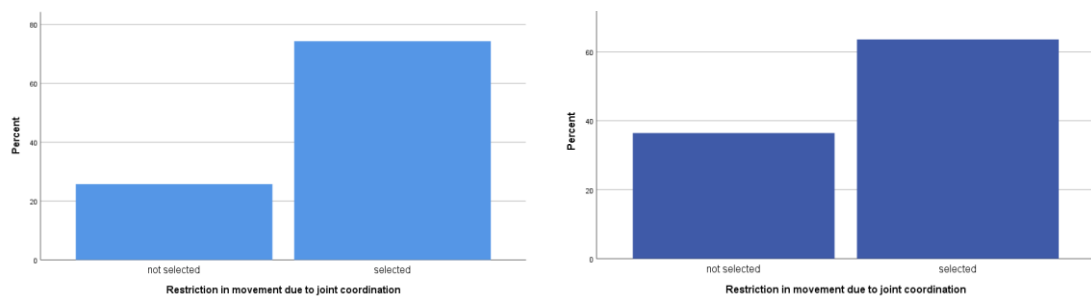


Figure 3: Bar Graphs of Patients and Caregivers for Response 1.1; Research Question 1

The compilation in table 7 and figure 3 shows the result of the patients and the caregivers regarding their opinion about restriction in movement due to joint incoordination. The graphs show that among both groups the dimension had higher rate of selection but it was slightly higher in patients, 74.3% ; than in caregivers, 63.6%. The results clearly indicate a similar trend found in both groups that suggests that after onset of hemiplegia, patients as well as caregivers, experience extreme restricted movements of patients due to incoordination of the joints. These restricted movements, after acquiring hemiplegia, form newer needs of comfort for both groups leading to need of some adaptations in garment to facilitate the act of putting on and taking off the dress.

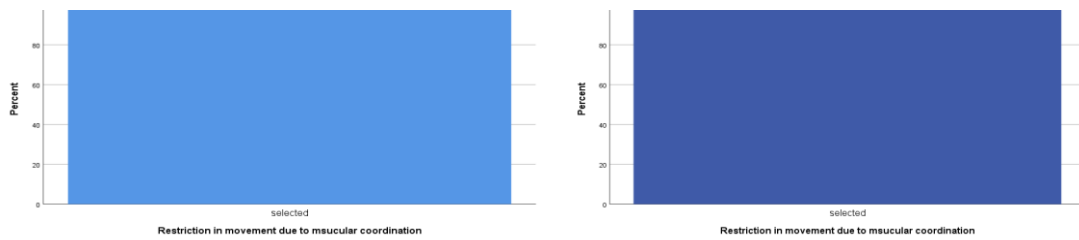


Figure 4: Bar Graphs of Patients and Caregivers for Response 1.2; Research Question 1

The compilation in table 7 and figure 4 shows the result of the patients and the caregivers regarding their opinion about restriction in movement due to muscular incoordination. The graphs show that among both groups the dimension had 100% rate of selection. The results clearly indicated exactly similar trend, with 100% selection rate in both groups, that suggested that after onset of hemiplegia, patients as well as caregivers experienced restricted movements due to muscular incoordination of patients. This muscular incoordination after onset of hemiplegia necessitated unique adaptations in the clothing of patients for provision of comfort to minimise the amount of muscle movement required while dressing.

Feeling of numbness and cold.

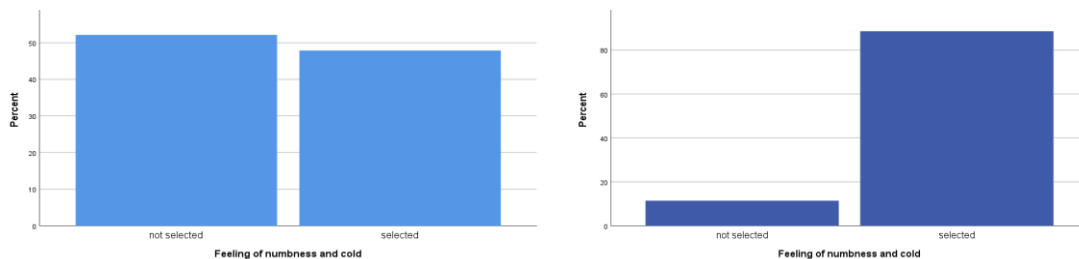


Figure 5: Bar Graphs of Patients and Caregivers for Response 1.3; Research Question 1

The compilation in table 7 and figure 5 shows the result of the patients and the caregivers regarding their opinion about feeling of numbness and cold. The graphs show that among both groups the dimension had slightly lower rate of selection in patients, 47.9% ; but it was very high among the caregivers, 88.6%. The results indicate that among both groups a difference of opinion was found about feeling of numbness and cold in patients. This suggested that after onset of hemiplegia, patients loose sensation, especially of their extremities along with loss of joint and muscular control. This lack of sensation seem the probable cause of the variation of results among both

groups. Caretakers with normal motor and sensory abilities were better able to feel the lower body temperature in extremities of the patients than the patients themselves. Lack of sensorial ability of sufferers was an important physical comfort need to be premeditated in their adaptive clothing.

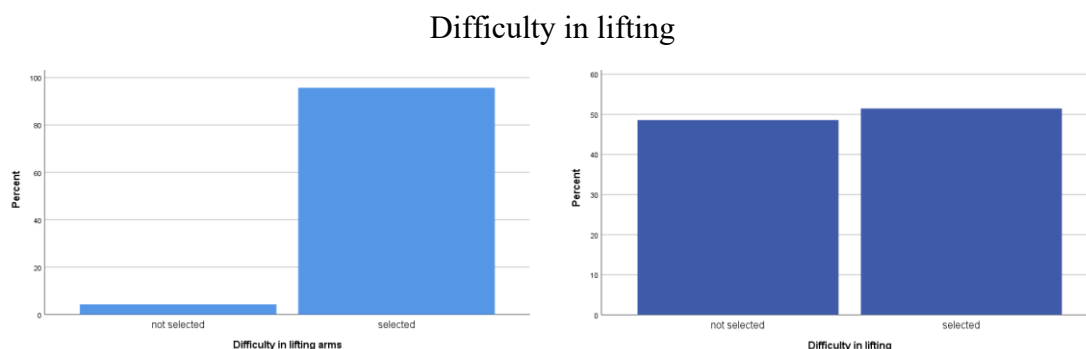


Figure 6: Bar Graphs of Patients and Caregivers for Response 1.4; Research Question 1

The compilation in table 7 and figure 6 shows the result of the patients and the caregivers regarding their opinion about difficulty in lifting. The graphs show that among the group of patients this dimension had very high rate of selection, 95.7% ; but among the group of caregivers this dimension had lower rate of selection, 51.4%. The results indicate that among both groups a dissimilarity of opinion was found about extent of difficulty of lifting among patients. This suggested that after onset of hemiplegia, patients suffered more from their inability to lift than their care givers. This personal inability to lift seem the probable cause of the variation of results among both groups. Caretakers with normal motor and sensory abilities were not able to rate this restriction than the patients themselves. Lack of ability to lift was also an important physical comfort need to be consciously planned in adaptive clothing of such sufferers.

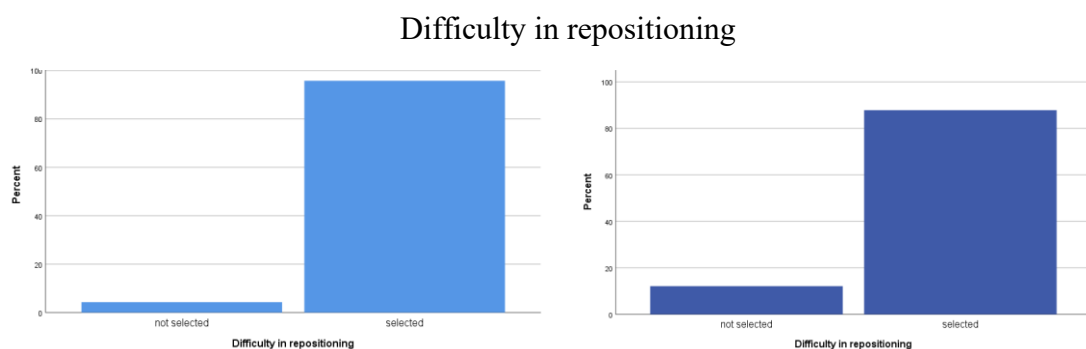


Figure 7: Bar Graphs of Patients and Caregivers for Response 1.5; Research Question 1

The compilation in table 7 and figure 7 shows the result of the patients and the caregivers regarding their opinion about difficulty in repositioning. The graphs show that among both groups this dimension had higher rate of selection but it was higher in patients, 95.7% ; than in caregivers, 87.9%. The results clearly indicated very similar trend, with very high selection rate in both groups, that suggested that after onset of hemiplegia, patients as well as caregivers experienced resistance while repositioning. This resistance while repositioning indicated need of unique adaptations in the clothing of patients to minimise the amount of repositioning required while dressing.

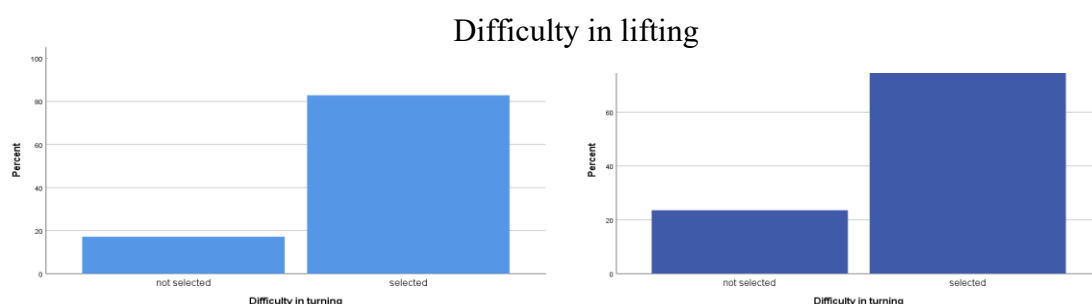


Figure 8: Bar Graphs of Patients and Caregivers for Response 1.6; Research Question 1

The compilation in table 7 and figure 8 shows the result of the patients and the caregivers regarding their opinion about difficulty in turning. The graphs show that among both groups the dimension had higher rate of selection but it was higher in patients, 82.9% ; than in caregivers, 76.4%. The results noticeably indicated a similar trend, with very high selection rate in both groups, that suggested that after onset of hemiplegia, patients as well as caregivers experienced restriction while turning to sides of patients. This lack of ability to take turn to a side after onset of hemiplegia necessitated unique adaptations in the clothing of patients to minimise the numbers of turns of body required while dressing.

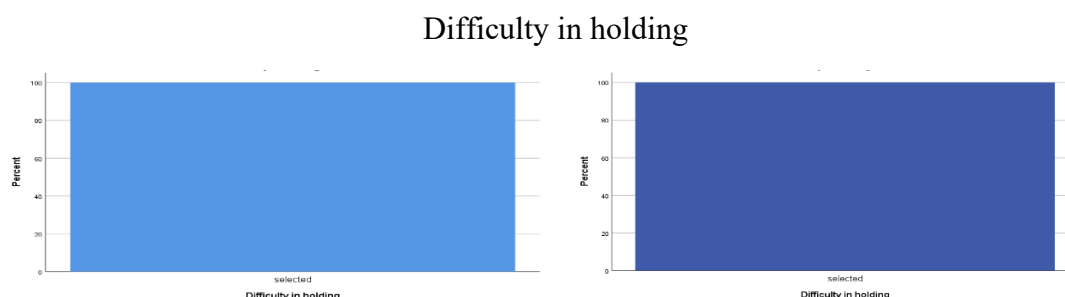


Figure 9: Bar Graphs of Patients and Caregivers for Response 1.7; Research Question 1

The compilation in table 7 and figure 9 show the result of the patients and the caregivers regarding their opinion about difficulty in holding. The graphs show that among both groups the dimension has 100% rate of selection. The results clearly indicated exactly similar trend, with 100% selection rate in both groups, that suggested that after onset of hemiplegia, patients as well as caregivers experienced restricted ability of grip due to muscular incoordination of patients. This muscular incoordination after onset of hemiplegia indicated need of unique adaptations in the clothing of patients for easy handling of fasteners in the garment.

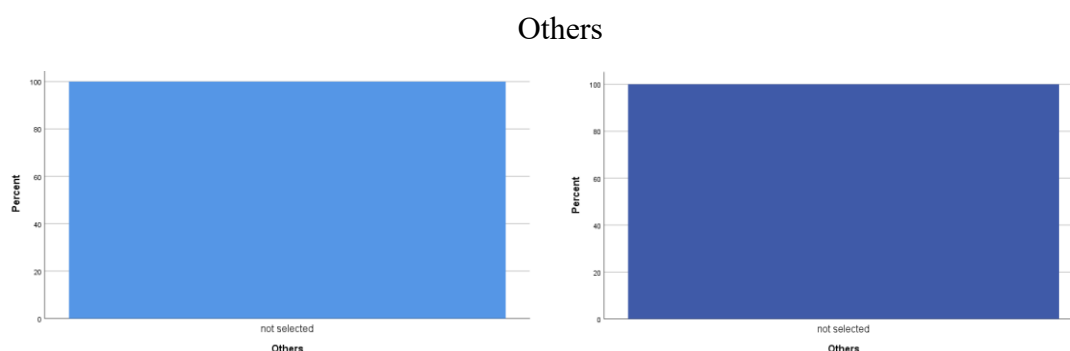


Figure 10: Bar Graphs of Patients and Caregivers for Response 1.8; Research Question 1

The compilation in table 7 and figure 10 show the result of the patients and the caregivers regarding their opinion about any other dimension. The graphs show that among both groups no other dimension had been indicated; 100% of both groups did not select for any other dimension. Both of the groups showed a complete response to all the previous questions while data collection. The parameters discussed in detail regarding physical comfort of the patients were explanatory enough that no more dimensions were pointed out by both groups.

1.2 Survey Question for Patients: (multiple response sets)

What are main areas of difficulty with regular clothing (select all that apply)?

1.2 Survey Question for Caregivers: (multiple response sets)

What are main areas of difficulty with regular clothing of patients (select all that apply)?

Table 8: Descriptive Statistics of Response 2; Research Question 1

	Patient		Caregiver	
	Responses		Responses	
	N=140	100%	N=140	100%
Fitting issues due to new special needs	86	61.4%	90	64.3%
Clothing challenges while putting on and off	140	100%	140	100%
Position of fasteners	31	22.1%	65	46,4
Type of fastener	67	47.9%	79	56.4%
Inadequate ease allowance at waistline	134	95.7%	128	91.4%
Inadequate ease allowance at hipline	30	21.4%	65	46.4%
In adequate ease allowance at armhole	43	30.7%	55	39.3%
Position of the seams	31	21.1%	77	55%
Type of seam	0	00%	0	00%
Location of openings	6	4.3%	37	26.4%
Others	6	4.3%	9	6.4%

Fitting issues due to special needs.

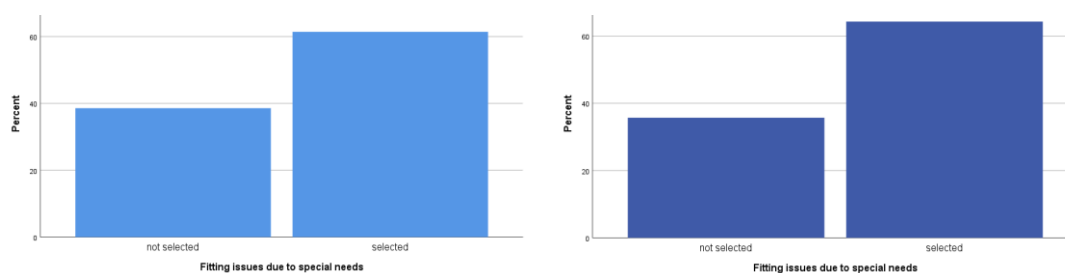


Figure 11: Bar Graphs of Patients and Caregivers for Response2.1; Research Question1

The compilation in table 8 and figure 11 shows the result of the patients and the caregivers regarding their opinion about fitting issues due to new special needs. The graphs show that among both groups the dimension had higher rate of selection but it was slightly lower in patients, 61.4%.; than in caregivers, 64.3%. The results pointd out

a similar concern shown by both groups about inadequacy of a proper fit of regular clothing . This brought into lime light the overall dissatisfaction of patients and caregivers for the use of regular clothing for such patients. The results indicated existance of newer needs to be accomodated in adaptive clpthing designs for such population. The muscular and motor changes assessed in response 1 of research question 1 also supported results of this dimension. Altered motor, muscular and sensorial capabilities of hemiplegia sufferers demanded for change in the structural layout of the specialised adaptive garment for accomodation of newer needs.

Clothing challenges while putting it on and off.

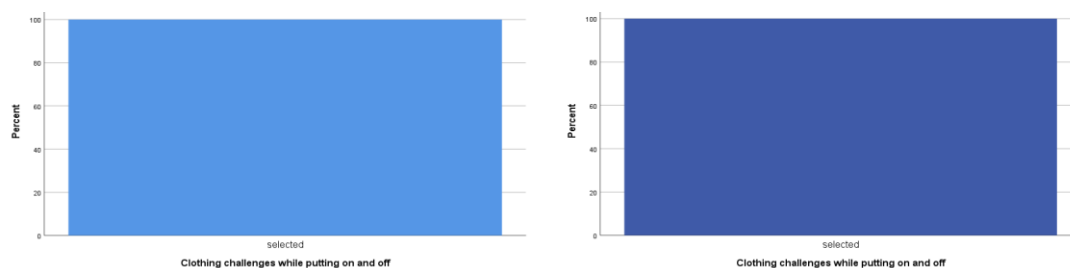


Figure 12:Bar Graphs of Patients and Caregivers for Response2.2;Research Question1

The compilation in table 8 and figure 12 shows the result of the patients and the caregivers regarding their opinion about clothing challenges while putting it on and off. The graphs show that among both groups this dimension had 100% rate of selection. The results clearly indicated similar trend, with 100% selection rate in both groups, it suggested that after onset of hemiplegia, patients as well as cregivers experienced a lot of challenges while dressing and undressing with regular clothing. This dissatisfaction due to challenges faced while dressing after onset of hemiplegia indicated need for unique adaptations in the clothing of patients for provision of comfort while dressing.

Clothing challenges due to position of fasteners.

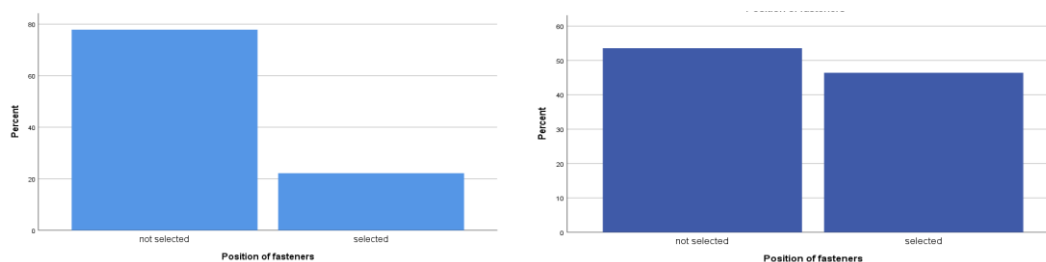


Figure 13:Bar Graphs of Patients and Caregivers for Response2.3;Research Question1

The compilation in table 8 and figure 13 shows the result of the patients and the caregivers regarding their opinion about clothing problem due to position of fasteners. The graphs show that among both groups the dimension had lower rate of selection but it was very low among patients, 21.1% ; but slightly low among caregivers, 46.4%. The results indicate that among both groups a difference of opinion was found about dressing issues due to position of fasteners. This suggested that after onset of hemiplegia, patients experienced lesser problem than their caregivers. The dependency upon caregivers while dressing seem the probable cause of the variation of results among both groups. Caretakers while handing regular clothing for dressing patients, expressed their reservations with the position of fasteners than the patients themselves.

Clothing challenges due to type of fasteners.

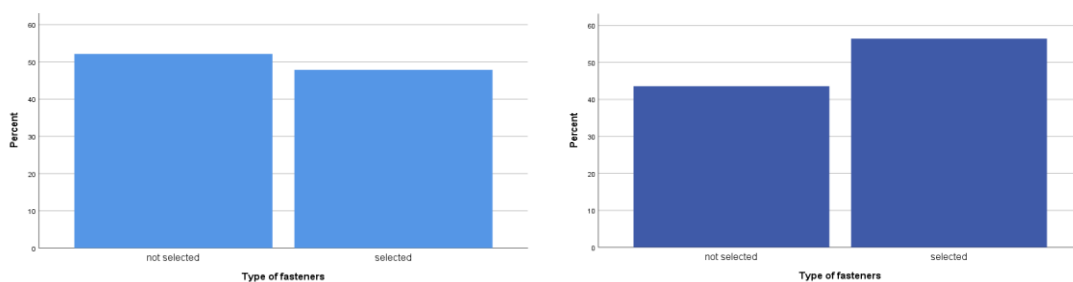


Figure 14: Bar Graphs of Patients and Caregivers for Response 2.4; Research Question 1

The compilation in table 8 and figure 14 shows the result of the patients and the caregivers regarding their opinion about clothing challenges due to type of fasteners. The graphs show that among both groups the dimension has almost similar rate of selection and non selection but selection was slightly lower in patients, 47.9% ; than in caregivers, 56.4%. Contrary to previous dimension about position of fasteners, the type of fasteners was actively responded by all participants and all suggested for change in the type of fasteners been used in regular clothing to facilitate the act of dressing .

Clothing challenges due to inadequate ease allowance at waistline.

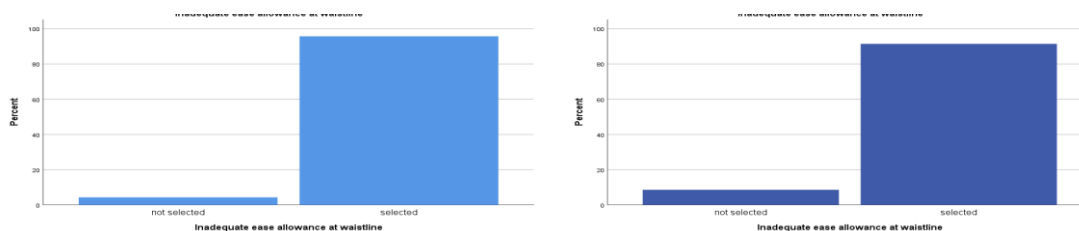


Figure 15: Bar Graphs of Patients and Caregivers for Response 2.5; Research Question 1

The compilation in table 8 and figure 15 shows the result of the patients and the caregivers regarding their opinion about inadequate ease allowance at waistline. The graphs show that among both groups the dimension had a very high rate of selection but it was slightly higher in patients, 95.7% ; than in caregivers, 91.4%. The results clearly indicate a similar trend found in responses of both groups that suggests that after onset of hemiplegia, patients as well as caregivers opted for provision of more ease allowance at waistline because of restricted movements of patients due to incoordination of the joints and muscles.

Clothing challenges due to inadequate ease allowance at hipline.

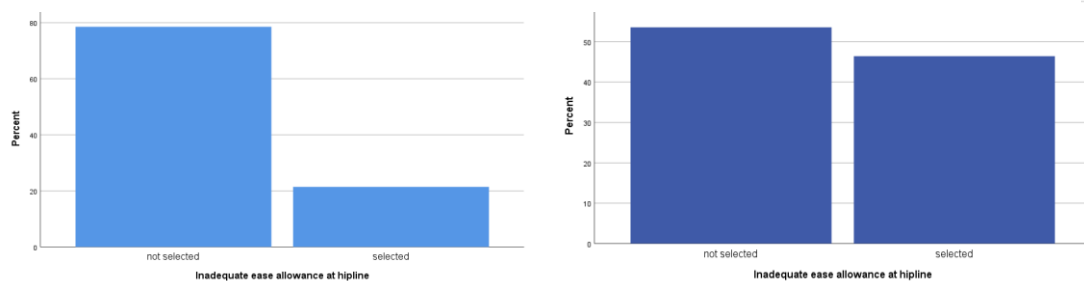


Figure 16: Bar Graphs of Patients and Caregivers for Response 2.6; Research Question 1

The compilation in table 8 and figure 16 shows the result of the patients and the caregivers regarding their opinion about inadequate ease allowance at hipline. The graphs show that among both groups this dimension had a lower rate of selection but it is very low in patients, 21.4% ; than in caregivers, 46.4%. The results clearly indicated very similar trend, with lower selection rate in both groups, this suggested that after onset of hemiplegia, patients as well as caregivers experienced lesser issue with the dimensions of regular garment at hipline and showed adequate satisfaction with the available ease allowance at hipline of regular clothing.

Clothing challenges due to inadequate ease allowance at armhole.

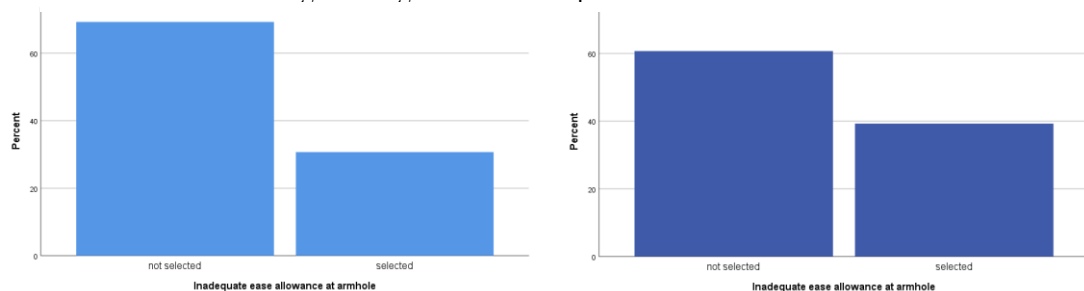


Figure 17: Bar Graphs of Patients and Caregivers for Response 2.7; Research Question 1

The compilation in table 8 and figure 17 shows the result of the patients and the caregivers regarding their opinion about inadequate easeallowance at armhole. The graphs show that among both groups the dimension had a low rate of selection but it was lower in patients, 30.7% ; than in caregivers, 39.3%. The results undoubtedly indicated very similar trend with lower selection rate in both groups, this suggested that after onset of hemiplegia, patients as well as cregivers experienced lesser issue with the easeallowance at armhole site of regular clothing.

Clothing challenges due to position of seams.

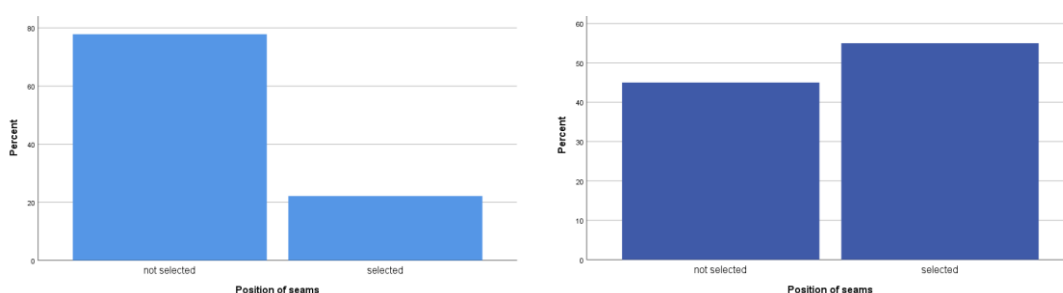


Figure 18:Bar Graphs of Patients and Caregivers for Response2.8;Research Question1

The compilation in table 8 and figure 18 shows the result of the patients and the caregivers regarding their opinion about clothing problems they face due to position of seams. The graphs show that among both groups the dimension had a very low rate of selection but it was lower in patients, 21.1% ; and slightly higher in caregivers, , 55%. The results indicate that among both groups a dissimilarity of opinion was found about clothing problems arising from position of seams in the regular clothing. Results suggested that hemiplegia patients with lowers sensory capability were lesser aware of the discomfort in regular clothing due to position of seams but their care givers opinion threw light on skin issues due to development of pressure points and rubbing at seams.

Clothing challenges due to type of seam.

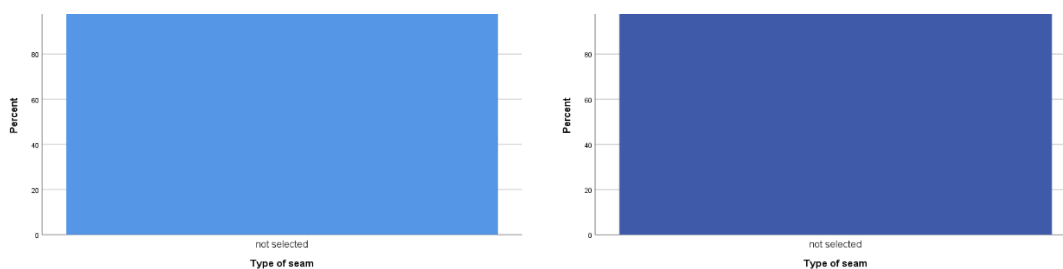


Figure 19:Bar Graphs of Patients and Caregivers for Response2.9;Research Question2

The compilation in table 8 and figure 19 shows the result of the patients and the caregivers regarding their opinion about clothing problems due to type of seams. The graphs show that among both groups the dimension had 100% rate of non selection.

Clothing challenges due to location of openings.

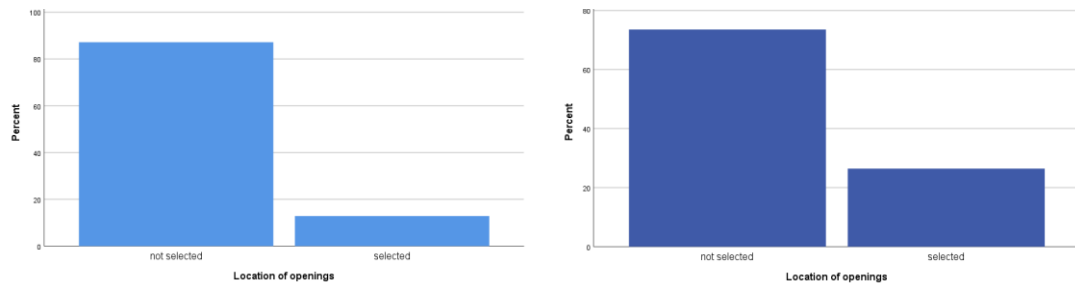


Figure 20: Bar Graphs of Patients & Caregivers for Response 2.10; Research Question 1

The compilation in table 8 and figure 20 shows the result of the patients and the caregivers regarding their opinion about clothing problems due to location of openings. The graphs show that among both groups the dimension had a very low rate of selection but it was very low in patients, 4.3% than in caregivers, 26.4%. %. The results clearly indicated very similar trend, with very low selection rate in both groups, that suggested that after onset of hemiplegia, patients as well as caregivers experienced lesser issues with location of openings.

Clothing challenges due to any other clothing dimension.

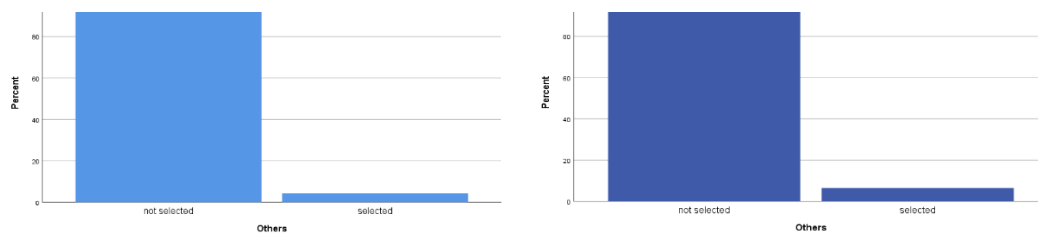


Figure 21: Bar Graphs of Patients & Caregivers for Response 2.11; Research Question 1

The compilation in table 8 and figure 21 shows the result of the patients and the caregivers regarding their opinion about any other dimension causing clothing issue. The graphs show that among both groups the dimension had a very low rate of selection but it was very low in patients, 4.3% ; than in caregivers, 6.4%. %. The results indicated very similar trend in both groups, showing no other issues than the mentioned dimensions of regular clothing

1.3 Survey Question for Patients: (multiple response sets)

Which area of body you need to expose for treatment (select all that apply)?

1.3 Survey Question for Caregivers: (multiple response sets)

Which area of body of patient needs to be exposed for treatment (select all that apply)?

Table 9: Descriptive Statistics of Response 3; Research Question 1

Patient Responses			Caregiver Responses	
	N=140	100%	N=140	100%
Arms	140	100%	140	100%
Shoulder	140	100%	140	100%
Chest	102	72.9%	102	72,9%
Legs	110	78.6%	108	77.1%
Side	78	55.7%	83	59.3%
Back	128	91.4%	116	82.9%
Others	0	0%	0	00%

Expouser of arms during treatment.

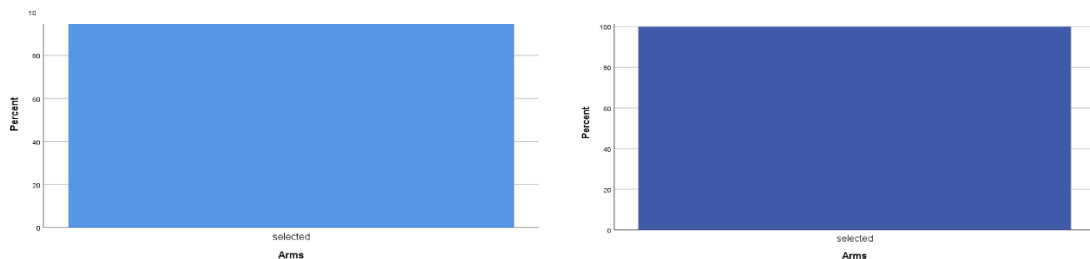


Figure 22: Bar Graphs of Patients and Caregivers for Response 3.1; Research Question 1

The compilation in table 9 and figure 22 shows the result of the patients and the caregivers regarding their opinion about expouser of arms for treatment. The graphs show that among both groups of patients and caregivers the dimension had a 100% rate of selection. The results clearly indicated exactly similar trend, with 100% selection rate in both groups, that suggested that expouser of the arms was necessary for different

type of treatments after onset of hemiplegia. This indicated need of unique adaptations in the clothing of patients for easy reachability along the full length of sleeves.

Expouser of shoulders during treatment.

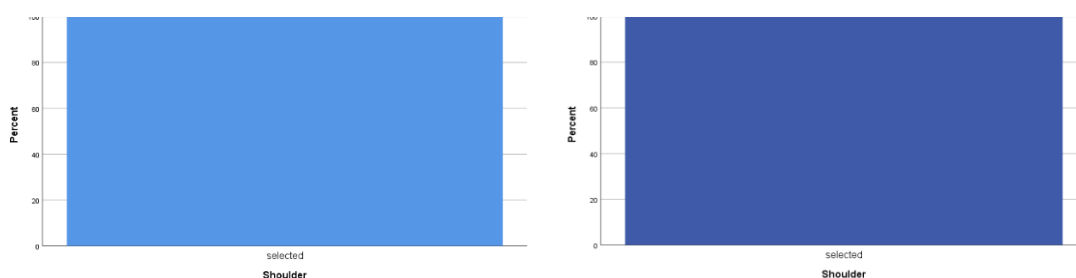


Figure 23: Bar Graphs of Patients and Caregivers for Response 3.2; Research Question 1

The compilation in table 9 and figure 23 shows the result of the patients and the caregivers regarding their opinion about expouser of shoulders for treatment. The graphs show that among both groups of patients and caregivers the dimension had a 100% rate of selection. The results showed exactly similar trend, with 100% selection rate in both groups, that suggested that after onset of hemiplegia, patients as well as caregivers expressed concern for difficulty to reach shoulder areas which needed expouser during different treatments. This trend was suggestive for provision of openings in adaptive clothing so that ease of access to these areas is ensured.

Expouser of chest during treatment.

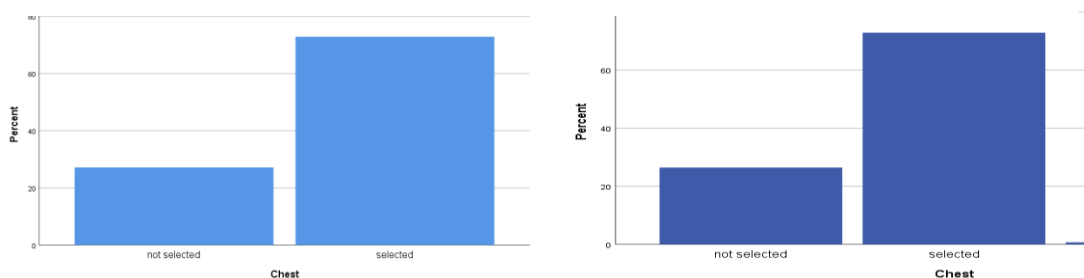


Figure 24: Bar Graphs of Patients and Caregivers for Response 3.3; Research Question 1

The compilation in table 9 and figure 24 shows the result of the patients and the caregivers regarding their opinion about expouser of chests for treatment. The graphs show that among both groups the dimension had a higher rate of selection and it was similar in both patients and caregivers, 72.9%. The results clearly indicated mostly similar trend, with higher selection rate in both groups, that suggested that after onset

of hemiplegia, patients as well as caregivers showed concern for need of expouser of chest area of patients for treatment.

Expouser of legs during treatment.

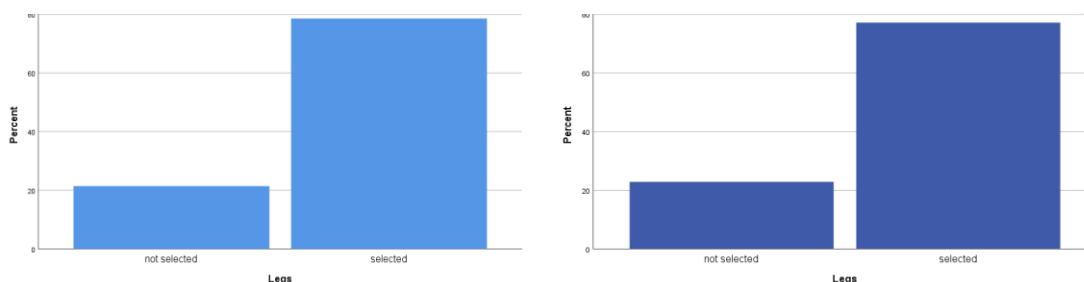


Figure 25: Bar Graphs of Patients and Caregivers for Response 3.4; Research Question 1

The compilation in table 9 and figure 25 shows the result of the patients and the caregivers regarding their opinion about expouser of legs for treatment. The graphs show that among both groups the dimension had a higher rate of selection but it was slightly higher in patients, 78.6% ; than in caregivers, 77.1%. The results clearly indicated exactly similar trend, with higher selection rate in both groups, that suggested that after onset of hemiplegia, patients as well as caregivers expressed need for specialised openings in dress to accommodate easy covering and uncovering and controlled extent of expouser along the length of legs.

Expouser of sides during treatment.

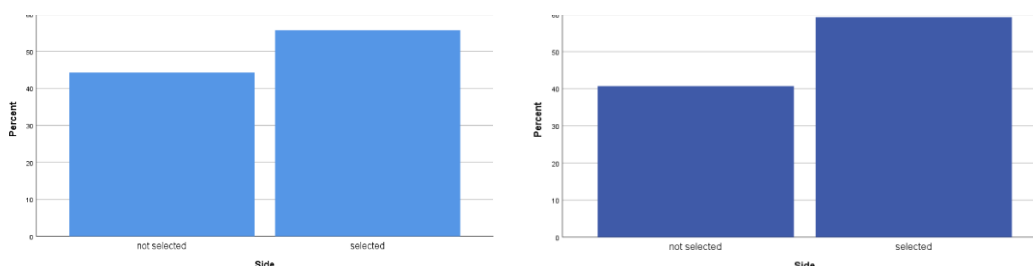


Figure 26: Bar Graphs of Patients and Caregivers for Response 3.5; Research Question 1

The compilation in table 9 and figure 26 shows the result of the patients and the caregivers regarding their opinion about expouser of sides for treatment. The graphs show that among both groups the dimension had slightly higher rate of selection but it was lower in patients, 55.7% ; than in caregivers, 59.3%. The results somehow similar trend, with similar selection rate in both groups, that suggested that after onset of

hemiplegia, patients as well as caregivers experienced similar need of easy approach to the side of patient for treatment purpose.

Expouser of back during treatment.

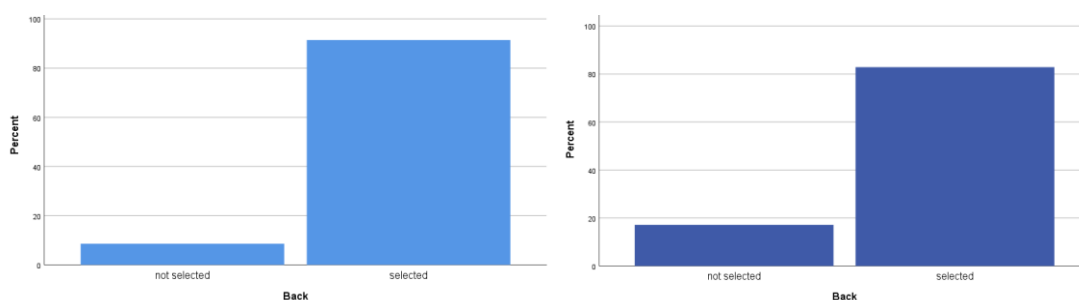


Figure 27: Bar Graphs of Patients and Caregivers for Response 3.6; Research Question 1

The compilation in table 9 and figure 27 shows the result of the patients and the caregivers regarding their opinion about expouser of back for treatment. The graphs show that among both groups the dimension had a very high rate of selection but it was higher in patients, 91.4% ; than in caregivers, 82.9%. The results clearly indicated exactly similar trend, with very high selection rate in both groups, that suggested that after onset of hemiplegia, patients as well as caregivers showed similar concern for easy covering and uncovering of the back of patient for treatment purposes. Conclusively the adaptive amendments in the structure of clothing were sensed that would allow for easy and controlled expouser of required body part while seeking any kind of medical help

Expouser of any other parts during treatment.

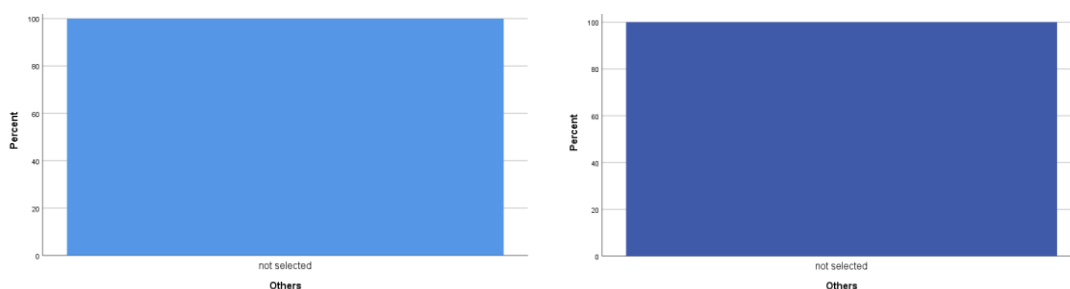


Figure 28: Bar Graphs of Patients and Caregivers for Response 3.7; Research Question 1

The compilation in table 9 and figure 28 show the result of the patients and the caregivers regarding their opinion about any other physical dimension exposed during treatment. The graphs show that among both groups no other dimension had been

indicated; 100% of both groups did not mention any other dimension. The previous parameters regarding physical expouser discussed in detail of possible options which were explanatory enough that no more dimensions were pointed out by both groups.

1.4 Survey Question for Patients:

Which is more important criterion for physical comfort in your dress?

1.4 Survey Question for Caregivers:

Which is more important criterion for physical comfort in patient's dress?

Table 10: Descriptive Statistics of Response 4; Research Question 1

Patient Responses			Caregiver Responses	
	N=140	100%	N=140	100%
Feel and type of material	12	8.6	21	15%
Style of dress	104	74.3	59	42.1%
Manner of sewing	24	17.1	60	42.9%

Preference for physical comfort in dress.

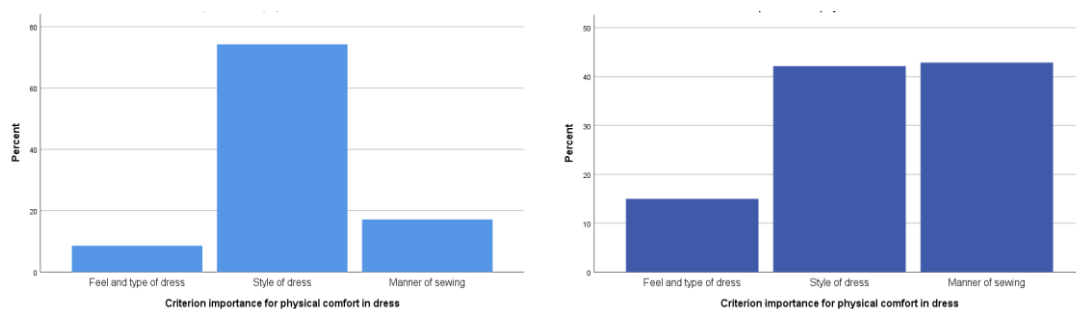


Figure 29: Bar Graphs of Patients and Caregivers of Response 4; Research Question 1

The compilation in table 10 and figure 29 shows the result of the patients and the caregivers regarding their opinion about more important criterion for physical comfort in patient's dress. The graphs show that among both groups the style of dress had a higher rate of selection in patients, 74.3% ; and in caregivers, 42.1%. Among the care giver the other important criterion that showed similar selection was manner of

sewing, 42.9%. The responses indicated variation among both groups, for the patients style of dress was perceived to be the most important factor to be considered while planning for adaptive clothing whereas caregivers had chosen manner of sewing and style of dress as important factors. The lowered muscular, sensorial and joint coordination experienced by the sufferers was the contributory factor among patients to choose style of dress as most important factor, on the other hand the handling of clothing and repositioning of the patient experienced by caregivers made them choose for style as well as manner of sewing to be important consideration while planning for adaptive clothing.

1.5 Survey Question for Patients:

If you could design your own garments, what features would you add or remove in regular clothing in order to make your clothing suitable to your new special needs?

1.5 Survey Question for Caregivers:

If you could design garments for such patients, what features would you add or remove in regular clothing in order to make clothing suitable to special needs?

None among both groups of patients and caregivers opted to answer for this question. The rigorous input of respondents among both groups given for every minor detail of previous responses was satisfactory enough that no further suggestions were made by them.

The input from the interviews of the specialist doctors, all suggested that the dimension of comfort of the material and garment of everyday clothing of patients facing physical challenges due to hemiplegia is an important requirement in the adaptive clothing after the manifestation of altered needs of users. The onset of hemiplegia causes many physical challenges within the sufferer, encompassing many due to decreased sensorial, muscular, and joint incoordination. All physical restrictions brought by onset of hemiplegia become a longer-term challenge to be dealt with.

4.1.3 Addressing Research Question Two Corresponding to Phase One

R.Q. 2 What are the specific needs regarding economic feasibility of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist doctors?

2.1 Survey Question for Patients:

How often do you purchase your clothing items after onset of hemiplegia?

2.1 Survey Question for Caregivers:

How often do patients purchase clothing items after onset of hemiplegia?

Table 11: Descriptive Statistics of Response 1; Research Question 2

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
1-5 times a year	18	12.9%	14	10%
5-10 times a year	92	65.7%	32	22.9%
Once a month	30	21.4%	40	28.6%
2-3 times a month	0	0%	23	16.4%
4-7 times a month	0	0%	26	18.6%
More than 8 times a month	0	0%	5	3.6%

Frequency of purchase of clothing items after onset of hemiplegia.

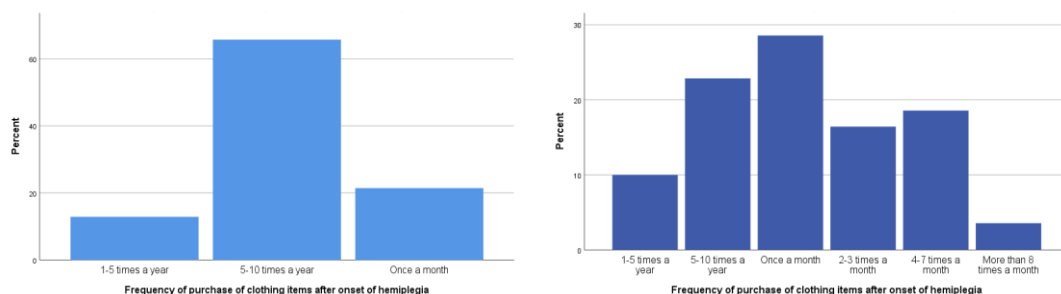


Figure 30: Bar Graphs of Patients and Caregivers for Response1; Research Question2

The compilation in table 11 and figure 30 shows the result of the patients and the caregivers regarding their opinion about frequency of purchase of clothing items after onset of hemiplegia. The graphs show that most among the group of patients

selected for buying their dresses 5-10 a year , 65.7% ; and among the group of caregivers most selected for monthly purchase, 28.6%. The responses show variation of opinion in both groups , as far as patients themselves are concerned they intend to keep their new purchases limited around once every two months due to its expanse as they need to consider their other needs as well after onset of hemiplegia.

2.2 Survey Question for Patients:

How much you usually spend in summers on clothing after onset of hemiplegia?

2.2 Survey Question for Caregivers:

How much patients usually spend in summers on clothing after onset of hemiplegia?

Table 12: Descriptive Statistics of Response2; Research Question 2

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Less than 5000	37	26.4%	11	7.9%
5000-10000	30	21.4%	18	12.9%
10000-15000	31	22.1%	22	15.7%
15000-20000	12	8.6%	28	20%
20000-25000	24	17.1%	51	36.4%
More than 25000	6	4.3%	10	7.1%

Expenditure on summer clothing after onset of hemiplegia.

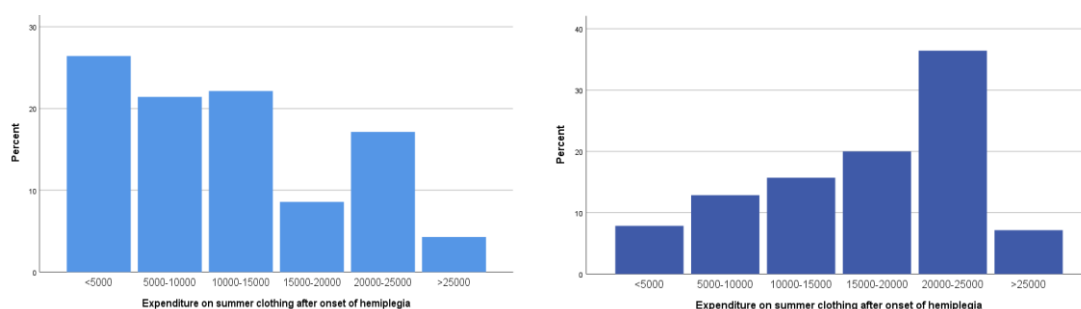


Figure 31: Bar Graphs of Patients and Caregivers for Response 2; Research Question 2

The compilation in table 12 and figure 31 shows the result of the patients and the caregivers regarding their opinion about amount spent for total summer clothing

items after onset of hemiplegia. The graphs show that most among the group of patients selected less than 5000 , 26.4% ; and among the group of caregivers most selected for 20000-25000, 36.4%. The responses show variation of expenditure trend in both groups. Consistent ith the trend of previous response , as far as patients themselves are concerned they intend to keep their summer purchases limited as they need to consider their other needs as well after onset of hemiplegia. On the other hand in view of caregivers, the trend is suggestive of a much higher expenditure.

2.3 Survey Question for Patients:

How much you usually spend in winters on clothing after onset of hemiplegia?

2.3 Survey Question for Caregivers:

How much patients usually spend in winters on clothing after onset of hemiplegia?

Table 13: Descriptive Statistics of Response 3; Research Question 2

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Less than 5000	19	13.6%	2	1.4%
5000-10000	30	21.4%	16	11.4%
10000-15000	19	13.6%	22	15.7%
15000-20000	6	4.3%	36	25.7%
20000-25000	60	42.95	48	34.3%
More than 25000	6	4.3%	16	11.4%



Figure 32: Bar Graphs of Patients and Caregivers for Response 3; Research Question 2

The compilation in table 13 and figure 32 shows the result of the patients and the caregivers regarding their opinion about amount spent for total winter clothing items after onset of hemiplegia. The graphs show that most among both the groups selected 20000-25000 , but it was slightly higher in patients, 42.95% ; and lower in caregivers, 34.3%. The responses show similar trend of responses among both groups. The results are suggestive of higher expense for the winters to afford proper clothing to safeguard against low temperatures. Due to lower sensorial and muscular capabilities and enhanced feeling of cold and numbness after onset of hemiplegia, both groups indicated more expense on clothing items in winters. Another reason of higher expenditure to fulfill the clothing needs of hemiplegia patients to survive in the lower temperature is lack of facilities to stabilize temperature of surrounding environment.

2.4 Survey Question for Patients:

How much you usually spend on one outfit in summers after onset of hemiplegia?

2.4 Survey Question for Caregivers:

How much patients usually spend on one outfit in summers after onset of hemiplegia?

Table 14: Descriptive Statistics of Response 4; Research Question 2

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Less than 500	6	4.3%	3	2.1%
500-1000	55	39.3%	29	20.7%
1000-1500	31	22.1%	31	22.1%
1500-2000	18	12.9%	21	15%
2000-2500	30	21.4%	36	25.7%
More than 2500	0	0%	20	14.3%

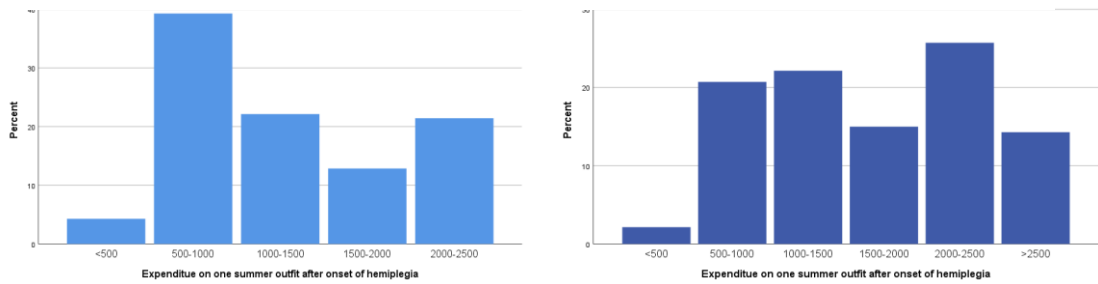


Figure 33: Bar Graphs of Patients and Caregivers for Response 4; Research Question 2

The compilation in table 14 and figure 33 shows result of patients and caregivers regarding their opinion about amount spent for one summer outfit after onset of hemiplegia. The graphs show that most among the group of patients selected 500-1000 , 39.3% ; and among the group of caregivers most selected for 2000-2500, 25.7%. The responses show variation of selected expenditure trend in both groups. Consistent with the trends of previous responses , as far as patients are concerned they intend to keep their individual summer purchase lower as they need to consider their other needs.

2.5 Survey Question for Patients

How much you usually spend on one outfit in winter after onset of hemiplegia?

2.5 Survey Question for Caregivers:

How much patients usually spend on one outfit in winter after onset of hemiplegia?

Table 15: Descriptive Statistics of Response 5; Research Question 2

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Less than 500	6	4.3%	0	0%
500-1000	43	30.7%	9	6.4%
1000-1500	31	22.1%	56	40%
1500-2000	12	8.6%	14	10%
2000-2500	30	21.4%	36	25.7%
More than 2500	18	12.9%	25	17.9%

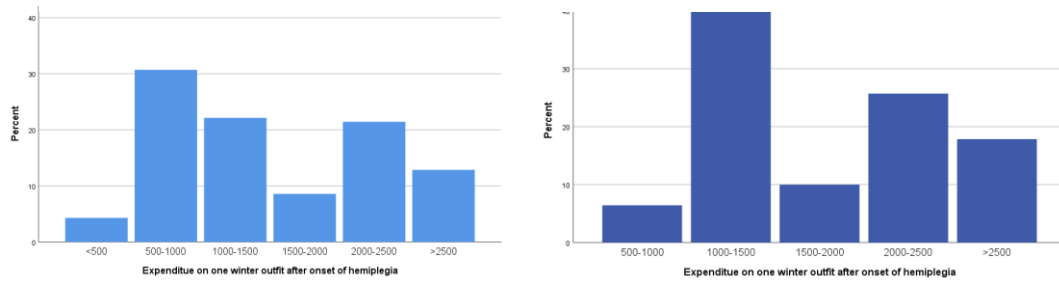


Figure 34: Bar Graphs of Patients and Caregivers for Response 5; Research Question 2

The compilation in table 15 and figure 34 shows the result of the patients and the caregivers regarding their opinion about amount spent for one winter outfit after onset of hemiplegia. The graphs show that most among the group of patients selected 500-1000 , 30.7% ; and among the group of caregivers most selected for 1000-1500, 40%. The responses show similarity of selected expenditure trend in both groups. Consistent with the trends of previous response about expenditure in winters , both groups intended to keep their individual winter purchase to similar limits.

The input from the interviews of the specialist doctors, most suggested that the dimension of economic feasibility of everyday clothing of patients facing physical challenges due to hemiplegia is an important requirement in the adaptive clothing after the manifestation of altered needs of users. On the other few doctor participants emphasized that the demand of the newer needs had to be catered to in the best possible manner regardless of its cost effectiveness so that the patient's needs are satisfied.

4.1.4 Addressing Research Question Three Corresponding to Phase One

R.Q. 3 What are the specific needs regarding manageability with respect to care and storage conformance to social norms of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist medical doctors?

3.1 Survey Question for Patients:

What is your opinion about easy wash ability of your clothing?

3.1 Survey Question for Caregivers:

What is your opinion about easy wash ability of the clothing of patient?

Table 16: Descriptive Statistics of Response 1; Research Question 3

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Very Essential	134	95.7%	114	81.4%
Slightly Essential	6	4.3%	25	17.9%
Neither Essential nor Nonessential	0	0%	0	0%
Slightly Nonessential	0	0%	1	0.7%
Very Nonessential	0	0%	0	0%

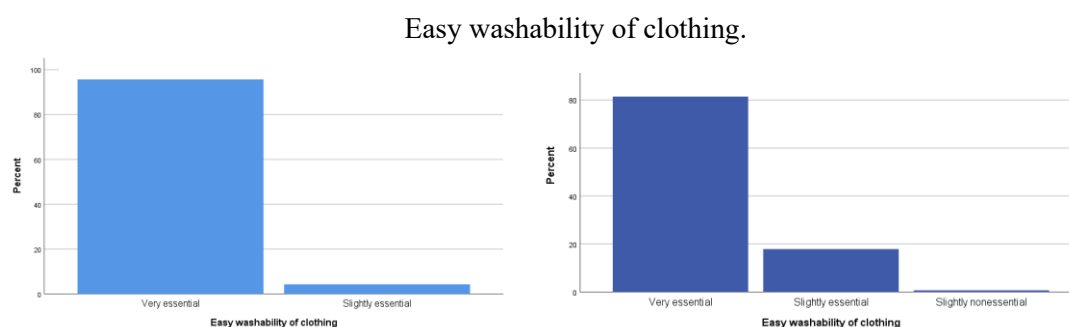


Figure 35: Bar Graphs of Patients and Caregivers for Response 1; Research Question 3

The compilation in table 16 and figure 35 shows the result of the patients and the caregivers regarding their opinion about easy wash ability of clothing. The graphs show that most among the both groups considered this dimension as very essential, however the consideration was higher among the patients, 95.7% ; and slightly lesser among the group of caregivers, 81.4%. The responses show similar trend in both groups as the muscular incoordination leads to need of frequent washings. Ease in washability of adaptive garment had been reflected as a very important consideration for both patients and caregivers.

3.2 Survey Question for Patients:

What is your opinion about quick drying of clothing?

3.2 Survey Question for Caregivers:

What is your opinion about quick drying of the clothing of patient?

Table 17: Descriptive Statistics of Response 2; Research Question 3

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Very Essential	128	91.4%	116	82.9%
Slightly Essential	12	8.6%	24	17.1%
Neither Essential nor Nonessential	0	0%	0	0%
Slightly Nonessential	0	0%	0	0%
Very Nonessential	0	0%	0	0%

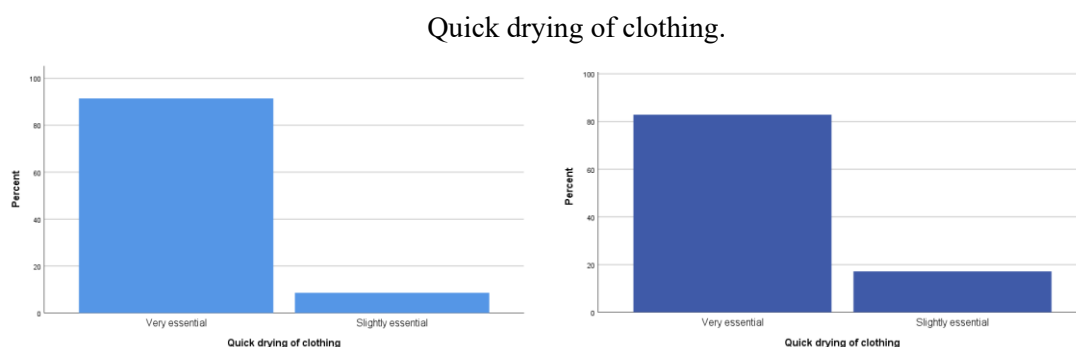


Figure 36: Bar Graphs of Patients and Caregivers for Response 2; Research Question 3

The compilation in table 17 and figure 36 shows the result of the patients and the caregivers regarding their opinion about quick drying of clothing. The graphs show that most among the both groups considered this dimension as very essential, however the consideration was higher among the patients, 91.4% ; and slightly lesser among the group of caregivers, 82.9%. The responses show similar trend among both groups. Consistent with the trend of previous response for washability, the quick drying property of clothing was also considered important for availability of clothing for reuse.

3.3 Survey Question for Patients:

What is your Opinion about long term usability clothing?

3.3 Survey Question for Caregivers:

What is your Opinion about long term usability of the clothing of patient?

Table 18: Descriptive Statistics of Response 3; Research Question 3

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Very Essential	116	82.9%	18	12.9%
Slightly Essential	24	17.1%	67	47.9%
Neither Essential nor Nonessential	0	0%	43	30.7%
Slightly Nonessential	0	0%	12	8.6%
Very Nonessential	0	0%	0	0%

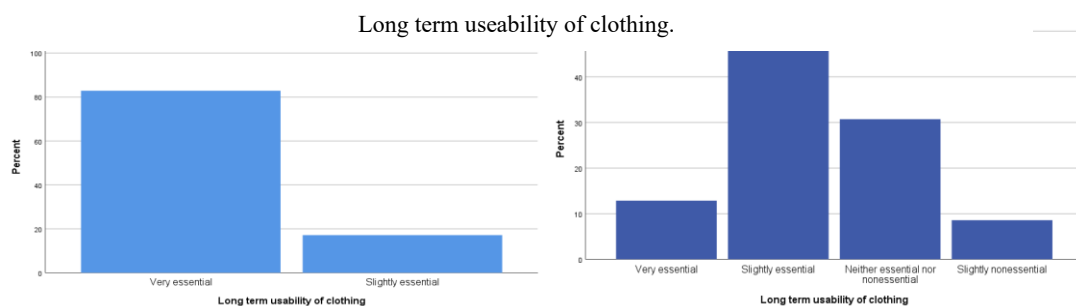


Figure 37: Bar Graphs of Patients and Caregivers for Response 3; Research Question 3

The compilation in table 18 and figure 37 shows the result of the patients and the caregivers regarding their opinion about long term use ability of clothing. The graphs show that most among the patients considered this dimension as very essential, 82.9% ; however most among the caregivers considered this dimension as slightly essential, 47.9%. The responses show variation of trend among both groups. Consistent with the trends of previous responses about cost effectiveness , as far as patients are concerned they intended to invest for clothing with long term usability. Durability of clothing was seen as less signifanct for the caregivers.

3.4 Survey Question for Patients:

What is your opinion about wrinkle free material of clothing?

3.4 Survey Question for Caregivers:

What is your opinion about wrinkle free material of the clothing of patient?

Table 19: Descriptive Statistics of Response 4; Research Question 3

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Very Essential	18	12.9%	30	21.4%
Slightly Essential	67	47.9%	54	38.6%
Neither Essential nor Nonessential	43	30.7%	49	35%
Slightly Nonessential	12	8.6%	7	5%
Very Nonessential	0	0%	0	0%

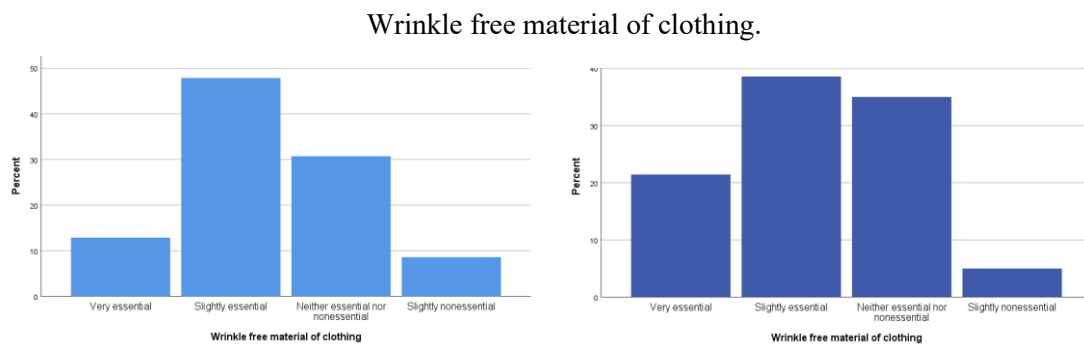


Figure 38: Bar Graphs of Patients and Caregivers for Response 4; Research Question 3

The compilation in table 19 and figure 38 shows the result of the patients and the caregivers regarding their opinion about wrinkle free material of clothing. The graphs show that most among the both groups considered this dimension as slightly essential, however the consideration was higher among the patients, 47.9% ; and slightly lesser among the group of caregivers, 38.6%. The responses show slight similarity of selected trend among both groups. Provision of wrinkle free clothing was given lesser importance by both groups as compared to previous dimensions of clothing. Such patients had lesser social interactions and mostly time was spent in bed so wrinkle free garment was not selected as priority by both the patients and caregivers.

3.5 Survey Question for Patients:

What is your opinion about ease of storage of out of season clothing?

3.5 Survey Question for Caregivers:

What is your opinion about ease of storage of out of season clothing of patient?

Table 20: Descriptive Statistics of Response 5; Research Question 3

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Very Essential	30	21.4%	98	70%
Slightly Essential	54	38.65	24	17.1%
Neither Essential nor Nonessential	49	35%	18	12.9%
Slightly Nonessential	7	5%	0	0%
Very Nonessential	0	0%	0	0%

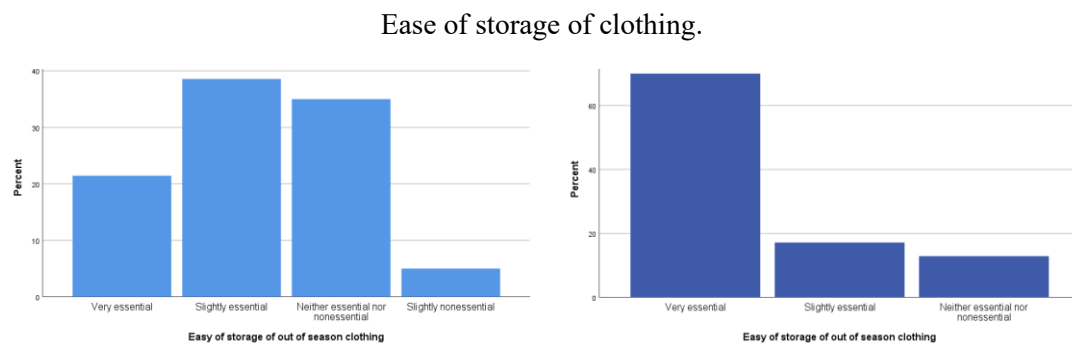


Figure 39: Bar Graphs of Patients and Caregivers for Response 5; Research Question 3

The compilation in table 20 and figure 39 shows the result of the patients and the caregivers regarding their opinion about ease of storage of clothing. The graphs show that most among the patients considered this dimension as slightly essential, 38.65% ; however most among the group of caregivers considered this dimension as very essential, 70%. The responses show variation of selected trend in both groups. Inconsistent with trends of cost effectiveness and durability , caregivers were more willing for clothing products that do not need specialised storage than the patients.

The input from the interviews of the specialist doctors, all suggested that the dimension of ease of maintenance and management of everyday clothing of patients facing physical challenges due to hemiplegia is an important requirement in the

adaptive clothing after the manifestation of altered needs of users. It was brought into limelight during the interview sessions that until all these parameters were not combined, a best fit for the suggested issue cannot be obtained.

4.1.5 Addressing Research Question Four Corresponding to Phase One

R.Q. 4 What are the specific needs regarding conformance to social norms of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist medical doctors?

4.1 Survey Question for Patients:

Do you feel embarrassed due to exposure while seeking medical help?

4.1 Survey Question for Caregivers:

Do you think that patients feel embarrassed due to exposure while seeking medical help?

Table 21: Descriptive Statistics of Response 1; Research Question 4

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Very often	98	70%	104	74.3%
Often	24	17.1%	12	8.6%
Sometimes	18	12.9%	24	17.1%
Never	0	0%	0	0%

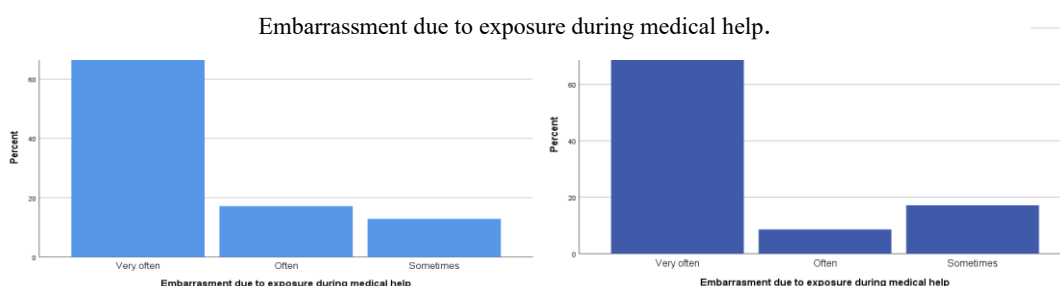


Figure 40: Bar Graphs of Patients and Caregivers for Response 1; Research Question 4

The compilation in table 21 and figure 40 shows the result of the patients and the caregivers regarding their opinion about embarrassment due to exposure during

medical help. The graphs show that most among the both groups considered this dimension as occurring very often, however the opinion was higher among the patients, 70% ; and slightly lesser among the group of caregivers, 74.3%. The responses showed similar trend in both groups associated with awkwardness due to expouser while seeking various medical treatments. As the regular clothing was more revealing and larger than needed area of body was exposed while seeking various kind of medical help so a rigorous need was indicated to incorporate such adaptations in clothing to resolve the over expouser of body parts while medical help sessions.

4.2 Survey Question for Patients:

Who usually influences you for your new purchase of clothing after the onset of hemiplegia?

4.2 Survey Question for Caregivers:

Who usually influences patients for their new purchase of clothing after the onset of hemiplegia?

Table 22: Descriptive Statistics of Response 2; Research Question 4

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Family	104	74.3%	13	9.3%
Doctor/Nurse	12	8.6%	127	90.7%
Friends	24	17.1%	0	0%
News paper	0	0%	0	0%
People around your area	0	0%	0	0%
Others	0	0%	0	0%

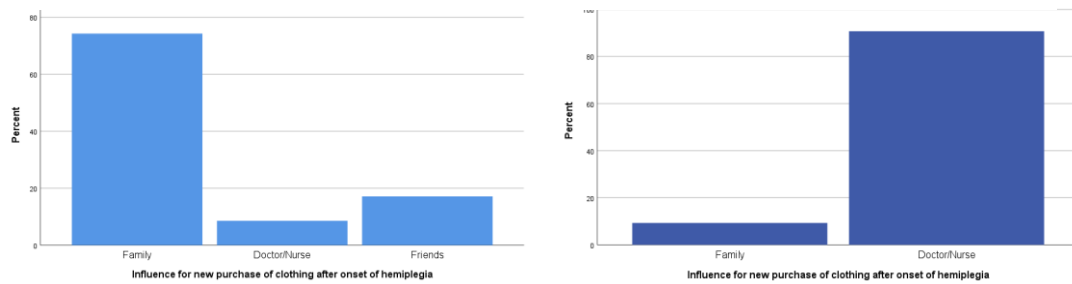


Figure 41: Bar Graphs of Patients and Caregivers for Response 2; Research Question 4

The compilation in table 22 and figure 41 shows the result of the patients and the caregivers regarding their opinion about who influences for purchase of clothing after onset of hemiplegia. The graphs show that most among the patients considered family as most influential, 74.3% ; however most among the group of caregivers considered doctors/nurses as most influential, 90.7%. The responses show complete contrast of trend among responses of both groups. Patients appeared influenced more by the family members but on the other hand the caregivers perceived doctors influenced the purchase decisions .

4.3 Survey Question for Patients:

Who do you mainly shop with for your clothing after onset of hemiplegia?

4.3 Survey Question for Caregivers:

With whom patients mainly shop with for their clothing after onset of hemiplegia?

Table 23: Descriptive Statistics of Response3; Research Question 4

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Friend	13	9.3%	80	57.1%
Family	127	90.7%	60	42.9%
Partner	0	0%	0	0%
Alone	0	0%	0	0%
Do not bother	0	0%	0	0%

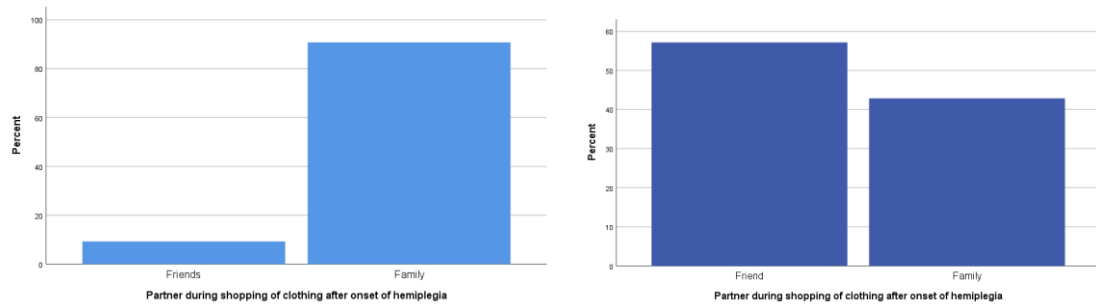


Figure 42: Bar Graphs of Patients and Caregivers for Response 3; Research Question 4

The compilation in table 23 and figure 42 shows the result of the patients and the caregivers regarding their opinion about who partners for shopping after onset of hemiplegia. The graphs show that most among the patients considered family as partner while shopping, 90.7% ; however most among the group of caregivers considered friends as partner while shopping, 57.1%. The responses show variation of selection trend in both groups. Consistent with the trend of previous response, as far as patients were concerned they appeared opting for the family members but on the other hand caregivers perceived acquaintances accompanied them. Both of these trends showcase increased dependency on family of the hemiplegia patients.

4.4 Survey Question for Patients: (multiple response sets)

What will encourage you to try any new type of clothing check as many options as apply?

4.4 Survey Question for Caregivers: (multiple response sets)

What can encourage patients to try any new type of clothing check as many options as apply?

Table 24: Descriptive Statistics of Response 4; Research Question 4

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Style	60	23.6%	19	13.6
Friend suggestion	19	7.5%	6	4.3%

Family suggestion	6	2.4%	109	77.9%
Doctor/Nurse suggestion	109	42.9%	0	0%
Partner suggestion	0	0%	48	34.3%
Comfort	48	18.9%	12	8.6%
Durability	12	4.7%	60	42.9%

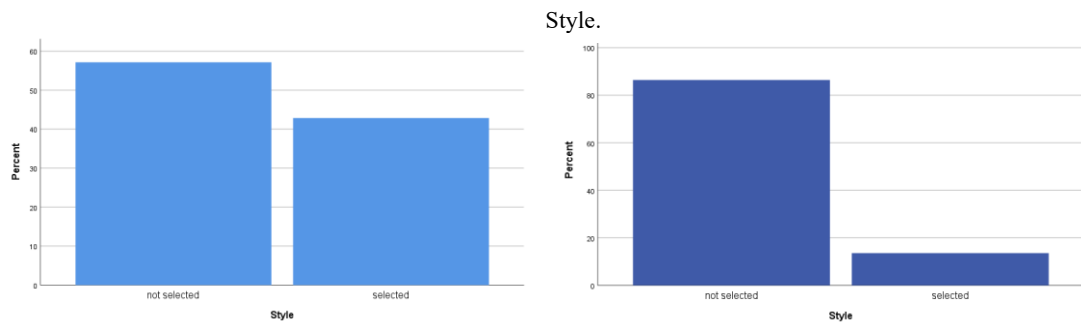


Figure 43: Bar Graphs of Patients and Caregivers for Response 4.1; Research Question 4

The compilation in table 24 and figure 43 shows the result of the patients and the caregivers regarding their opinion about style as factor that might encourage users to try any new type of clothing. The graphs show that among both groups the dimension of style had a very low rate of selection but it was slightly raised in patients, 23.6% ; than in caregivers, 13.6%. The responses show similar trend among both groups. For both groups just style of adaptive clothing was an insignificant fascination for purchase.

Friend suggestion.

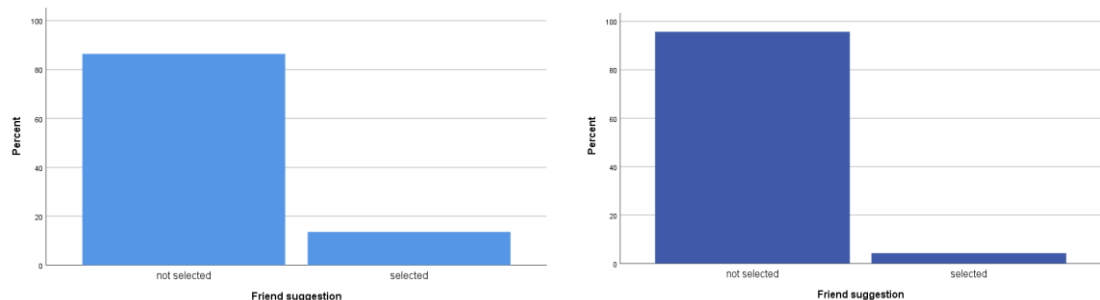


Figure 44: Bar Graphs of Patients and Caregivers for Response 4.2; Research Question 4

The compilation in table 24 and figure 44 shows the result of the patients and the caregivers regarding their opinion about friend suggestion as factor that might encourage users to try any new type of clothing. The graphs show that among both groups the dimension of friend suggestion had a very very low rate of selection but it

was slightly raised in patients, 7.5% ; than in caregivers, 4.3%. The responses show similar trend among both groups. Consistent with the trend of previous response just suggestion of acquaintance about adaptive clothing was an insignificant attraction for its purchase.

Family suggestion.

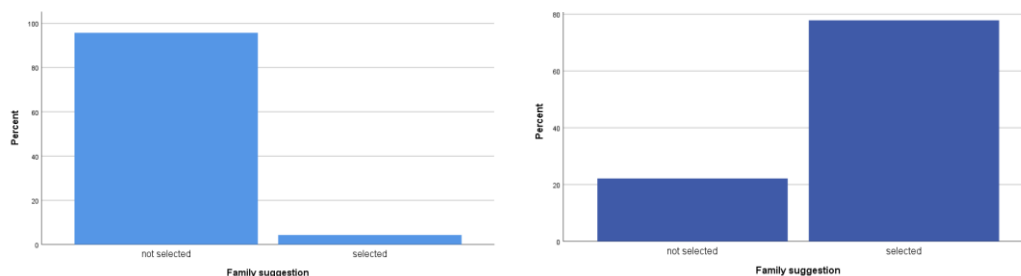


Figure 45: Bar Graphs of Patients and Caregivers for Response 4.3; Research Question 4

The compilation in table 24 and figure 45 shows result of patients and caregivers regarding their opinion about family suggestion as factor that might encourage users to try any new type of clothing. The graphs show that among both groups the dimension of family suggestion had a varied response. It had very low rate of selection in patients, 2.4% ; on the other hand it had higher selection rate in caregivers, 77.9%. The responses show variation of selection trend in both groups, as far as patients were concerned they appeared not opting for just opinion of family members as their decision of purchase of adaptive clothing but on the other hand caregivers perceived contrary to it.

Doctor/nurse suggestion.

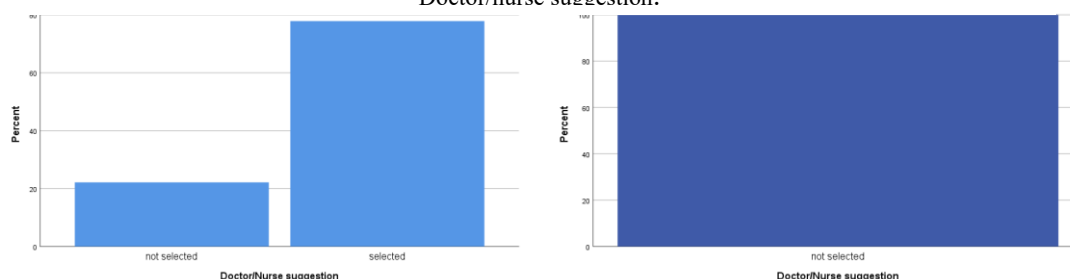


Figure 46: Bar Graphs of Patients and Caregivers for Response 4.4; Research Question 4

The compilation in table 24 and figure 46 shows result of patients and caregivers regarding their opinion about doctor/nurse suggestion as factor that might encourage users to try any new type of clothing. The graphs show that among both groups the dimension of doctor/nurse suggestion had a low response. It had slightly raised rate of

selection in patients, 42.9% ; on the other hand it had no selection rate in caregivers, 0%. The responses show variation of selection trend in both groups, as far as patients were concerned they appeared opting for the doctor/nurse recommendation about adaptive clothing but on the other hand caregivers perceived it completely insignificant

Partner suggestion.

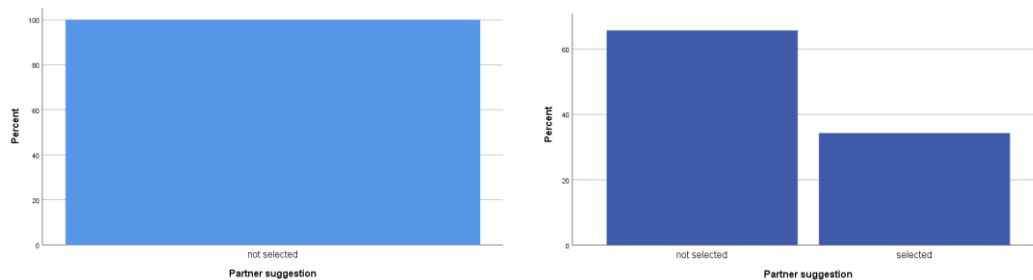


Figure 47: Bar Graphs of Patients and Caregivers for Response 4.5; Research Question 4

The compilation in table 24 and figure 47 shows result of patients and caregivers regarding their opinion about partner suggestion as factor that might encourage users to try any new type of clothing. The graphs show that among both groups dimension of partner suggestion had a varied response. It had no selection in patients, 0% ; but on the other hand it had slightly raised selection rate in caregivers, 34.3%. The responses show variation of selection trend in both groups, as far as patients were concerned they appeared not to be influenced by suggestion of partner but a mix response was shown by caregivers for influence of partner suggestion for purchase of adaptive clothing.

Comfort.

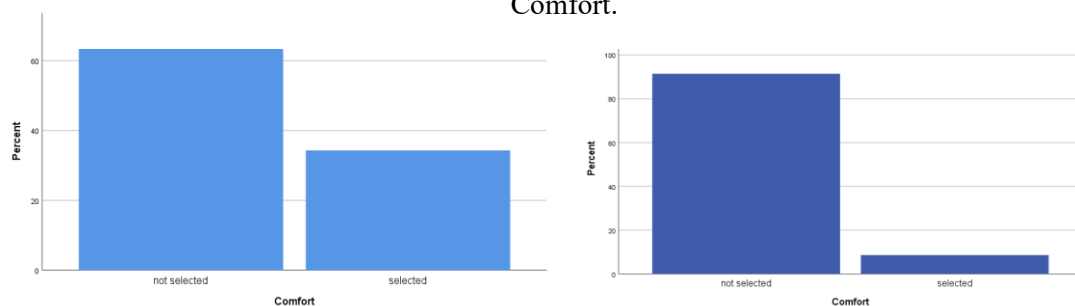


Figure 48: Bar Graphs of Patients and Caregivers for Response 4.6; Research Question 4

The compilation in table 24 and figure 48 shows the result of the patients and the caregivers regarding their opinion about comfort as factor that might encourage users to try any new type of clothing. The graphs show that among both groups the dimension of comfort had a low selection response. It had very slight selection in

patients, 18.9% ; but on the other hand it had very low selection rate in caregivers, 8.6%. The responses indicate similar trend in both groups showing that just the factor of comfort was insignificant for buying intention of adaptive clothing.

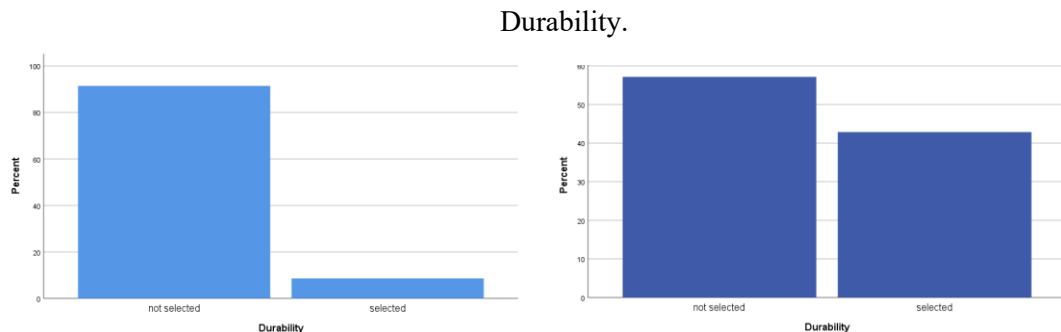


Figure 49: Bar Graphs of Patients and Caregivers for Response 4.7; Research Question 4

The compilation in table 24 and figure 49 shows the result of the patients and the caregivers regarding their opinion about durability as factor that might encourage users to try any new type of clothing. The graphs show that among both groups the dimension of durability had a varied response. It had very low selection in patients, 4.7% ; but on the other hand it had slightly raised selection rate in caregivers, 42.9%. The responses indicate various trend among both groups, but it was clear that just factor of durability was insignificant for purchase intention of adaptive clothing. Conclusively it was brought into lime light that only single factor can not enhance purchase intentions of adaptive clothing , there has to be a good blend of desired qualities.

4.5 Survey Question for Patients:

Do you think yourself is reflected by what you wear?

4.5 Survey Question for Caregivers:

Do you think someone's self is reflected by what one wears?

Table 25: Descriptive Statistics of Response 5; Research Question 4

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Strongly Agree	80	57.1%	6	4.3%

Slightly Agree	60	42.9%	37	26.4%
Neither Agree nor Disagree	0	0%	78	55.7%
Slightly Disagree	0	0%	19	13.6%
Strongly Disagree	0	0%	0	0%

Self reflection through clothing.

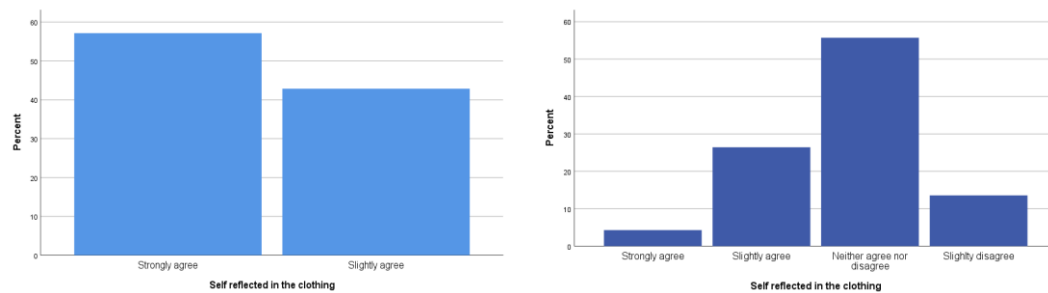


Figure 50: Bar Graphs of Patients and Caregivers for Response 5; Research Question 4

The compilation in table 25 and figure 50 shows the result of the patients and the caregivers regarding their opinion if someone's self is reflected by what one wears. The graphs show that among both groups this dimension had a varied response. It had slightly higher selection for strongly agree in patients, 57.1% ; and on the other hand slightly higher selection for neither agree nor disagree in caregivers, 55.7%. The responses indicate variation in trend among both groups showing that for the patients self identification through the clothing they wear is highly significant. Contrary to it, caregivers considered self identification through clothing as less important for patients.

According to the input from the interviews of the specialist doctors, few suggested that the dimension of the conformance to social norms of everyday clothing of patients facing physical challenges due to hemiplegia is an important requirement in the adaptive clothing after the manifestation of altered needs of users. On the other most doctor participants emphasized that the demand of the newer needs had to be catered to in the best possible manner regardless of its failure for the conformance to social norms, so that the patient's needs are completely accommodated.

4.1.6 Addressing Research Question Five Corresponding to Research Phase One

R.Q. 5 What are the specific needs regarding aesthetics of design of everyday clothing as expressed by hemiplegia patients, their family care givers, specialized nursing care providers and specialist medical doctors?

5.1 Survey Question for Patients:

When planning new clothing items after onset of hemiplegia do you care for matching outfit items?

5.1 Survey Question for Caregivers:

When planning new clothing items after onset of hemiplegia do patients care for matching outfit items?

Table 26: Descriptive Statistics of Response 1; Research Question 5

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Very essential	6	4.3%	0	0%
Slightly Essential	37	26.4%	0	0%
Neither Essential nor Nonessential	78	55.7%	12	8.6%
Slightly Nonessential	19	13.6%	48	34.3%
Very Nonessential	0	0%	80	57.1%

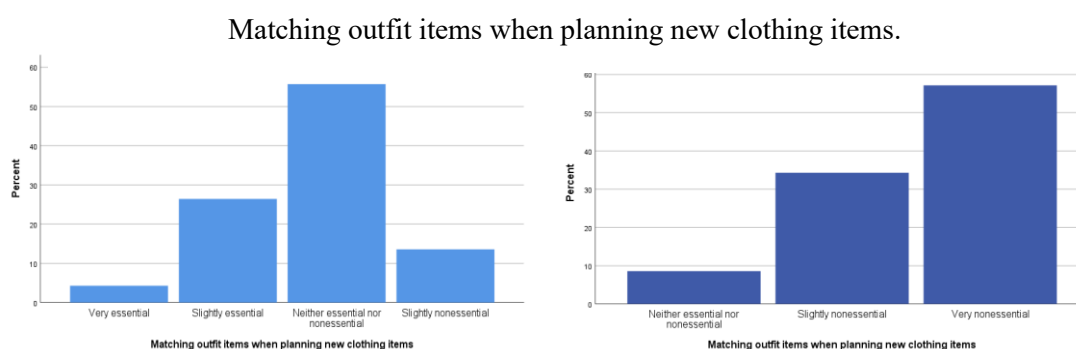


Figure 51: Bar Graphs of Patients and Caregivers for Response 1; Research Question 5

The compilation in table 26 and figure 51 shows the result of the patients and the caregivers regarding their opinion about if users care for matching outfit items. The

graphs show that among both groups this dimension had a varied response. It had slightly higher selection for neither essential nor non essential in patients, 55.7% ; and on the other hand slightly higher selection for very non essential in caregivers, 57.1%. The responses indicate slightly similar trend in both groups showing that requirement of matching clothing items was insignificant according to both groups.

5.2 Survey Question for Patients:

What is your opinion about coherence to local style of your garments?

5.2 Survey Question for Caregivers:

What is your opinion about coherence to local style of a patient's garments?

Table 27: Descriptive Statistics of Response 2; Research Question 5

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Very Essential	0	0%	6	4.3%
Slightly Essential	0	0%	49	35%
Neither Essential nor Nonessential	12	8.6%	67	47.9%
Slightly Nonessential	48	34.3%	18	12.9%
Very Nonessential	80	57.1%	0	0%

Garment styles differ from local style.

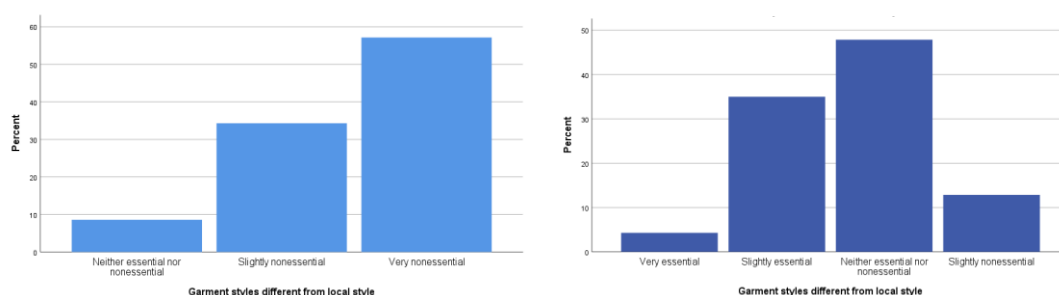


Figure 52: Bar Graphs of Patients and Caregivers for Response 2; Research Question 5

The compilation in table 27 and figure 52 shows the result of the patients and the caregivers regarding their opinion about coherence to local style. The graphs show that among both groups this dimension had a varied response. It had slightly higher

selection for very non essential in patients, 57.1% ; and on the other hand slightly higher selection for neither essential nor non essential in caregivers, 47.9%. The responses indicate slightly similar trend in both groups showing that requirement of coherence to local style was insignificant according to both groups.

5.3 Survey Question for Patients:

When planning new clothing items what is your opinion about suitability of colors?

5.3 Survey Question for Caregivers:

When patients plan new clothing items do they care for suitability of colors?

Table 28: Descriptive Statistics of Response 3; Research Question 5

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Very Essential	6	4.3%	128	91.4%
Slightly Essential	49	35%	12	8.6%
Neither Essential nor Nonessential	67	47.9%	0	0%
Slightly Nonessential	18	12.9%	0	0%
Very Nonessential	0	0%	0	0%

Color suitability of new clothing items.

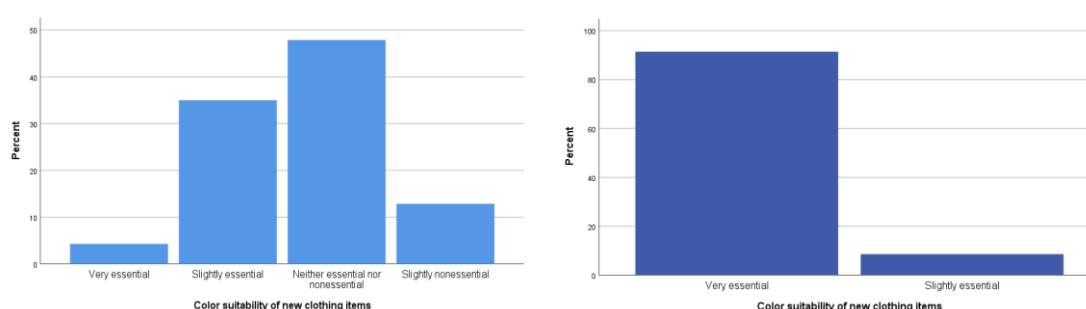


Figure 53: Bar Graphs of Patients and Caregivers for Response 3; Research Question 5

The compilation in table 28 and figure 53 shows the result of the patients and the caregivers regarding their opinion about suitability of colors. The graphs show that among both groups this dimension had a varied response. It had slight selection as neither essential nor non essential in patients, 47.9% ; and on the other hand very higher

selection as very essential in caregivers, 91.4%. The results indicate that among both groups a difference of opinion was found about suitability of colors of dressing. This suggested that after onset of hemiplegia, patients were less concerned than their caregivers about the appropriateness of clothing colours. The dependency upon caregivers for dressing appears the underlying reason of the variation of these results among both groups.

5.4 Survey Question for Patients:

When planning new clothing items what is your opinion about seasonal suitability of type of material?

5.4 Survey Question for Caregivers:

When patients plan for new clothing items do they care about seasonal suitability of type of material?

Table 29: Descriptive Statistics of Response 4; Research Question 5

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Very Essential	128	91.4%	49	35%
Slightly Essential	12	8.6%	91	65%
Neither Essential nor Nonessential	0	0%	0	0%
Slightly Nonessential	0	0%	0	0%
Very Nonessential	0	0%	0	0%

Seasonal suitability of clothing.

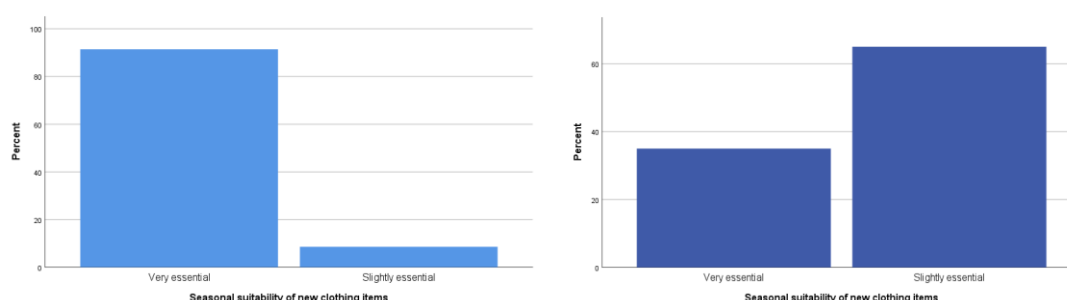


Figure 54: Bar Graphs of Patients and Caregivers for Response 4; Research Question 5

The compilation in table 29 and figure 54 shows the result of the patients and the caregivers regarding their opinion about seasonal suitability of type of material. The graphs show that among both groups the dimension had a varied rate of selection. It had very high selection as very essential in patients, 91.4% ; and on the other raised selection as slightly essential in caregivers, 65%. The results indicate that among both groups a difference of opinion was found about seasonal suitability of type of material. This suggested that after onset of hemiplegia, patients experienced numbness and altered sensorial capacity especially around their extremities. The caregivers showed their distress about maintenance of normal body temperature of patients across all body parts, hence showing greater concern for seasonal suitability of material.

5.5 Survey Question for Patients:

What kind of services would you prefer from an adaptive clothing designer to offer?

5.5 Survey Question for Caregivers:

What kind of services an adaptive clothing designer should offer?

Table 30: Descriptive Statistics of Response 5; Research Question 5

	Patient Response		Caregiver Response	
	N=140	100%	N=140	100%
Ready to wear	49	35%	128	91.4%
Made to measure on order	91	65%	12	8.6%
Others	0	0%	0	0%

Preferred service from adaptive clothing designer.

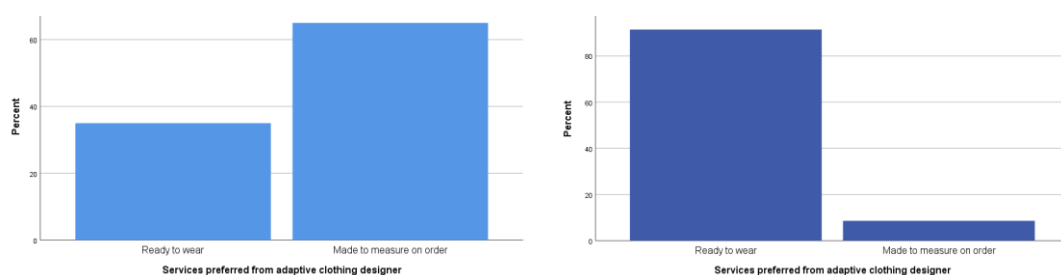


Figure 55: Bar Graphs of Patients and Caregivers for Response 5; Research Question 5

The compilation in table 30 and figure 55 shows the result of the patients and the caregivers regarding their opinion about preferred kind of services from adaptive clothing designers. The graphs show that among both groups this preference had a varied kind of selection. It had higher preference for made to measure services by patients, 65% ; and on the other very high preference for ready to wear services by caregivers, 91.4%. The results indicate that among both groups a difference of opinion was found about preferred kind of adaptive clothing services. Higher preference of patients for made to measure services, in accordance to their previous trends, showed their greater desire for thorough fulfillment of their needs, on the other hand caregivers preferred ready to wear services, indicating their longing for instant availability of suitable adaptive clothing solutions for provision of quicker care services.

According to the input from the interviews of the specialist doctors, all suggested that the dimension of the aesthetics of design of every day clothing of patients facing physical challenges due to hemiplegia is slightly important in the adaptive clothing after the manifestation of altered needs of users. Provision of basic functionality to accommodate newer needs surpassed the priority of aesthetics of adaptive clothing design according to all doctors participating in interviews.

4.1.7 Additional Analysis

An additional question was asked on this survey regarding assessment of overall preference of hemiplegia specific needs of adaptive clothing.

Survey Question for Patients (1):

What is your main criterion when you purchase your clothing items after onset of hemiplegia, rate each of the following factors according to your preference?

Survey Question for Caregivers (2):

What can be your criterion if you purchase clothing items for patients after onset of hemiplegia, rate each of the following factors according to your preference?

Table 31: Descriptive Statistics of Response About Overall Preferences

	Very High		Slightly High		Neither High nor Low		Slightly Low		Very Low	
	1	2	1	2	1	2	1	2	1	2
Physical Comfort	128	68	12	60	0	12	0	0	0	0
	91.4%	48.6%	8.6%	42.9%	0%	8.6%	0%	0%	0%	0%
Quality	68	79	60	61	12	0	0	0	0	0
	48.6%	56.4%	42.9%	43.6%	8.6%	0%	0%	0%	0%	0%
Type and feel of Material	79	121	61	19	0	0	0	0	0	0
	56.4%	86.4%	43.6%	13.6%	0%	0%	0%	0%	0%	0%
Style of garment	121	60	19	68	0	12	0	0	0	0
	86.4%	42.9%	13.6%	48.6%	0%	8.6%	0%	0%	0%	0%
Fitting	60	6	68	6	12	90	0	38	0	0
	42.9%	4.3%	48.6%	4.3%	8.6%	64.3%	0%	27.1%	0%	0%
Fashion Appropriateness	6	98	6	36	90	6	38	0	0	0
	4.3%	70%	4.3%	25.7%	64.3%	4.3%	27.1%	0%	0%	0%
Durability	98	6	36	98	6	30	0	6	0	0
	70%	4.3%	25.7%	70%	4.3%	21.4%	0%	4.3%	0%	0%
Ease of care	6	128	98	12	30	0	6	0	0	0
	4.3%	91.4%	70%	8.6%	21.4%	0%	4.3%	0%	0%	0%
Climatic suitability	128	0	12	6	0	36	0	36	0	62
	91.4%	0%	8.6%	4.3%	0%	25.7%	0%	25.7%	0%	44.3%
Uniqueness	6	0	36	54	36	36	62	50	0	0
	4.3%	0%	25.7%	38.6%	25.7%	25.7%	44.3%	35.7%	0%	0%
Color	54	134	36	6	50	0	0	0	0	0
	38.6%	95.7%	25.7%	4.3%	35.7%	0%	0%	0%	0%	0%
Price	134	33	6	43	0	39	0	12	0	13
	95.7%	23.6%	4.35	30.7%	0%	27.9%	0%	8.6%	0%	9.3%

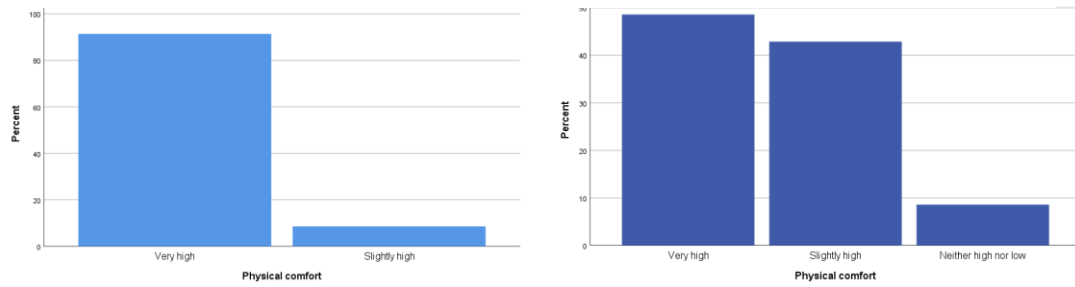


Figure 56: Bar Graphs of Patients and Caregivers for Physical Comfort

The compilation in table 31 and figure 56 shows the result of the preference of patients and the caregivers regarding physical comfort. The graphs show that among both groups the physical comfort had very high preference by most, but it was raised among patients, 91.4% ; than in caregivers, 48.6%.

Quality.

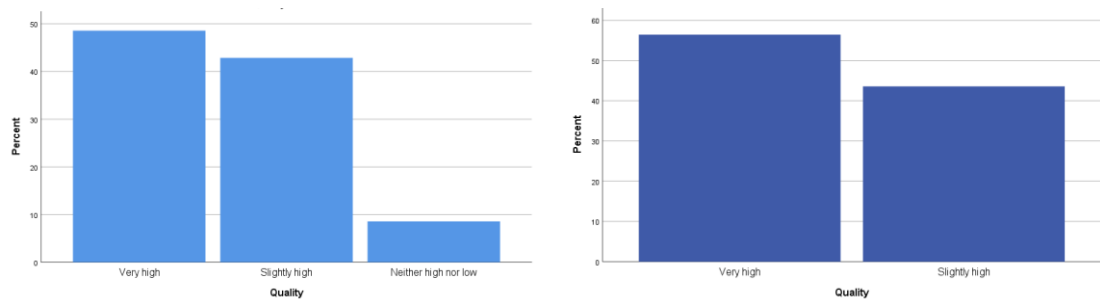


Figure 57: Bar Graphs of Patients and Caregivers for Quality

The compilation in table 31 and figure 57 shows the result of the preference of patients and the caregivers regarding quality. The graphs show that among both groups the quality had very high preference by most, but it was reduced among patients, 48.6% ; than in caregivers, 56.4%.

Type and feel of material.

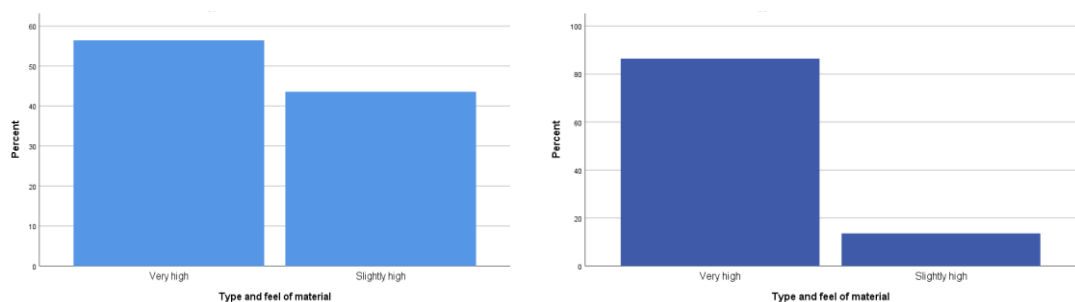


Figure 58: Bar Graphs of Patients and Caregivers for Type and Feel of Material

The compilation in table 31 and figure 58 shows the result of the preference of patients and the caregivers regarding type and feel of material. The graphs show that among both groups the type and feel of material had very high preference by most, but it was slightly lower among patients, 56.4% ; than in caregivers, 86.4%.

Style of garment.

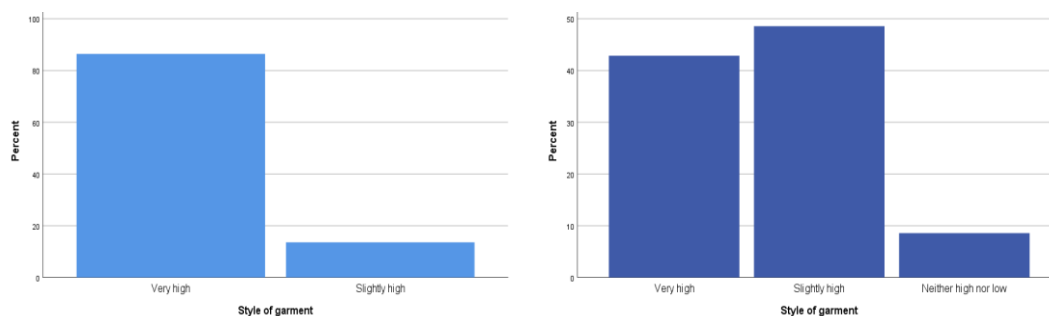


Figure 59: Bar Graphs of Patients and Caregivers for Style of Garment

The compilation in table 31 and figure 58 shows the result of the preference of patients and the caregivers regarding style of garment. The graphs show that among both groups the style of garment had varied preference, it was considered very high by most among patients, 86.4% ; on the other hand it was considered slightly high by most among caregivers, 48.6%.

Fitting.

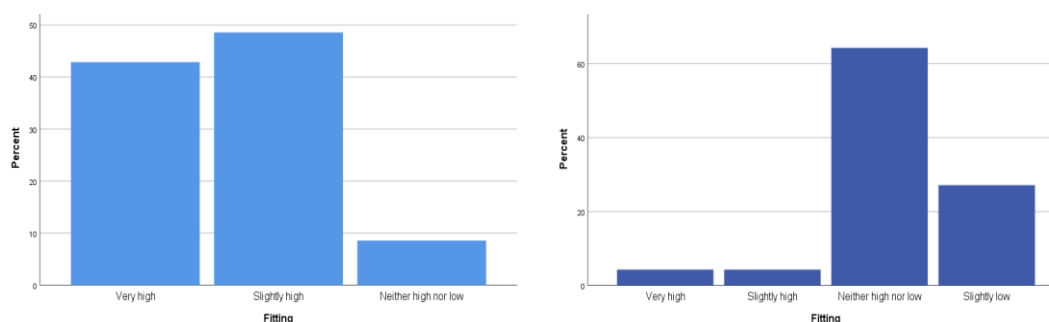


Figure 60: Bar Graphs of Patients and Caregivers for Fitting

The compilation in table 31 and figure 60 shows the result of the preference of patients and the caregivers regarding fitting. The graphs show that among both groups the fitting had varied preference, it was considered slightly high by most among patients, 48.6% ; on the other hand it was considered neither high nor low by most among caregivers, 64.3%.

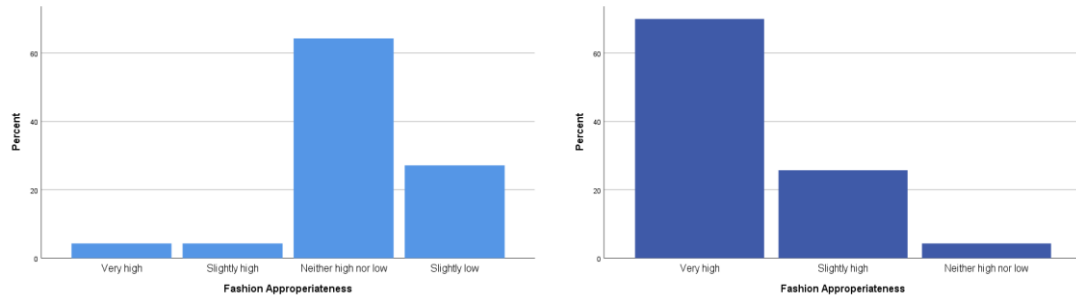


Figure 61: Bar Graphs of Patients and Caregivers for Fashion Appropriateness

The compilation in table 31 and figure 61 shows the result of the preference of patients and the caregivers regarding fashion appropriateness. The graphs show that among both groups the fashion appropriateness had varied preference, it was considered neither high nor low by most among patients, 64.3% ; on the other hand it was considered very high by most among caregivers, 70%.

Durability.

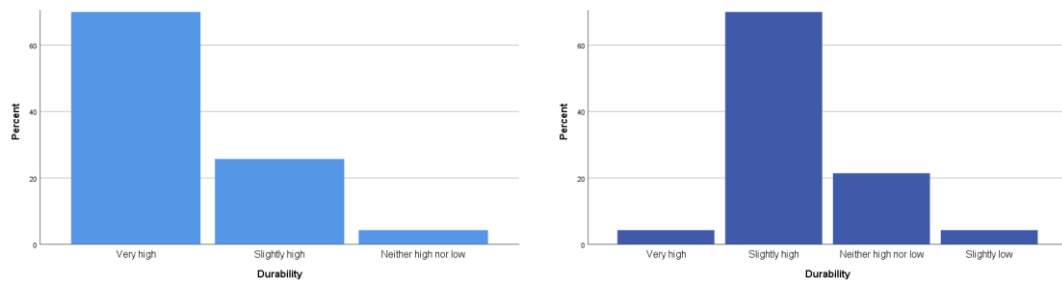


Figure 62: Bar Graphs of Patients and Caregivers for Durability

The compilation in table 31 and figure 62 shows the result of the preference of patients and the caregivers regarding durability. The graphs show that among both groups the durability had varied preference, it was considered very high by most among patients, 70% ; on the other hand it was considered slightly high by most among caregivers, 70%.

Ease of care.

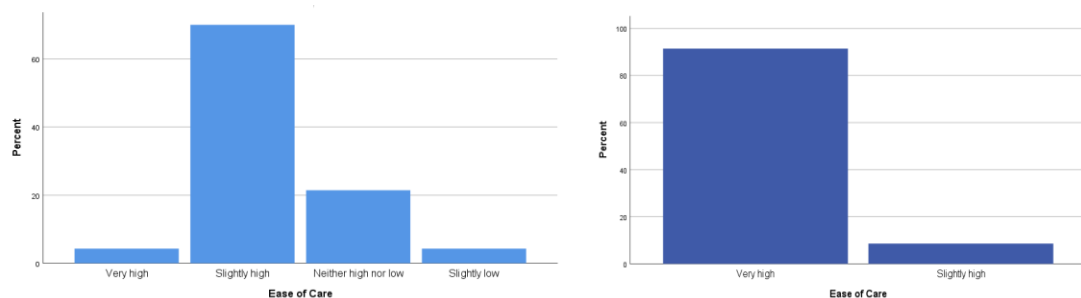


Figure 63: Bar Graphs of Patients and Caregivers for Ease of Care

The compilation in table 31 and figure 63 shows the result of the preference of patients and the caregivers regarding ease of care. The graphs show that among both groups the style of garment had varied preference, it was considered slightly high by most among patients, 70% ; on the other hand it was considered very high by most among caregivers, 91.4%.

Climatic suitability.

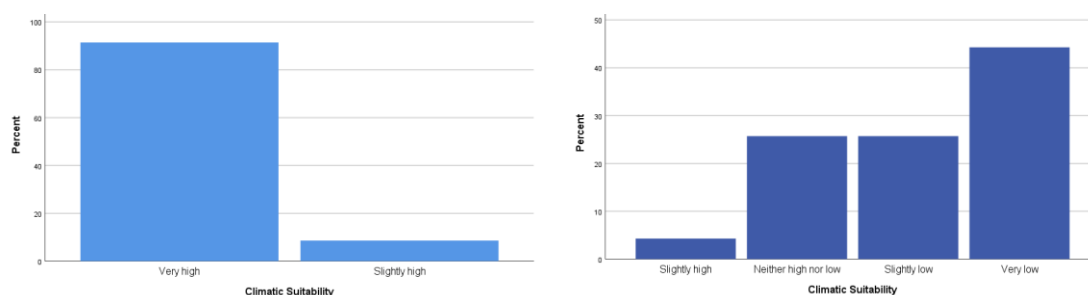


Figure 64: Bar Graphs of Patients and Caregivers for Climatic Suitability

The compilation in table 31 and figure 64 shows the result of the preference of patients and the caregivers regarding climatic suitability. The graphs show that among both groups the climatic suitability had varied preference, it was considered very high by most among patients, 91.4% ; on the other hand it was considered very low by most among caregivers, 44.3%.

Uniqueness.

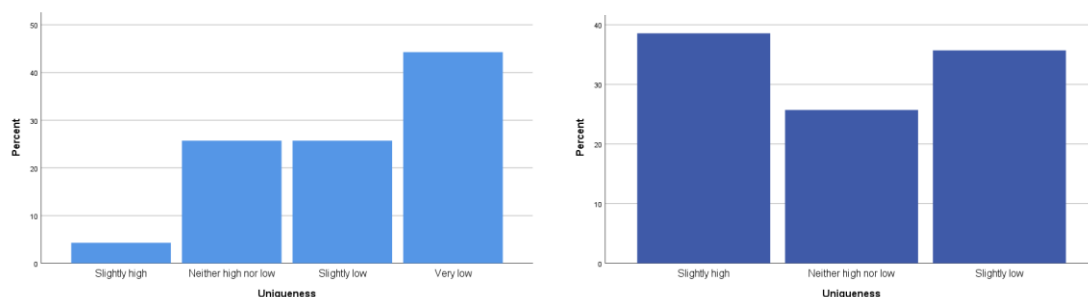


Figure 65: Bar Graphs of Patients and Caregivers for Uniqueness

The compilation in table 31 and figure 65 shows the result of the preference of patients and the caregivers regarding uniqueness. The graphs show that among both groups the uniqueness had varied preference, it was considered very low by most among patients, 43.4% ; on the other hand it was considered slightly high by most among caregivers, 38.6%.

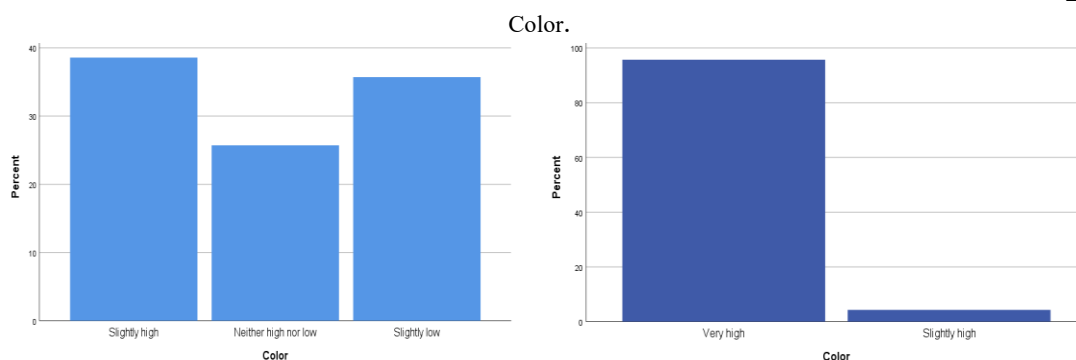


Figure 66: Bar Graphs of Patients and Caregivers for Color

The compilation in table 31 and figure 66 shows the result of the preference of patients and the caregivers regarding color. The graphs show that among both groups the color had very high preference, it was considered very high by most among patients, 38.6% ; and it was considered very high by most among caregivers, 95.7%.

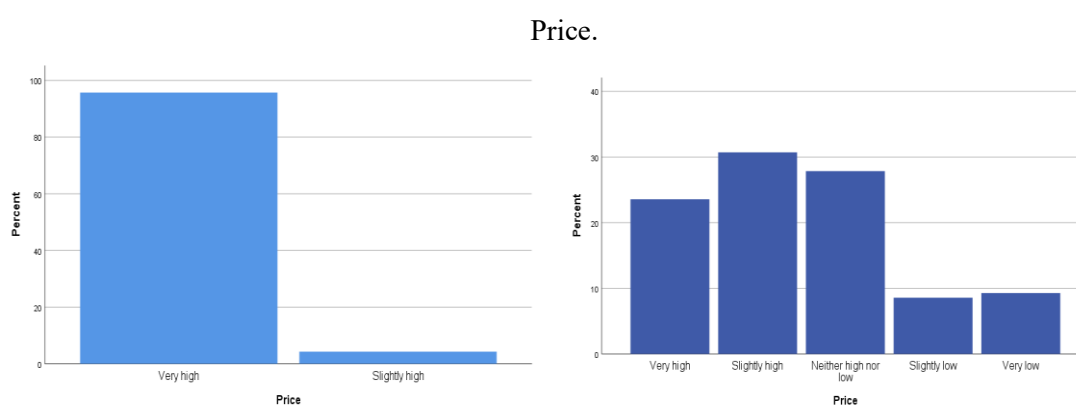


Figure 67: Bar Graphs of Patients and Caregivers for Price

The compilation in table 31 and figure 67 shows the result of the preference of patients and the caregivers regarding price. The graphs show that among both groups the price had varied preference, it was considered very high by most among patients, 95.7% ; on the other hand it was considered slightly high by most among caregivers, 30.7%.

Conclusively the results of additional analysis were also consistent with previous trends of responses among patients and caregivers and brought into limelight that both groups had different preferences for various dimensions of adaptive clothing.

4.2 Case Study; Research Phases Two, Three, Four and Five

The objectives of latter part of the study comprised of in-depth study of adaptive clothing needs of six hemiplegia patients as case study participants. The qualitative part of study was divided into four phases to answer corresponding last four research questions proposed for the study. Demographic details of study participants, shown in table 32 were also collected to know the frequency distribution of different features.

Table 32: Description of Study Participants and Their Grade of Muscular Strength

	Participant	Age	Grade of Hemiplegia
1	01	44	Grade of muscular strength is 2
2	02	39	Grade of muscular strength is 0
3	03	55	Grade of muscular strength is 1
4	04	46	Grade of muscular strength is 3
5	05	52	Grade of muscular strength is 2
6	06	56	Grade of muscular strength is 0

Detailed analysis of research phases two, three, four and five are provided in this section. After overview of responses, both individual and aggregate data are presented. Information was gathered from group of study participants ($n=6$) concerning (a) assessment of physical limitations (b) body measurements (c) clothing needs and preferences, (d) time taken while using regular clothing (e) adaptive clothing sketching from basic body block patterns for female shirt, female eastern trouser, male shirt and male trouser (f) specification sheets for construction of one trial adaptive clothing, (g) evaluation of trial adaptive garment and (h) time taken while using adaptive clothing. Data is presented as frequency distribution first, followed by in-depth qualitative analysis to accurately gauge the real user needs.

4.2.1 Addressing Research Question Six Corresponding to Research Phase Two

R.Q. 6. Why hemiplegia patients require special adaptations in their clothing?

Assessment of Physical Limitations: Phase two began with selection of a sample (n=6) of participants surviving from attack of hemiplegia of grade zero to three. All participants had limited body movements and needed assistance while dressing. During data collection and analysis, participants were identified only by numbers from 01 to 06. Participants presented different degrees of physical limitations due to hemiplegia attack. The researcher conducted semi-structured in-person interviews with participants at their residences. Participants were asked to assign a rating to each area using a five-point Likert-type scale, ranging from ‘no problem’ (0) to ‘impossibility’ (4) as shown in table 33. Participants were requested to give a full description of problem areas rated (1) or higher.

Table 33: Assessment of Physical Limitations for Research Question 6

Physical Limitations	0	1	2	3	4
1. Incoordination				2	4
2. Limitation of Body Strength				2	4
3. Limitation of Head Movement			1	3	2
4. Limitation of Stamina				1	5
5. Limitation of Sensation				2	4
6. Difficulty Lifting, Reaching or Carrying					6
7. Difficulty Handling and Fingering				1	5
8. Inability to Use Extremities			1	4	1
9. Difficulty with Range of Motion of Body				2	4

Note. Greatest identified functional problem areas shown in bold type

This part of study was majorly concerned only with the physical functional limitations due to challenge of onset of hemiplegia. Table 33 shows the frequency results of assessment of physical limitations for participants for nine areas of physical functional limitations. Each of the nine areas was identified from the literature and endorsed by a specialist medical professional as common physical limitations in patients of hemiplegia of grade 0 to 3. The greatest physical limitation areas were considered by determining the number of participants who assessed them as a problem or greater. All areas were identified as concern from the participants. Following qualitative analysis describe each physical limitation as reported to the researcher during interviews.

In Coordination. All participants gave in coordination (lack of body coordination) a score higher than zero while assessment. In coordination has been described in the literature as lack of large muscle coordination. The participant one and three considered that in coordination was a problem as their physical conditions had become progressively worse. Participant two and five referred in coordination as a consistent problem after onset of hemiplegia. They experienced difficulty coordinating almost every work. Participant three and four had varying physical limitations with carrying out tasks. For all of these participants, the problem was worse in one side of body which was affected by hemiplegia. This condition caused weakness, numbness, paresthesia, and pain in their hand, ankle, and foot. Presence of weakness in their hand and foot caused difficulty in coordinating movements in rest of their body. In summary, in coordination, as assessed by study affected their control over their body movements and they experienced restrictions in performing fine and gross motor skills. This limitation also affected the use of clothing and fasteners. In coordination affected overall balance and equilibrium of their body.

Limitations in Body Strength. All participants gave a score greater than zero to the physical limitations due to body strength. Two of the participants; three and five, assessed that body strength was a problem. Rest of the participants; one, two, four and six stated that their upper body strength had been deteriorating as their disease progressed and physical conditions worsened. Participant one experienced burning sensations in the muscles across her back. Participant two and four reported that burning sensations occasionally decrease as he started to perform exercises promoted by physical therapist. Participant six had very little strength on his right side and could not lift anything. He had very little strength in his hands and arms. Body weakness for these participants involved the full length of the arms and legs (including wrists, hands, ankle, and feet), shoulder, neck, upper and lower back. The participant's limitations in these areas have restricting impact while wearing clothing. Muscular endurance and strength had been identified as necessary for dressing.

Limitations of Head Movement. All participants assessed limitations of head movement with a score greater than zero. One participant; three, considered head movement to be an occasional problem. Participants two, four and six were having problems moving their head to the right and turning it quickly to either side. With this condition they had to be very careful against moving their head to the side and could no longer touch their chin to their shoulder. Participant one and five had extreme head movement limitations in moving either to the left or right side and could only turn their head about halfway towards their shoulder on either side. Any type of up and down movements of head were currently not possible for them. This limitation had implications not only while wearing clothing but also for the styling features of garment around the neckline area. Usage of head movement as limitation was also found as a separate issue in clothing literature.

Limitations of Stamina. All participants assessed limitations in stamina as greater than zero. Participant four stated that stamina limitations were dependent largely upon the type of activity at this stage of his disability. He disclosed that stamina was a by-product of Hemiplegia stroke, and he was not able to sustain any sort of activity if his routine was disturbed. According to him he did not have the endurance to perform any continual activity due to fatigue. Rest of the participants considered stamina to be major and consistent problem because they had severe symptoms of hemiplegia. Participant two stated she also felt fatigued because she had to spend the day in some kind of pain. She explained how her stamina problems worsened over time due to onset of hemiplegia. Participant three and five narrated that they had been experiencing tiredness, headache, dizzy spells, and a tremendous amount of pain. Both explained how they feel excessively thirsty and had high blood pressure, blood sugar and cholesterol levels. For all study participants, stamina was assessed as a limitation that was found dependent upon multiple factors. Their stamina was inadequate in performing many tasks, and specially the task of dressing.

Limitations of Sensation. All participants assessed this of limitation with a score greater than zero. Four participants; two, three, five and six, expressed major problems associated with sensation. Participant three was experiencing increasing numbness in her extremities. She felt threatened by increasing numbness. Participant five could not move without substantial effort. Participant six considered sensation to be a major issue. He also had fluctuating pain around his hipbone and lower back. Limitation in sensation for these participants encompassed hyper-sensitivity of the skin in some parts of the body, sensitivity to humidity, sensitivity to low temperature and numbness in the extremities. These limitations had consequences regarding wear ability of clothing, specially towards the type of fabric used in a garment and the construction method of the garment.

Difficulty in Lifting and Reaching. All study participants expressed difficulty in various lifting and reaching movements, majorly due to lack of strength. All participants, therefore, gave similar score to the best of their judgment. Each Participant assessed as impossible to perform for various activities in this area. The limitations of lifting and reaching had significant repercussions for the act of dressing and affected their choice of type of fastening and location of fasteners.

Difficulty in Handling and Fingering. Most of the participants assessed this area with a score of four, indicating impossibility. This limitation mainly contributed towards failure to execute fine motor movements and was taken as major issue in dressing activities such as manipulating small fasteners and using accessories. A common concern found was inability in handling small items due to inadequate capacity in clutching and holding. One Participant; three, commented that in spite of her strong intentions this limitation held her back from performing a lot of activities. Participant five shared how he had to get help of some caregiver to get ordinary tasks done, such as adjusting his shirt properly, as his fingers lacked the sensitivity to manipulate fabric layer. Participant six experienced enhanced pain and numbness in his left side and so this limitation was seen more on this side. Many participants held the view that this limitation was worsening with time. This limitation had its consequences regarding type of clothing design such users need along with modifications required in choice of fasteners.

Inability to Use Extremities Three participants; two, five and six, assessed body extremities inability with a score of three, on the other hand and one participant; four assessed it with a score of four and one participant; one, assessed this limitation with a score of two. Most of the participants previously experienced a phase of confinement, and lost capability to use all extremities during this phase. Phase of complete confinement improved to a little extent regarding functionality in extremities. The

threat of such repeat confinement was felt very strongly by all participants. Limitation of full range of movements of arms and legs became an important reason to have modified needs regarding clothing. This limitation affected the act of dressing as well as compatibility of movements of body and garment. Due to this limitation a huge need prevailed to incorporate some concealed features in clothing that enhanced usability but not visible enough to categorize such wearers as different from regular users.

Difficulty with Range of Motion of Body. Two of the participants; two and five, assessed range of motion to be a problem and rest of four participants; one, three, four and six assessed this limitation as very major problem with scoring it by four. Most of the participants held the view that their limitation of moving arms over their head and behind their back as well as limitation of turning their head to side are major contributing factor towards the emergence of new needs in regular clothing. Declined range of movements were narrated as limited movements of both arms, limited movements of head and limitation of leg, knee, and hip movements. Such limitation caused the participants to not to be able to sustain same position for some period of time. Lacking the ability to reach to the side or bringing arms behind the back affected the act of dressing and a desire was expressed to enhance the shape and style of regular clothing to accommodate for lack of range of motion. Regular clothing requires a necessary freedom of range of body movements and same is also needed to adjust clothing once it is on the body.

Other. No participant expressed any additional limitations to the researcher.

Body Measurements of Case Study Participants: Along with assessment of physical limitation the other important data collected during this phase was individual body measurements of case study participants. Participants were measured using a standard tape measure in inches. The measurements taken were recorded in the measurement chart. This set of measurements were taken in order to make the trial

garment to the actual size of corresponding participant. Table 34 shows compilation of these body measurements. For standardization of their sizes, falling in one of four readymade garment categories of extra small, small, medium, large, and extra-large for men and women, reference sizes of bust, waist and hip circumference were compared as shown in table 35. This comparison showed that one of the participants; one, belonged to small size for female, whereas another female participant; two belonged to large size for female, and last female participant; three belonged to extra-large size for female, two among male participants; four and five belonged to medium category of men and last male participant; six belonged to the large size category for men.

Table 34:Case Study Participant's Body Measurements Chart in Inches

Participants	01	02	03	04	05	06
	Female			Male		
Across Back	14	15	15 ½	15 ½	16 ½	17
Chest/Bust	36 ½	40	43 ½	40	38	44
Waist	29	33	38	34 ½	33	38 ½
Hip	38	44	46	40	38	44
Center Back Length	14	15	15	15	16	17
Hip Depth	10	10 1/2	11	11	12	13
Arm Length	20	21	22	23	23 1/2	24 1/2
Girth	13	15	15 ½	16	16 ½	17
Trouser Length	39 ½	41	42 ½	42	43	45
Crotch	10	11	11	11	12	13

Table 35: Relevance of Individual Measurements to Standard Sizes

	Extra Small	Small	Medium	Large	Extra Large
Male			4 & 5	6	
Female		1		2	3

4.2.2 Addressing Research Question Seven Corresponding to Phase Three

R.Q. 7. What are the special requirements expressed by hemiplegia patient for everyday clothing to acquire enhanced agility, with special focus on viewpoint about comfort in material and garment, management of care and storage, conformance to social norms, aesthetics, and cost effectiveness?

Assessment of Potential Clothing Problems: All participants expressed about their limited body movements in phase two and stated about their need of assistance while dressing. During data collection and analysis of phase three, participants were identified only by numbers from 01 to 06. The researcher conducted semi-structured in-person interviews with participants at their residences regarding assessment of potential clothing problems as shown in table 36. Participants were requested to assign a rating to each regular clothing problem using a five-point Likert-type scale, ranging from ‘no concern’ (0) to ‘very high concern’ (4). Participants were requested to give a full detail of clothing problem rated (1) or higher.

Table 36: Assessment of Potential Clothing Problems for Research Question 7

0=No concern, 1=Light concern, 2=Moderate Concern, 3 High Concern, 4= Very high Concern

Clothing Problems	0	1	2	3	4
Putting on and Taking off Dress				2	4
Managing Fasteners of Dress				1	5
Freedom of Movement after Dressing				2	4
Quality of Fabric of Dress				1	5

Coverage of the Body by Dress	3	3	
Style of Dress	2	4	
Construction Quality of Dress	4	2	
Irritating Features in Dress		6	
Aesthetics of Dress	1	5	
Cultural Conformance of Dress	4	2	
Cost of Dress	1	1	4
Storage of Dress	2	3	1
Wash ability of Dress	1	5	
Facility of Features for New Needs		6	
Durability of Dress	1	2	3
Overall Comfort of Dress	2	4	

Note. Greatest identified clothing problem shown in bold type

For each clothing problem, all participants ($n=6$) responded to every item. Outlining the required clothing needs and preferences of the study participants helped in narrowing down the desired adaptive features in the designing stage. Each of the potential clothing issue was identified from the literature and endorsed by specialist medical professional as common problem with regular clothing for patients of hemiplegia of grade 0 to 3. With identification of regular clothing problem participants were they also probed about their perceived desirable features in clothing suitable for them. Table 36 shows the response of participants for each problem. Using the same analysis as for Table 34 the data of current phase was analyzed to bring into limelight the actual needs for adaptive clothing designs as described by the real users.

Putting on and Taking off Dress All participants gave this dimension a score greater than zero. Out of these four participants, one, three, four and five, described this clothing problem as problem with very high concern. For rest of two participants, two

and six, this problem was scored as holding high concern. Participant four categorically expressed his pain while putting on and taking off regular clothing as it was confining and felt tight while act of dressing. Participant three and five correlated this problem with their inability to coordinate and lack of stamina. Participant one exclaimed how she had to take rest period while dressing as the process in one go was very draining for her. She pointed out the pain streaks as she tried to pull her dress up over her head to put it on. Thus, the act of dressing had been reported as a painful task that required help from some caregiver on daily basis. Categorically, all participants indicated a need in adaptive clothing design for an opening, preferably at front, to facilitate act of dressing.

Managing Fasteners of Dress. All participants ($n=6$) had problem with fastenings. Five of the participants; one, two, four, five and six, held the view that fasteners were problem of very high concern and only one participant; three, considered it as problem of high concern. All participants considered zippers as problematic due to physical limitation of holding and fingering. Location of zippers at the back was completely disliked by all. Zippers were either considered for elimination or to have a large holder at zipper slider to aid in holding and moving it. All participants favored attachment of a bottom flap and a covering flap when zipper is applied to avoid any friction to skin. It was also mentioned that use of zipper on the side which is not affected by hemiplegia was easier. Participants also criticized use of regular size small buttons and buttonholes as fasteners. Difficulty of to manipulate and manage buttons if used as fastener was also accompanied by the complaint of becoming undone as participants turned over in bed. Another issue reported was that the button come off the garment easily if it was not very securely attached to the garment fabric. Recommendations consisted of minimum numbers of buttons to be opened and closed, use of larger size buttons which had to be stitched securely on the side which could be reached easily.

Use of *hooks and eyes* were declared as impossibility by all the six participants, due to small size of hook and eye and level of focus needed to use these as fasteners. Another problem fastener type identified for this population while interviews was the *snap*. Participants commented that snaps needed more pressure by the fingers than they possessed. A rejection for the use of hooks and eyes or snaps as fasteners in clothing was judged from the interviews. *Velcro*, a hook-and-loop fastening mechanism, was considered as a favorable solution by the participants. A few complaints about Velcro mentioned the stiffness and inflexibility of its material; the materials were uncomfortable because the sharp corners if exposed directly caused damage to the skin adding additional discomfort to the pain of the disability. Adequate solutions comprised of sensitive methods of its stitching to prevent harm to wearer which in turn could built user confidence in its ability to stay fastened. General comments with fasteners were attributed to their nature, location on garment, size, the strength needed to fasten and ability of hand-to-eye coordination to manipulate fastenings. It was found that participants had already made some adaptations on their own in their regular clothing to create opening and used fasteners that would work within the existing regular clothing.

Freedom of Movement after Dressing. Deficiency of freedom of movement was scored as problem of very high concern for most of the participants; two, four, five and six. Two of the participants; one and three, considered it as problem of high concern. The participant two who considered this a problem of very high concern tried to solve it by wearing oversized clothing. Darts and shaping of any kind were declared as problems by all the participants. They also designated weight of fabric used for clothing as a contributory factor to create hindrance of movement. Any feature of the garment that kept close to the neck was also considered as constraining movement. Solutions proposed by the participants for improving freedom of movement in adaptive

garment included creating more ease allowance, and planning flat necklines not very close to neck

Quality of Fabric of Dress. Participant responses were found most for this clothing dimension as problem of very high concern. For only one participant, four, it was a problem of high concern. Participants specified that the use of man-made fibers in the garment be kept to a minimum. They stated that fabric such as polyester was not comfortable, and they held the view that natural fiber specially cotton “breathed” better and looked nicer. Complaint against polyester causing skin rash was also reported by one participant: three. The only concern with cotton was its tendency to wrinkle and for it participants recommended a very mild blend to provide wrinkle free property. Intolerance against pure wool was also reported by two participants: one and five. Along with nature of fabric, its construction was also mentioned as an issue. All favored a soft, wash and wear type of fabric.

Coverage of the Body by Dress. Participant responses were split as problem with high concern; participant two, three and five, and as problem with very high concern; participant one, four and six, for his area of clothing related problem. It was assumed at the start of study that coverage of the body related to modesty only. After data collection and analysis of this phase, coverage of the body by dress was found to be an important concern for warmth. Comments that related to modesty referred to sizing of garment and corresponding body measurements. Distribution of size of regular garments were addressed as too short and with inadequate ease. Due to specific physical limitations of this group the movements of wearer were less synchronized and thus caused raised hems and side slits, exposing areas of the body. A strategic planning of ease allowances at different locations of dress was highly recommended. Participants also required to fulfill their need of warmth in addition to modesty with this aspect of

clothing. Due to onset of hemiplegia, they suffer inadequate blood circulation leading to lack of ability to maintain their body temperature at certain intervals.

Style of Dress. All participants showed their concern about the styles of clothing that became constricting due to physical limitations of hemiplegia. Most of the participants categorized it as problem with very high concern; participant two, four, five and six. Two of the participants; one and three, considered it as problem of high concern. Almost every participant complained about problem with neck areas of regular clothing. They explained their inability to have anything tight at the base of neck. Collars were considered equally undesirable by all, the tight and stiff edge of collar created pressure areas around the neck. Similar disliking was conveyed about any constricting element around bust area. All reviewed about more ease needed at the armhole area and extra ease throughout the length of sleeve. Provision of extra ease at the waistline was also a common recommendation. It was strongly conveyed that non availability of these features in every clothing was frustrating for these users. These participants reported their views about with constricting styles of clothing in general and held the view that their current physical limitations after onset of hemiplegia caused all these.

Construction Quality of Dress. Most of the participants; one, two, four and six, considered construction quality of dress as a problem of high concern whereas two of the participants; three and five ranked it as problem with very high concern. They all recommended excellence of construction quality of dress to provide better service and withstand extra pressure after onset of hemiplegia. Participant four specially indicated the dire need of durability of construction features to safeguard the issue of ripped and wearing out seams, popping buttons, disintegration of poor-quality elastics and fraying edges. It was emphasized that excellence of construction was also needed to withstand extra washings and stain removal of clothing.

Irritating Features in Dress. All participants consistently expressed their concern about problems they face with irritating features in regular everyday clothing. All rated it as a problem of very high concern. Complaints were about restricting features at neckline, poor management of buttons and buttonhole, poor fitting of set-in sleeves and irritable lengths of sleeve which they disliked, any constriction at wrist was not acceptable along with unsatisfactory lengths of side slits and hem widths. These participants explained that they started experiencing these irritating features in their regular clothing after onset of physical limitations of hemiplegia.

Aesthetics of Dress. Majority of the participants; one, three, four, five and six, considered visual appeal of their everyday clothing to be problem with very high concern. Only one participant; two, ranked it as problem of high concern. It was a common comment that lack of good styling to accommodate their new needs made them look “pitiable” and “different from others”. All expressed their frustration at non accessibility of appropriate clothing. Functionally designed clothing is usually planned without any concern of aesthetic appeal, and appropriateness. They expressed that people with special needs require such solutions for everyday clothing which did not make them stand apart from normal people or convey a sense of a uniform of some type to accommodate their special need.

Cultural Conformance of Dress. All participants considered adherence to cultural norms of local dress as priority and most participants; three, four, five and six, ranked it as problem of high concern and two participants; one and two, ranked the conformance to cultural norms as issue of very high concern. All participants desired to appear comparable to the group around them hence proposed that functional features should be merged in local dress style to maintain their sense of belongingness.

Cost of Dress. Cost effectiveness was considered an important factor by all participants. For most of the participants, two, three, five and six cost of dress was a

problem of very high concern but one of the participants; four, ranked it as problem of high concern and one participant; one, categorized it as problem of moderate concern. Everyone was concerned about obtaining higher value in their dress in manageable budget. Availability of better-quality clothing with desired features in most cost-effective way was endorsed by all.

Storage of Dress. All participants expressed the ease of storage of their special clothing as a dimension of concern and ranked it higher than one. Most of the participants; three, five and six, ranked this as problem of high concern but one of the participants; four, endorsed this feature as problem with very high concern. Two of the participants; one and two categorized this dimension as problem with moderate concern. It was commonly commented that the desired features should not be technical in a way that these require special facilities of storage when not in use. Everyone talked about invisibility of special features while wearing as well as storage.

Wash ability of Dress. Easy washing of the everyday clothing of participants with special needs due to hemiplegia was commented by most participants; one, two, four, five and six, as problem with very high concern. Where one participant; three, ranked it as problem with high concern. All held the view that easy wash ability is very necessary because due to specific needs their clothing goes to frequent washing cycles thus any specific technique needed to wash and dry these will add to the cost of maintenance. It was commonly stated that the desired featured used in their everyday clothing should be planned with easy maintenance in mind.

Facility of Features for New Needs. Provision of facility of features to cater to new needs after onset of hemiplegia was endorsed as problem with very high concern by all the study participants; one, two, three, four, five and six. Everyone brought into limelight the dire need to bring special features in everyday clothing to accommodate their new needs.

Durability of Dress. All participants showed their concern about durability of their clothing by giving it a score higher than 1. More participant, three, four and six considered it as problem of very high concern. Fewer participants, one and five scored it as problem of high concern, whereas a single score of participant; two, regarded it as issue of moderate concern. Along with appropriateness of clothing according to new needs, all participants considered durability as very important factor. According to one participant the struggle to obtain a good piece of clothing would be useless if it is not durable.

Overall Comfort of Dress. Higher concern was shown towards overall comfort, encompassing all dimensions of their dress. Most of the participants; one, three, four and six, ranked it as issue of very high concern, whereas fewer participants; two and five considered it as problem with high concern. All endorsed the need of overall comfort of dress in all respects of physical, sensorial, psychological, and physiological.

Assessment of Time Taken for Dressing by Study Participants: For phase three of data collection dressing time estimation was also conducted. Data was gathered from each participant individually. Each participant was estimated thrice for dressing time then average of three readings is compiled in table 37.

Table 37: Assessment of Time Taken for Dressing of Regular Clothing

	Participants					
	1	2	3	4	5	6
Minutes	7	7.5	8.5	7	7.5	8

Each participant was estimated for time taken to dress and undress, thrice on different visits by using a stopwatch, then an average of three recorded readings was calculated.

4.2.3 Addressing Research Question Eight Corresponding to Phase Four

R.Q. 8. How to incorporate specified requirements as expressed by hemiplegia patient in the structural layout of proposed everyday adaptive clothing design solution to acquire enhanced agility?

Analysis of previous phases provided working background for phase four of research. All activities were focused around development of appropriate adaptive clothing design solutions for specific needs due to physical challenges as outcome of hemiplegia. Corresponding standard body block patterns were used to create modifications appropriate for the study participants. Specification sheets outlined the construction process of the chosen trial adaptive clothing design.

Designing of Adaptive Clothing: Participants recommended the development of an acceptable basic style of everyday clothing, they showed inclination that if adaptive structural detailing suits their specific needs they will be willing to use it further in different colors and made out of different fabrics according to changing seasons. The scope of current study was to evolve structural modification in the clothing design to accommodate the preferences stated in previous phases of research. There were no efforts made beyond the scope of study to incorporate variation of colors and fabrics. Current exploration was focused on finding out how new needs could be engineered in the structural design of everyday clothing to appropriately fulfill the specific needs stated by participants. Researcher anticipated to collaborate the input of all study participants during previous phases to draw three variations of adaptive clothing designs for both genders, and latter selecting one design which was most favored among these to be constructed. The designing phase followed the conceptual framework proposed for the study to create user centered adaptive clothing designs for everyday use. Traditional methodology of designing does not include opinion of real users while this process. In contrast to the stereotype method of design development,

during current study, prospective users were major contributors in development of adaptive clothing designs so that their real needs are incorporated in proposed designs in most appropriate manner, so a successful solution is sought.

Adaptive clothing design sketches started with the basic body block patterns of female and male garments as reference guideline. Three adaptive clothing sketches of female shirt and eastern trouser and three adaptive clothing sketches of male shirt and trouser were prepared keeping in mind the user needs assessed in previous phases. For development of female adaptive clothing sketches the front and back drawing of basic bodice block of long, straight, set-in sleeves, a round neckline, bust and waist darts in the front, and waist darts in the back was used as template and manipulated for adaptations. Similarly, basic block patterns of female eastern trouser, male shirt and male trouser were used, appendix 17, 18, 19 and 20. Using the details of participant interviews at phase two and three, the researcher proposed three adaptive clothing design options for female and three for male clothing which accommodated functional as well as esthetic features. Flat sketches of the adaptive clothing designs were drawn and are shown in appendix 21, 22, 23, 24, 25 and 26. The findings from the real end users, during different phases of research, provided foundation guidelines that a priority in design development would be to design a comfortable, well-fitting adaptive clothing design with easy-to-manage fasteners and extra ease allowance for ease of movement. Overall designing preferences were for a loose and unfitted type of clothing as expressed by end users. Plain round neckline was also analyzed as a dominant preference. For loose fitting sleeves raglan and drop shoulder styles were recommended. A common rejection for any detailing feature of adornment was assessed. As the emphasis was more on the structural modification to accommodate new functionality with esthetics so this study rigorously explored probabilities of structural layout and construction details and no effort was made to assess effect of

changing color and surface patterns of material. The length of proposed shirt designs (just touching the knees) was also preferred by all participants. This concealed certain areas of the body, which was also noted as a modesty requirement of Pakistani context. Two side slits allowed for extra flexibility, and hem was slightly lower than regular to allow for extra coverage, a feature preferred by participants. Adaptive clothing sketch development completed with participant view about functional and aesthetic aspect of proposed clothing. Type of seams suggested were simple seam with press opened seam allowances to minimize possibility of bulk at seams; problem mentioned in interviews.

Fabric Selection and Construction of Trial Adaptive Clothing: Material selection for proposed adaptive clothing designs was done from locally produced materials, keeping in mind specific needs assessed in phase one, two and three. After detail deliberation and approval of supervisory committee locally produced combed mercerized cotton of 100gsm was selected that seemed fulfilling indicated performance requirements and held best possible combination of required comfort properties. Standardized textile tests of the selected material were done in textile testing lab at material manufacturing site (appendix 27). After approval of textile experts of advisory panel, the selected material was procured from a local production unit (appendix 28). Out of three flat sketches one was selected for trial garment. A quarter scale of selected design was first constructed from recommended local material. The prototype was rigorously discussed with garment construction specialist to reach best fit of solutions regarding sewing detail and fastener placement. A few technical modifications were recommended by specialists. Second prototype incorporated all recommended features of construction and was finalized as baseline for trial garment. All construction details were written carefully in respective specification sheets of every part to ensure conformance to recommendations, appendix 29, 30, 31 and 32. Specification sheets were prepared, as shown in figure 68, 69, 70, 71, to ensure replicability of current study.

Design Details And Sketches Of Front And Back Of Trial Adaptive Female Shirt

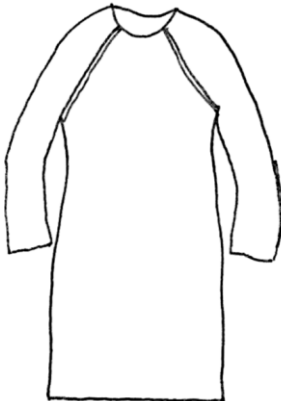
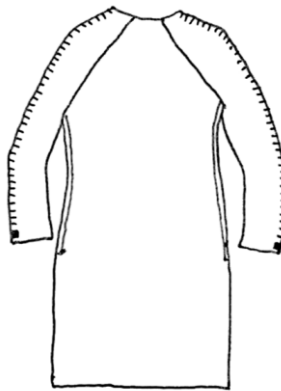
Description of trial adaptive design				A loosely fitted long shirt with round neckline having full opening at both sides with velcro strips attached to both sides of back of shirt and corressponding soft part of velcro on both sides at front, as clouser in stead of side seams. Long, loosely fitted raglan sleeves with velcro as fastener at front diagonal raglan line providing an openings in front. Sleeves with double sided zipper, stiched with one flap facing back ward through out the length of sleeve across top with two sliders moving in opposite direction  Front  Back
Measurments of dress in inches				
	1	2	3	
Bust	23	25	26	
Waist	21	23	24	
Hip	25	27	28	
Full Length	39	36	40	
Sleeve Length	21	20	21	
Sleeve Opening	6.5	6.5	7	
Across Back	14.5	15	16	
Side Slit	19	17	20	

Figure 68:Specification Sheet of Adaptive Clothing Design, Female Shirt

Design details and sketches of front and back of trial adaptive male shirt

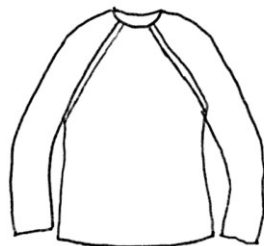
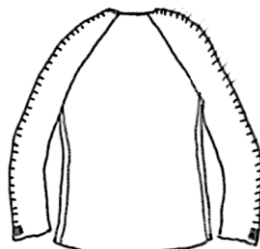
Description of trial adaptive design				A loosely fitted short shirt with round neckline having full opening at both sides with velcro strips attached to both sides of back of shirt and corressponding soft part of velcro on both sides at front, as clouser in stead of side seams. Long, loosely fitted raglan sleeves with velcro as fastener at front diagonal raglan line providing an openings in front. Sleeves with double sided zipper, stiched with one flap facing back ward through out the length of sleeve across top with two sliders moving in opposite direction  Front  Back
Measurments of dress in inches				
	4	5	6	
Bust	27	26	28	
Waist	26	25	27	
Hip	27	26	28	
Full Length	30	30	33	
Sleeve Length	23	22	24	
Sleeve Opening	7	7	7.5	
Across back	16	17	17	

Figure 69: Specification Sheet of Adaptive Clothing Design, Male Shirt

Design details and sketches of front and back of trial adaptive female eastern trouser

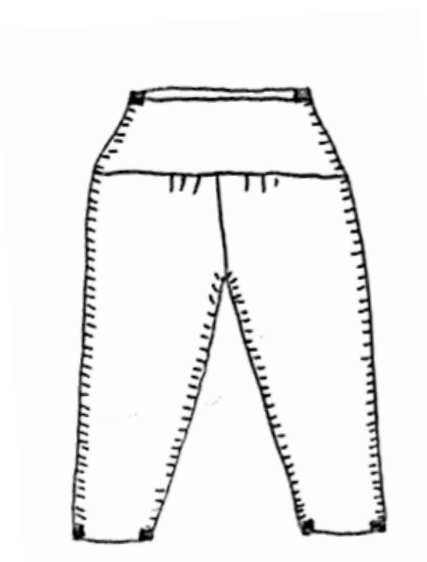
Description of trial adaptive design				A eastern trouser with loose belt having elastic waist band and top to bottom opening at both sides with double sided zipper and two rollers on both sides; velcro strap from front to back at both sides on top of back of belt for clouser
Measurments in inches				
	1	2	3	 Front
Trouser Length	39	36	40	
Crotch	15	14	16	
Trouser Width	24	24	24	
Belt Length	7	7	7	
Paincha Width	15	15	16	
Paincha Opening	8.5	8.5	9	
Paincha Length	40	42	44	
Crotch	15	14	16	 Back

Figure 70: Specification Sheet of Adaptive Clothing Design, Female Eastern trouser

Design details and sketches of front and back of trial adaptive male trouser

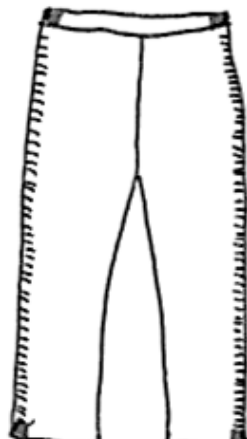
Description of trial adaptive design				A loosely fitted trouser with elastic waist band at belt and top to bottom opening at both sides with double sided zipper and two rollers on each side; velcro straps from front to back at both sides on top of back of belt for clouser
Measurments in inches				
	4	5	6	 Front  Back
Belt	34	34	40	
Waist	34	33	39	
Hip	45	43	49	
Belt Length	2	2	2	
Trouser Width	18	18	20	
Trouser Opening	8.5	8.5	9	
Trouser Length	42	43	45	
Crotch	17	17	18	

Figure 71: Specification Sheet of Adaptive Clothing Design, Male Trouser

4.2.4 Addressing Research Question Nine Corresponding to Research Phase Five

R.Q. 9. What is the effectiveness of proposed structural modifications in every day adaptive clothing design solutions, incorporating special requirements expressed by hemiplegia patients to acquire enhanced agility?

Assessment of Wear Trial Effectiveness: After preparation of triplicates of adaptive clothing trial adaptive clothing design, these were provided to the same study participants for wear trial of three weeks at their residences, assuming their everyday life. The last phase of data collection from selected study participants was focused to evaluate the effectiveness of modifications proposed in trial garment after trial period. A timed dress trial was also conducted to compare time taken to dress using regular and adaptive clothing. The effectiveness was expressed by same study participants who provided information in phase two and three about their physical challenges and clothing problems in regular clothing after onset of hemiplegia and took part in user centered adaptive clothing design sketches of phase four. Participants were able to evaluate the trial garment for its structural modifications based on their previous feedback. Participants ranked each choice from five of the options starting from not wearable to exceptional.

Table 38: Evaluation of Trial Garment Intervention for Research Question 9

0= Not wearable, 1=worse than expected, 2=Just as Expected, 3=Better than expected, 4=Exceptional

Clothing Dimension	0	1	2	3	4
Putting on and Taking off Dress				4	2
Managing Fasteners of Dress			2	3	1
Freedom of Movement after Dressing				2	4
Quality of Fabric of Dress			2	2	2
Coverage of the Body by Dress			3	1	2

Style of Dress	5	1	
Construction Quality of Dress	4	2	
Irritating Features in Dress	6		
Aesthetics of Dress	2	4	
Cultural Conformance of Dress	1	5	
Cost of Dress	4	2	
Storage of Dress	2	4	
Wash ability of Dress	2	4	
Facility of Features for New Needs	1	5	
Durability of Dress	4	2	
Overall Comfort of Dress	1	2	3

Note. Greatest identified trial adaptive clothing feedback shown in bold type

Participants ($n=6$) were asked about the same clothing related problems after onset of hemiplegia as were asked in phase three of the study. Participants ranked the trial adaptive clothing for its structural modification to accommodate the special needs of hemiplegia patients due to the specific physical challenges after onset of stroke. According to their expectations they selected against each clothing dimension. The accumulative results are shown in Table 38 and then qualitative reviews of participants regarding each dimension are reported. Latter results of timed dressing of adaptive clothing trial design was estimated to compare it with recorded timed dressing of regular clothing. This phase of current study concluded data collection and analysis

Putting on and Taking off Dress All participants gave this dimension a score greater than zero. Out of these four participants, one, three, four and five, described this trial adaptive clothing as problem better than they expected. For rest of two participants, two and six, the trial adaptive clothing was scored as exceptional. Participant four categorically expressed his happiness while putting on and taking off adaptive clothing

as it was comforting and felt right while act of dressing. Participant three and five correlated their experience of trial adaptive clothing according to the freedom of dressing before onset of hemiplegia. Participant one exclaimed how she had to take rest period while dressing with regular clothing but now the act of dressing became easier and less draining. Categorically, all participants indicated a positive feedback for trial adaptive clothing design with its structural modifications to facilitate act of dressing.

Managing Fasteners of Dress. All participants ($n=6$) had shown liking for the proposed fastenings in trial adaptive clothing. Three of the participants; one, two, and six, held the view that fasteners were better than they expected whereas two participants ranked it as just as expected and one participant; three, considered it as exceptional. All participants considered Velcro fastener as a good choice. Location of zippers in the trial adaptive clothing was liked by all. All participants favored attachment of bottom flap and a covering flap of zipper which avoided any chance of friction to skin. General comments with fasteners were attributed to their nature, location on garment, size, the strength needed to fasten and ability of hand-to-eye coordination to manipulate fastenings.

Freedom of Movement after Dressing. Freedom of movement after dressing the trial adaptive clothing was scored as exceptional by most of the participants; two, four, five and six. Two of the participants; one and three, considered it as better than their expectations. The participant two who considered this as exceptional appreciated the right amount of ease at different locations. Participants also designated type of fabric used for clothing as a contributory factor to promote freedom of movement.

Quality of Fabric of Dress. Participant responses were found equally distributed among just as expected, better than expected and exceptional. Two participants; four and six, ranked it as just as expected. Two participants; one and five, ranked it as better than expected. Two participants; two and three, ranked it as

exceptional. Participants specified that the natural fiber content cotton of trial adaptive clothing “breathed” better while use and looked nicer. Mercerization of the selected cotton material provided partial wrinkle resistance. Along with nature of fabric, its construction and weight was also mentioned as contributory factor favored by all.

Coverage of the Body by Dress. Participant responses were split as just as expected; participant two, three and five, and better than expected; participant one and four, and exceptional by participant six, for his area of trial adaptive clothing. It was exclaimed by participants that coverage of the body not only provided modesty but was also found to be important for provision of warmth. Comments that related to modesty referred to right sizing of trial adaptive clothing to corresponding body measurements. All favored the strategic planning of ease allowances at different locations of dress, appropriate lengths of clothing parts and best fit of length of side openings

Style of Dress. All participants showed their appreciation about the style of trial adaptive clothing that accommodated their modified needs due to physical limitations after onset of hemiplegia. Most of the participants categorized it as better than expected; participant one, two, four, five and six. One of the participants; three, considered it as exceptional. All participant preferred trial adaptive clothing over regular clothing. They explained their positive reviews about more ease provided at the armhole area and extra ease throughout the length of sleeve. Provision of extra ease at the waistline was also a common relief felt by all. These participants reported about overall appropriateness of style of trial adaptive clothing in general and held the view that their current physical limitations after onset of hemiplegia were catered well.

Construction Quality of Dress. Most of the participants; one, two, four and six, considered construction quality of dress as better than they expected whereas two of the participants; three and five ranked it as exceptional. They all endorsed fineness of construction quality of trial adaptive clothing that provided better service and withstood

extra pressure on certain areas to address their specific physical challenges after onset of hemiplegia. Participant four specially indicated durability of construction features that safeguard the issue of ripped and wearing out seams. It was also emphasized that excellence of construction also contributed to withstand extra washings and stain removal of clothing.

Irritating Features in Dress. All participants consistently expressed their positive review of removal of irritating features of regular clothing in the provided trial adaptive clothing. All rated it as just according to their expectations. These participants explained that they felt satisfied with the modifications in trial adaptive clothing which controlled irritating features they started to experience in their regular clothing after onset of physical limitations of hemiplegia.

Aesthetics of Dress. Majority of the participants; one, three, five and six, considered visual appeal of their trial adaptive designs as everyday clothing to be exceptional. Two of the participants; two and four, ranked it as better than their expectations. It was a common comment that aesthetical styling of trial adaptive clothing to accommodate their functional needs was very satisfactory and helped to make them look “just like others”. All expressed their pleasure about appropriateness of incorporated modifications in trial adaptive clothing that maintained aesthetic appeal. They expressed that such solutions were needed so that people with special needs did not feel themselves institutionalized or apart from normal people.

Cultural Conformance of Dress. Most participants: one, three, four, five and six, ranked cultural conformance of provided trial adaptive clothing as exceptional and one participant; two, ranked the conformance to cultural norms as better than her expectations. All participants conveyed their pleasure to be able to appear comparable to the group around them and appreciated the way functional features were merged in local dress style to maintain their sense of belongingness.

Cost of Dress. Cost effectiveness of trial adaptive clothing was considered by most of the participants; two, three, five and six, as just according to their expectations and two of the participants; one and four, ranked it as better than their expectations. Everyone approved cost of trial adaptive clothing, they conveyed their satisfaction about being able to obtain higher value in their everyday use adaptive clothing in affordable budget. Availability of trial adaptive clothing for everyday use with better quality possessing desired features in most cost-effective way was endorsed by all participants.

Storage of Dress. All participants expressed satisfaction for the ease of storage of trial adaptive clothing and ranked it higher than one. Most of the participants; three, four, five and six, ranked this as better than their expectations, whereas two of the participants; one and two, endorsed this feature in trial adaptive clothing as just according to their expectations.

Wash ability of Dress. Easy washing of the trial adaptive clothing provided to study participants with special needs due to hemiplegia was commented by most participants; one, two, four, and six, as better than their expectations. Whereas two participants; three and five, ranked it as just according to their expectations. All appreciated the easy wash ability as due to their specific needs their clothing had to go to frequent washing cycles. It was commonly stated that the ease in washing of provided adaptive solution as everyday clothing was significant for easy and economical maintenance.

Facility of Features for New Needs. Provision of facility of features to cater to new needs after onset of hemiplegia was endorsed as exceptional by most of the study participants; one, two, three, four, and six. One participant; five, considered it as better than his expectations Everyone brought into limelight the successful endeavor of

bringing special features in every day adaptive clothing to accommodate their new needs.

Durability of Dress. All participants showed their confidence about durability of trial adaptive clothing by giving this dimension a score higher than 1. More participant, three, four, five and six considered it just as they expected. Fewer participants, one and two scored it as better than their expectations. Along with appropriateness of clothing according to new needs, all participants also acknowledged durability of trial adaptive clothing. According to one participant this enabled them to obtain a durable piece of clothing with adaptive features.

Overall Comfort of Dress. Higher satisfaction was shown towards overall comfort, encompassing all dimensions of trial adaptive clothing. Most of the participants; one, three, and six, ranked it as exceptional, whereas fewer participants; two and five considered it as better than their expectations and participant four ranked it as just as he expected. All endorsed the provision of overall comfort of trial adaptive clothing, in all respects of physical, sensorial, psychological, and physiological. All participants felt that adaptations presented in the trial adaptive clothing as everyday garment were sufficient to their satisfaction.

Assessment of Time Taken for Dressing of Trial Adaptive Clothing by Study Participants: To conclude data collection of phase five of this research, dressing time estimation was conducted with the study participants while using trial adaptive clothing. Data was gathered from each participant individually. Each participant was estimated thrice for dressing time then average of three readings is compiled in table 39, along with the estimated time taken while using regular cloth to draw comparison.

Table 39: Comparison of Time Taken for Dressing of Regular and Adaptive Clothing

	Participants					
	1	2	3	4	5	6
Minutes (regular clothing)	7	7.5	8.5	7	7.5	8
Minutes (adaptive clothing)	3.5	3	3.5	3.5	3.5	3.5
Difference	3.5	4.5	5	3.5	4	4.5

Each participant was estimated for time taken while dressing with trial adaptive clothing, thrice by using a stopwatch, then an average of three recorded readings was calculated. All results are shown in table 39. Difference of duration of dressing interval of regular and adaptive clothing was calculated to assess effectiveness of trial adaptive clothing. For each participant, the difference of time taken to dress with regular and adaptive clothing showed a substantial difference indicating effectiveness of trial adaptive clothing.

Chapter 5

Discussion

Hemiplegia affects sufferers in many ways and in different degrees. When someone experiences a stroke and is paralyzed the act of getting dressed is a painful ordeal both physically and emotionally. Changes and limitations that occur in physical body are very pronounced for such sufferers and thus special needs for adaptive clothing arise. Physically challenged population due to any base line body condition have great difficulty finding everyday use garments that fit correctly, hang properly, and enable them to be dressed easily. When a segment of society has some specific need, designing clothing to accommodate that need is required. Satisfaction and confidence one can achieve from usual dress is hard to accomplish when the clothing one wears is difficult to manipulate and does not fit well. This research about adaptive clothing designing for special needs of physically challenged hemiplegia patients provided such solutions that both the study participants and their care givers had an easier time with dressing. Different types of adaptations recommended in this study allowed the participants to be dressed with reduced rolling, lifting, or repositioning and provided enhanced satisfaction, an emotional boost and elevated confidence to users. In this chapter significant findings are discussed considering existing literature. The chapter also encompasses major conclusions drawn from the study, implications of the findings and recommendations for the future research.

5.1 Summary of the Findings

For **objective one** the survey from hemiplegia patients and caregivers along with interview input from specialist doctors revealed that the comfort of the material and garment of everyday clothing of patients facing physical challenges due to hemiplegia is an important requirement in the adaptive clothing after the altered needs of users. The

five questions asked in this context focused on getting information about various dimensions of clothing comfort. The overall trend and higher percentage of responses showed that study participants believe that provision of comfort in the material and structure of garment is an important element to be encompassed for effective designing of every day adaptive clothing for hemiplegia survivors. Viewpoint about physical limitations, issues regarding different areas of difficulty in regular clothing, extent of exposure in regular clothing during treatment, priority of comfort dimensions and individual ideas other than questioned were probed from all participants.

For **objective two** the survey from hemiplegia patients and caregivers along with interview input from specialist doctors revealed that the economic feasibility of everyday clothing of patients facing physical challenges due to hemiplegia is an important requirement. The five questions asked in this context focused on getting information about various dimensions of economic feasibility. A mix overall trend of responses showed that patient participants believe that cost effectiveness is very important element to be encompassed for effective designing of every day adaptive clothing for hemiplegia survivors whereas caregiver participants held slightly different opinion and considered cost effectiveness as slightly less important factor. The input of doctors also supported the caregiver's viewpoint. Questions regarding annual frequency of buying clothing, gross expenditure in summer, gross expenditure in winters, expenses on single dress in summers and expense on single everyday dress in winter were estimated

For **objective three** the survey from hemiplegia patients and caregivers along with interview input from specialist doctors revealed that the ease of maintenance and management of everyday clothing of patients facing physical challenges due to hemiplegia is an important requirement in the adaptive clothing after the altered needs of users. The five questions asked in this context focused on getting information about

various dimensions of manageability of clothing. The overall trend and higher percentage of responses showed that study participants believe that ease of garment management is an important element to be encompassed for effective designing of every day adaptive clothing for hemiplegia survivors. Viewpoints about ease of washing, quick drying, long term usability, wrinkle free material and ease of storage were enquired from study participants.

For **objective four** the survey from hemiplegia patients and caregivers along with interview input from specialist doctors revealed that the conformance to social norms of everyday clothing of patients facing physical challenges due to hemiplegia is an important requirement. The five questions asked in this context focused on getting information about various dimensions of social conformance. A mix overall trend of responses showed that patient participants believe that social conformance is very important element to be encompassed for effective designing of every day adaptive clothing for hemiplegia survivors whereas caregiver participants held slightly different opinion and considered social conformance as slightly less important factor. The input of doctors also supported the caregiver's viewpoint. Questions regarding feeling of embarrassment due to extent of exposure, influencers for clothing decisions, contributors for clothing acquisition, aspects affecting clothing decisions and perception of self by use of clothing were probed.

For **objective five** the survey from hemiplegia patients and caregivers along with interview input from specialist doctors revealed that the aesthetics of design of everyday clothing of patients facing physical challenges due to hemiplegia is slightly important requirement in the adaptive clothing after the altered needs of users. The five questions asked in this context focused on getting information about various dimensions of aesthetics of design. The overall trend and higher percentage of responses showed that study participants believe that provision of aesthetics of design

in garment is slightly important element for designing of every day adaptive clothing for hemiplegia survivors. Viewpoints about getting matching clothing items, coherence to local style, suitability of color, seasonal suitability, and type of services from designers to provide such clothing were probed from all participants.

For **objective six**, detailed information about physical limitations was gathered during participant interviews, establishing different physical limitations expressed by the sample of participants ($n=6$). These physical limitations had been detailed based on suggestions in the literature, the Enabler Model and as proposed from concerned medical specialists. Analysis of the results showed that body strength, difficulty lifting, reaching, or carrying, difficulty handling and fingering, limitations of stamina, limitations of head movement, difficulty with range of motion of body and in coordination were major problem areas for participants.

For **objective seven** clothing needs and preferences were assessed, as expressed by hemiplegia patient for everyday clothing to acquire enhanced agility, with special focus on viewpoint about comfort in material and garment, management of care and storage, conformance to social norms, aesthetics, and cost effectiveness. Clothing dimensions were established from past clothing literature. These findings about clothing inclinations expressed by study participants suggested how important it was to priorities real user's preferences to find some solutions that generated a comfortable, well-fitting garment that allowed for ample ease of movement along with adherence to local social norms, ease of care and storage and affordability.

For **objective eight** to incorporate specified requirements as expressed by hemiplegia patient in the structural layout of proposed everyday adaptive clothing design solution to acquire enhanced agility, the researcher created three adaptive clothing design sketches for female and same for male participants; inspired by the real

needs of users as assessed in previous phases of research. The suggested drawings of adaptive clothing designs were evolved from basic body blocks for both male and female; modified structural features accommodated the functional as well as aesthetic requirements as suggested by study participants during in-depth interviews

For **objective nine** to assess the effectiveness of proposed structural modifications in every day adaptive clothing design solutions, incorporating special requirements expressed by hemiplegia patients to acquire enhanced agility, one adaptive clothing design was selected from those suggested in previous stage of the study. Three sets of one selected adaptive clothing design in selected fabric (local medium weight mercerized cotton) were made according to the corresponding measurements of individual participants, taken during their interviews. The details of the selected trial adaptive clothing designs were mentioned in the specification sheets to facilitate the process of construction of the adaptive clothing sets for the wear trial. Specification sheets contained the information of style line with flat sketches of front and back, corresponding sets of measurements of dress and all details of construction features. The triplicate sets of trial adaptive clothing were made from same fabric and were provided to the same group of participants for its evaluation for effectiveness after use of three weeks. due to time and financial constraints, the wear testing in this study was conducted in a short time frame, not over a longer period of time. The researcher recognized the ‘unreal’ situation of the wear tests. The focus of this study at this stage was more on the effectiveness of the trial adaptive garment rather than long term clothing product performance; therefore, a short wear test was considered sufficient to evaluate participant satisfaction. Participants positively evaluated the trial adaptive clothing after using it for recommended period. The participants found some dimensions of suggested adaptive clothing as “better than they had envisioned”, these included easy-to-manage features and comfort of movement. On the other hand,

coverage, visual appeal, construction, and adaptation of features in style of clothing were rated as exceeding expectations by the participating group. According to the participants, proposed style of adaptive clothing design inspired by the needs expressed by real end users was very acceptable, they all were willing to use this amended clothing style

5.2 Implications of the Findings

The purpose of this study was to explore the possibilities of making suitable clothing for adult patients of hemiplegia of grade 0 to 3 in Pakistan. The objectives were to obtain information about clothing needs and preferences from a group of hemiplegia patients, use this information to co-design and create structural modifications in clothing that suit the unique needs in local context of modesty and style, finally to evaluate the user's satisfaction with a wear test of trial garment, and suggest further research strategies. Findings of the current study are important because these have several implications.

There are a number of hemiplegia adult male and female patients suffering from severe physical limitations in Pakistan having specific clothing needs; hence the development of adaptive clothing for this population was strongly felt. Pakistan has its own unique dress styles and standards of modesty, especially for women. No study had been done to provide solutions for such special needs in local context. Such hemiplegia patients became able to obtain the quality of life, maintain the dignity, and make the tasks of dressing and undressing easier by the recommended convenient and comfortable solutions of adaptive clothing designs.

The ethics dictated that the needs of such people should be realized in order to provide opportunities of a better life for them and efforts were required to explore possibilities to make their daily life as comfortable as possible. This study was a

contribution of the expertise of researcher to present ideas and solutions to address these special needs of clothing. Better appearance through improvement of clothing helped such people to believe that they had worth in the sight of others and in their own view. Such patients made the access to the world a little easier by provision of adaptive clothing designs.

The feeling of self-confidence, the sense of well-being and of social acceptance came from the wearing of clothing, which was functional, appropriate, and attractive. This was important to all people but to those with special needs it was much more important. Adaptive clothing options provided an immense socio-psychological boost among such women. Until recently little research had been shown in developing adaptive clothing for various types of physical limitations. Earliest efforts to develop more practical clothing for individuals with special needs were pioneered by occupational therapists that had daily contact with such people and their dressing problems. The pressing need for clothing that such people can manage was emphasized by Boettke (1997) in a study conducted to determine how much help is considered necessary by the patients in activities of daily living. Dressing posed a problem for hemiplegia patients because of poor muscular coordination or extraneous movement and conditions worsen when the selection of appropriate clothing was none or very limited by what was available.

Until recently little interest was shown by manufacturers in the design and construction of clothing for the person for whom dressing was a problem. Till today most of the clothing for the people with physical limitations and resulting special needs were only especially custom designed and ordered. Women surviving from hemiplegia, no less than the rest of us, desired good design in the clothes they wear. The selection of clothing was largely an individual problem, based on particular needs and preferences. As a group of people having the same general physical limitation, their

needs and preferences were similar thus same designs were a solution for all. These needs were not met by traditional clothing designs. The outcome of the study was equally useful for anyone with limited mobility, ones who needed care due to problems of weight bearing or limitation of dexterity and to accommodate challenges of severe arthritis, frozen shoulder, Alzheimer's disease, or extreme weakness due to any other reason.

The outcome of study also provides a base line for starting an entirely new product line for niche marketing to persons suffering from physical limitations due to hemiplegia in Pakistan.

5.3 Recommendations

When a study is made with a small sample, such as this one, the first recommendation is that the study be repeated with a larger sample and for a longer period of time. After careful analysis of the methods and procedures used for current study some recommendations for refinement of the study are suggested. In addition to replication of the study, recommendations for refinement or for further study are made. Some recommendations explain ways that future studies could validate and extend the present study and other recommendations describes new ideas that could be explored to further expand the research applications and literature base.

5.3.1 Prospective for Future Research.

1. The number of individuals comprising the participant sample of adult female patients of hemiplegia of grade 0 to 3 can be increased in number and in range of severity of the attack of hemiplegia.

2. The identification of common problems of clothing dimensions indicate the potential for a more focused and quantitative method of data collection to be used with the larger participant sample. One example of this can be the use of a survey

questionnaire with a large sample, which could be analyzed to determine statistical significance using regression techniques or analysis of variance (ANOVA). An experimental research design might consist of a stamina and endurance study of donning and doffing clothing, which varies with disease, activity, environment, and time.

3. Wear testing can take place among two groups, the original participants of study and other group comprising of women without any physical disability. This will allow comparison of views between participants of study and views of people without physical disability

4. The issue of comfort in type of fabric used for clothing can be addressed in future research. Future studies can develop focus on fabrication issues by including use of different fabrics in such study.

5. The researcher and original group of participants can be removed from the wear testing component of the study because of the potential for bias. The participants have worked with the researcher in developing the adaptive clothing design and may not give an objective viewpoint about the finished trial garment.

6. Future studies attempting to replicate this one can make an attempt to bring this idea for ready to make products.

7. Some research can be conducted with a larger sample size of participants and a cross-section analysis of other features like demographics to analyzed and determine statistical significance of these different features contributing to specialized adaptive clothing design development.

This study has linked people with physical disabilities to a normal life with help of using adaptive clothing, a unique design concept.

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List of Appendices

Appendix 1: Approval Letter from Board of Advance Studies and Research, UMT



University of Management and Technology

Ms. Asna Mubashra
ID # 13001118001

No. OCE-011/Stu_let/PhD/2019/03
Date: May 27, 2019

Dear PhD Scholar

We are pleased to inform you that the Board of Advanced Studies and Research (BASAR) has approved your research proposal titled **"Designing clothing for special needs of physically challenged hemiplegia patients"** in its 27th meeting held in the University on 10 & 11 July, 2018. **Many congratulations.**

Please note that the BASAR made the following observations in the above mentioned meeting which need to be considered by you:

1. In annexure 5 of synopsis, a lot of characterization of textile is mentioned; this is very expensive characterization of fabric so it must be looked into.
2. In survey, same weightage has been given to all questions which should be reviewed.
3. Research objectives should be clear and specific in terms of achieving the stated aims.
4. The research should not be too generic as it would be very difficult to complete the study.
5. Remove thermos-physiological characterization of fabric such as moisture management, thermal insulation etc.
6. Choose fabric for summer and winter with known required moisture management, thermal insulation etc, to prepare patients' dresses.

You are hereby further advised to comply with the timeline as given in your research proposal and complete the research thesis within 24 months from the date of approval of your research proposal by the BASAR.

The policy on PhD time duration as given in the Participants' Handbook is reproduced below for your information and necessary action:

4.2 PhD time duration

The time period to complete a PhD program is usually 3 years after passing comprehensive examination, however, total time should not exceed 8 years from the date of admission in PhD program.

4.8 PhD research work:

PhD scholars, who fail to submit their thesis within specified time duration i.e. 3 years may apply to respective Dean/ Director for extension through supervisor. The SGC may recommend extension for consideration/approval by BASAR. The BASAR may extend time duration up to 8 years. Afterwards case will be time barred and admission would be cancelled.


Haseeb Haider

Manager Examinations

Copy to:

1. Dean STD
2. Supervisor (Dr. Nabeel Amin)

UMT Road, C-II, Johar Town, Lahore-54770, Pakistan

UAN: 111 300 200 Fax: +92 42 35184789 Email: info@umt.edu.pk Website: www.umt.edu.pk

Appendix 2: Approval Letter from School of Textile & Design

**University of Management and Technology****To Whom It May Concern**

It is hereby certified that Ms. Asna Mubashra having University ID# 13001118001 is a PhD scholar in the School of Textile and Design of University of Management and Technology based in Lahore, Pakistan. Her doctoral research title is "**Adaptive Clothing Designing for Special Needs of Physically Challenged Hemiplegia Patients**" This project is being supervised by Dr. Nabeel Amin, Adjunct Faculty in School of Textile and Design, UMT and Dr. Abher Rasheed, Assistant Professor at National Textile University, Faisalabad.

I would be grateful to you if you could kindly allow Ms. Asna Mubashara to visit your esteemed organization for the data collection as questionnaire survey from selected study informants and interviews from specialized doctors and nurses in respective area.

Thank you in advance for your consideration.

Regards

Date: September 05, 2018

A handwritten signature in blue ink, appearing to read "Mumtaz Hassan Malik", is written over a horizontal line.

Prof. Dr. Mumtaz Hassan Malik
Dean, School of Textile and Design, UMT
Lahore, Pakistan
Email: std.dean@umt.edu.pk

NO. OF PATIENTS WITH CVA LEADING TO PARALYSIS

Sr. NO.	Name of Hospital	Number of patients reported from 01-01-14 to 31-12-2014
1.	Lahore General Hospital, Lahore.	2655
2.	Services Hospital Lahore.	1330
3.	Mayo Hospital Lahore.	1569

Appendix 4: Approval Letter of Research Site 1



University of Management *and* Technology

To Whom It May Concern

It is hereby certified that Ms. Aana Mubashra having University ID# 13001118001 is a PhD scholar in the School of Textile and Design of University of Management and Technology based in Lahore, Pakistan. Her doctoral research title is "Adaptive Clothing Designing for Special Needs of Physically Challenged Hemiplegia Patients" This project is being supervised by Dr. Nabeel Amin, Adjunct Faculty in School of Textile and Design, UMT and Dr. Abiher Rasheed, Assistant Professor at National Textile University, Faisalabad.

I would be grateful to you if you could kindly allow Ms. Aana Mubashara to visit your esteemed organization for the data collection as questionnaire survey from selected study informants and interviews from specialized doctors and nurses in respective area.

Thank you in advance for your consideration.

Regards

Date: September 05, 2018


Prof. Dr. Mumtaz Hassan Malik
Dean, School of Textile and Design, UMT
Lahore, Pakistan
Email: std.dean@umt.edu.pk

Allowed as per rules


25/9/18
Medical Superintendent
Sir Ganga Ram Hospital,
Lahore.

Appendix 5: Approval Letter of Research Site 2

**To Whom It May Concern**

It is hereby certified that Ms. Aana Mubashra having University ID# 13001118001 is a PhD scholar in the School of Textile and Design of University of Management and Technology based in Lahore, Pakistan. Her doctoral research title is "Adaptive Clothing Designing for Special Needs of Physically Challenged Hemiplegia Patients". This project is being supervised by Dr. Nabeel Amin, Adjunct Faculty in School of Textile and Design, UMT and Dr. Abher Rasheed, Assistant Professor at National Textile University, Faisalabad.

I would be grateful to you if you could kindly allow Ms. Aana Mubashara to visit your esteemed organization for the data collection as questionnaire survey from selected study informants and interviews from specialized doctors and nurses in respective area.

Thank you in advance for your consideration.

Regards

Date: September 05, 2018


 Prof. Dr. Muntaz Hassan Malik
 Dean, School of Textile and Design, UMT
 Lahore, Pakistan
 Email: m.hassan@umt.edu.pk


 Prof. Mahmood Ayyaz
 (MD, FRCS (Gen), FRCS (Soc), MRCS (Ed))
 Principal
 Services Institute of Medical Sciences
 Services Hospital Lahore
 UMT House, C-4, Johar Town, Lahore-54770, Pakistan
 UAN: 111 300 200 Fax: +92 42 35084789 Email: info@umt.edu.pk Website: www.umt.edu.pk


 Prof. M. Javed
 (MD, FRCS (Gen), FRCS (Soc), MRCS (Ed))
 Principal
 Services Institute of Medical Sciences
 Services Hospital Lahore



Appendix 6: Approval Letter of Research Site 3



University of Management and Technology

To Whom It May Concern

It is hereby certified that Ms. Asna Mubashra having University ID# 13001118001 is a PhD scholar in the School of Textile and Design of University of Management and Technology based in Lahore, Pakistan. Her doctoral research title is "**Adaptive Clothing Designing for Special Needs of Physically Challenged Hemiplegia Patients**". This project is being supervised by Dr. Nabeel Amin, Adjunct Faculty in School of Textile and Design, UMT and Dr. Abher Rasheed, Assistant Professor at National Textile University, Faisalabad.

I would be grateful to you if you could kindly allow Ms. Asna Mubashra to visit your esteemed organization for the data collection as questionnaire survey from selected study informants and interviews from specialized doctors and nurses in respective area.

Thank you in advance for your consideration.

Regards

Date: September 05, 2018


 Prof. Dr. Mumtaz Hassan Malik
 Dean, School of Textile and Design, UMT
 Lahore, Pakistan
 Email: std.dean@umt.edu.pk


 25/9/18
 Medical Superintendent
 Jinnah Hospital, Lahore

Appendix 7: Informed Consent Form For All Research Participants

Informed Consent for Participants in Research Project

Title: Adaptive Clothing Designing for Special Needs of Physically Challenged Hemiplegia Patients

Researcher: Asna Mubashra (13001118001)

I. Purpose of this Research Project

The purpose of this research is to determine whether appropriate adaptive clothing for hemiplegic patients can be suggested using user centered designing approach. The anticipated contributions of findings are to further expand literature on adaptive clothing for individuals with physical disabilities and on user centered design approach for specialized adaptive clothing, and to move towards a practical solution to the problem of adaptive clothing for people with physical disabilities. The participant pool will consist of 100-150 adult hospitalized hemiplegic patients of grade 0-3 (with body physical limitation which affects interaction with clothing in some way) from three teaching medical hospital facilities; 9 specialist doctors of hemiplegia from three teaching medical institutes; 15 nursing-care staff for hemiplegia patients from three teaching medical hospitals; 15 family care givers of hemiplegia patients of grade 0-3 (with body physical limitation which affects interaction with clothing in some way); 6 adult hospitalized hemiplegic patients of grade 0-3 (with body physical limitation which affects interaction with clothing in some way). Expert opinion of one textile material expert and one garment manufacture specialist will also be taken time to time.

II. Procedures

The procedures involving the human participants are as following.

- From 100-150 adult hospitalized hemiplegic patients, responses will be collected as questionnaire survey for exploratory quantitative need assessment.
- From 9 specialist doctors, responses will be collected as semi structured interviews.
- From 100-150 family care givers of hemiplegia patients and nursing-care staff for hemiplegia patients, responses will be collected as questionnaire survey

- For in-depth case study investigations 6 participants will be involved in series of semi structured interviews by the researcher, followed by co-designing, dress trial and evaluation. In these interviews, they will be asked to identify clothing problems that they experience due to their physical limitations and will co-design a garment by sketching with the researcher their ‘ideal’ type of clothing piece. The interview interactions will last within one hour and will be conducted by the researcher, at a location decided upon by the subject in order to alleviate mobility problems. The participants will be expected to answer specific questions related to the adaptive clothing development.

III. Risks

This study presents no more than minimal risks to the participants. In the event that emergency help is needed during any of the sessions with participants described above, emergency services will be made available immediately.

IV. Benefits

No promise or guarantee of benefits has been made to encourage participants in this project. Participants may contact the researcher at a later time for a summary of the research results.

V. Extent of Anonymity and Confidentiality

Each participant will be given a code number (01, 02, etc.) to identify individuals during data collection as note taking, transcriptions, audio taping and reports. At no time, will names be disclosed for use in the study. Transcripts will be made from field notes and audiotapes recorded during in-person interviews. The code number of the recorded participant will identify these tapes. The codebook will be kept in a secure place inside the office of the researcher’s adviser. Only the researcher and advisor will have access to the codebook, the tapes, and the transcripts. The codebook, tapes and transcripts will be destroyed after three years. At no time, will the researchers release the results of the study to anyone without the informant’s written consent.

VI. Compensation

Each participant will be given a package of useful information about adaptive clothes. These instructions will be compiled from research, and will be beneficial to the participants.

VII. Freedom to Withdraw

Participants are free to withdraw from the study at any time without penalty. Participants will be free not to answer any questions or to respond to situations that they choose. There may be circumstances under which the researcher may determine that an informant should not continue as a participant.

VIII. Approval of Research

This research project is approved, as required, by School of Textile and Design and BASAR at University of Management and Technology.

September, 2018

September, 2020

Approval Date

Approval Expiration Date

IX. Participant's Responsibilities

I voluntarily agree to participate in this study. I have the following responsibilities:

- Participate in face-to-face interview/questionnaire survey.
- Answer questions relating to clothing problems to best of my knowledge.

X. Participant's Permission

I have read and understood the Informed Consent and conditions of this research. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent:

Date

Participant's signature

(Should I have any questions about this research or its conduct, I may contact the researcher).

Adaptive Clothing Designing (Questionnaire for patients)

Demographics

Name: -----

Address: -----

Select your gender

- Male
- Female

Select your age

- >15
- 16-20
- 21-30
- 31-40
- 41-50
- 51-60
- +60

Select your educational qualification

- High School Certification
- Undergraduate
- Graduate
- Postgraduate
- Professional
- Others

Select your Profession

- Government Employment
- Private Employment

- Business
- Staying at home
- Others

Select your family monthly Income

- >30000
- 30000-50000
- 50000-100000
- 100000-200000
- 200000-300000
- 300000-400000
- 400000-500000
- +500000

Choose your marital status

- Married
- Unmarried
- Divorced
- Widow/ widower

Duration of disease

- -----

Which side of your body is affected by hemiplegia?

- Right
- Left

Category1: Physical Comfort of Clothing

What changes do you feel in yourself after onset of hemiplegia (select all that apply)?

- Restriction in movement due to joint incoordination
- Restriction in movement due to muscular incoordination
- Feeling of numbness and cold
- Difficulty in lifting
- Difficulty in repositioning
- Difficulty in turning
- Difficulty in holding
- Others-----

What are main areas of difficulty with regular clothing (select all that apply)?

- Fitting issues due to new special needs
- Clothing challenges while putting on and off
- Position of fasteners
- Type of fastener
- Inadequate ease allowance at waistline
- Inadequate ease allowance at hipline
- Inadequate ease allowance at armhole
- Position of the seams
- Type of seam
- Location of openings
- Others

Which area of body you need to expose for treatment (select all that apply)?

- Arms

- Shoulder
- Chest
- Legs
- Side
- Back
- Others -----

Which is more important criterion for physical comfort in your dress?

- Feel and type of material
- Style of dress
- Manner of sewing

If you could design your own garments, what features would you add or remove in regular clothing in order to make your clothing suitable to your new special needs?

Category2: Economy

How often do you purchase your clothing items after onset of hemiplegia?

- 1-5 times a year
- 5-10 times a year
- Once a month
- 2-3 times a month
- 4-7 times a month
- More than 8 times a month

How much you usually spend in summers on clothing after onset of hemiplegia?

- Less than 5000
- 5000-10000
- 10000-15000

- 15000-20000
- 20000-25000
- More than 25000

How much you usually spend in winters on clothing after onset of hemiplegia?

- Less than 5000
- 5000-10000
- 10000-15000
- 15000-20000
- 20000-25000
- More than 25000

How much you usually spend on one outfit in summers after onset of hemiplegia?

- Less than 500
- 500-1000
- 1000-1500
- 1500-2000
- 2000-2500
- More than 2500

How much you usually spend on one outfit in winter after onset of hemiplegia?

- Less than 500
- 500-1000
- 1000-1500
- 1500-2000
- 2000-2500
- More than 2500

Category3: Management/Ease of Care

What is your opinion about easy wash ability of your clothing?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
 Slightly Nonessential ☐ Very Nonessential ☐

What is your opinion about quick drying of clothing?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
 Slightly Nonessential ☐ Very Nonessential ☐

What is your Opinion about long term usability clothing?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
 Slightly Nonessential ☐ Very Nonessential ☐

What is your opinion about wrinkle free material of clothing?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
 Slightly Nonessential ☐ Very Nonessential ☐

What is your opinion about ease of storage of out of season clothing?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
 Slightly Nonessential ☐ Very Nonessential ☐

Category4: Socio-Psychological**Do you feel embarrassed due to exposure while seeking medical help?**

Very often ☐ Often ☐ Sometimes ☐ Never ☐

Who usually influences you for your new purchase of clothing after the onset of hemiplegia?

- Family
- Doctor/Nurse
- Friends
- News paper
- People around your area
- Others

Who do you mainly shop with for your clothing after onset of hemiplegia?

- Friend
- Family
- Partner
- Alone
- Do not bother

What will encourage you to try any new type of clothing check as many options as apply

- Style
- Friend suggestion
- Family suggestion
- Doctor/Nurse suggestion
- Partner suggestion
- Comfort
- Durability

Do you think yourself is reflected by what you wear?

Strongly Agree ☐ Slightly Agree ☐ Neither Agree nor Disagree ☐
 Slightly Disagree ☐ Strongly Disagree ☐

Category5: Aesthetics

When planning new clothing items after onset of hemiplegia do you care for matching outfit items?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
 Slightly Nonessential ☐ Very Nonessential ☐

What is your opinion about coherence to local style of your garments?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
 Slightly Nonessential ☐ Very Nonessential ☐

When planning new clothing items what is your opinion about suitability of colors?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
Slightly Nonessential ☐ Very Nonessential ☐

When planning new clothing items what is your opinion about seasonal suitability of type of material?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
Slightly Nonessential ☐ Very Nonessential ☐

What kind of services would you prefer from an adaptive clothing designer to offer?

- Ready to wear
- Made to measure on order
- Others

What are your main criterion when you purchase your clothing items after onset of hemiplegia, rate each of the following factors according to your preference?

• **Physical Comfort**

Very High ☐ Slightly High ☐ Neither High nor Low ☐
Slightly Low ☐ Very Low ☐

• **Quality**

Very High ☐ Slightly High ☐ Neither High nor Low ☐
Slightly Low ☐ Very Low ☐

• **Type and feel of Material**

Very High ☐ Slightly High ☐ Neither High nor Low ☐
Slightly Low ☐ Very Low ☐

• **Style of garment**

Very High ☐ Slightly High ☐ Neither High nor Low ☐
☐

Slightly Low ☐ Very Low

- **Fitting**

Very High ☐ Slightly High ☐ Neither High nor Low ☐

Slightly Low ☐ Very Low ☐

- **Fashion Appropriateness**

Very High ☐ Slightly High ☐ Neither High nor Low ☐

Slightly Low ☐ Very Low ☐

- **Durability**

Very High ☐ Slightly High ☐ Neither High nor Low ☐

Slightly Low ☐ Very Low ☐

- **Ease of care**

Very High ☐ Slightly High ☐ Neither High nor Low ☐

Slightly Low ☐ Very Low ☐

- **Climatic suitability**

Very High ☐ Slightly High ☐ Neither High nor Low ☐

Slightly Low ☐ Very Low ☐

- **Uniqueness**

Very High ☐ Slightly High ☐ Neither High nor Low ☐

Slightly Low ☐ Very Low ☐

- **Color**

Very High ☐ Slightly High ☐ Neither High nor Low ☐

Slightly Low ☐ Very Low ☐

- **Price**

Very High ☐ Slightly High ☐ Neither High nor Low ☐

Slightly Low ☐ Very Low ☐

فالج کیلئے مخصوص لباس کی تیاری

خصوصیات آبادی

نام:..... فون نمبر:.....

پتہ:.....

.....

اپنی منف کا انتخاب کریں: مرد (یا) عورت

اپنی عمر کا انتخاب کریں: ☆ 15 سال ☆ 16 سے 20 سال ☆ 21 سے 30 سال ☆ 31 سے 40 سال

☆ 41 سے 50 سال ☆ 51 سے 60 سال ☆ 60 سال سے زیادہ

اپنی تعلیمی قابلیت کا انتخاب کریں:

☆ میٹرک ☆ انٹر میڈیٹ: ☆ گریجویٹ: ☆ پوسٹ گریجویٹ: ☆ پیشہ ورانہ تعلیم ☆ کوئی:.....

اپنا پیشہ منتخب کریں:

☆ سرکاری ملازمت ☆ نجی ملازمت ☆ کاروبار ☆ گھر پر ☆ کوئی اور:.....

اپنی ماہانہ خاندانی آمدن کا انتخاب کریں:

☆ 30 ہزار روپے ☆ 30 سے 50 ہزار روپے ☆ 50 ہزار سے 1 لاکھ روپے

☆ 1 لاکھ سے 2 لاکھ روپے ☆ 2 لاکھ سے 3 لاکھ روپے ☆ 3 لاکھ سے 4 لاکھ روپے

☆ 4 لاکھ سے 5 لاکھ روپے ☆ 5 لاکھ روپے سے زیادہ ہے۔

اپنی ازدواجی حیثیت کا انتخاب کریں:

☆ شادی شدہ ☆ غیر شادی شدہ ☆ طلاق یافتہ ☆ بیوہ / رخصت

☆ آپ کے فالج کی بیماری کا دورانیہ کتنا ہے

فالج سے آپ کے جسم کی کونسی طرف متاثر ہے: دائیں طرف (یا) بائیں طرف

فالج کو جانے کے بعد آپ کے سردیوں کے طبیہات کے اثرات کھتے ہوئے ہیں۔

☆ 5 روپے سے کم ☆ 5 روپے سے 10 روپے ☆ 10 روپے سے 15 روپے

☆ 25 سے 20 تک 5 کے فرق پر
☆ 20 سے 15 تک 5 کے فرق پر
☆ 15 سے 10 تک 5 کے فرق پر

لہجہ ہو جانے کے بعد گرمیوں کے ایک لباس بدھو مانسکا اڑھ کر تے ہیں:

☆ 5 سو روپے سے کم ☆ 5 سو سے 1 لاکھ روپے ☆ 1 لاکھ سے 15 سو روپے

☆ 15 سو سے 2 جڑار روپے ☆ 2 جڑار سے 25 سو روپے ☆ 25 سو روپے سے 2 جڑار

لہجہ ہو جانے کے بعد سرویوں کے ایک لباس پر عموماً کیا فرج کرتے ہیں:

☆ 5 سو روپے سے کم ☆ 5 سو سے 1 ہزار روپے ☆ 1 ہزار سے 15 سو روپے

☆ 15 سو سے 2 روپے 25 سو سے 2 روپے 25 سو روپے سے زیادہ

3. دیکھ بھال کی آسانی

کہڑوں میں آسان دھلائی کی خوبی ہوئے کئے ہارے میں آپ کی رائے:

☆ بے اچھا ضروری ☆ کچھ ضروری ☆ ع ضروری ع غیر ضروری ☆ کچھ غیر ضروری ☆ بے اچھا غیر ضروری

کپڑوں میں جلد سوکھ جانے کی صلاحیت ہونے کے بارے میں آپ کی رائے:

☆ بے اچھا ضروری ☆ کچھ ضروری ☆ نہ ضروری نہ غیر ضروری ☆ کچھ ضروری ☆ بے اچھا غیر ضروری

کپڑوں کا لمبے عرصہ تک استعمال کے قابل رہنے کے لیے آپ کی رائے:

☆ بے اہمیا ضروری ☆ کچھ ضروری ☆ بے ضروری ☆ کچھ ضروری ☆ بے اہمیا ضروری

کپڑوں میں سلوٹ نہ بنانے کی صلاحیت کے ہمارے میں آپ کی رائے:

☆ بے اہمیا ضروری ☆ کچھ ضروری ☆ عہد ضروری ☆ کچھ ضروری ☆ بے اہمیا ضروری

ہے موسم کے لباس کو سہولت سے محفوظ کرنے کی صلاحیت کے ہمارے میں آپ کی رائے:

☆ بے اچھا ضروری ☆ کچھ ضروری ☆ عہ ضروری عہ ضروری ☆ کچھ ضروری ☆ بے اچھا ضروری

4. سماجي و نفسياتي پہلو:

طبعی امداد کے دوران جسم کے حصوں کا ظاہر ہونا ضروری مندی کہا جاتا ہے؟

☆ پیسہ اکو ☆ اکو ☆ کھی کھی ☆ کھی نہیں

فالج کے بعد ملبوسات کی نئی خریداری میں اکثر کون اثر انداز ہوتا ہے:

☆ گھر کے ارا اور ☆ ڈاکٹر ☆ دوست ☆ احباب ☆ عزیز صہ ہمائے ☆ اور کوئی

لہجے کے بعد اپنے ملبوسات کی خریداری کیلئے آپکے ساتھ موما کون ہوتا ہے؟

☆ دوست ☆ اہل اہل خانہ ☆ ساتھی ☆ سہیا

مندرجہ ذیل میں سے کیا کیا مواصلات آپ کو نئے انداز کے لباس کیلئے آمادہ کر سکتے ہیں:

☆ انداز ☆ دوست احباب کا مشورہ ☆ اہل اہل خانہ کا مشورہ ☆ ڈاکٹر کا مشورہ ☆ ساتھی کا مشورہ

☆ سکون ☆ پائیداری

آپ کے خیال میں آپ کا لباس آپکی شخصیت کا آئینہ دار ہے:

☆ بے اسبھا ضروری ☆ کچھ ضروری ☆ ضروری ہے غیر ضروری ☆ کچھ غیر ضروری ☆ بے اسبھا غیر ضروری

5. جمالیاتی پہلو:

لہجے کے حملہ کے بعد نئے ملبوسات کا انتخاب کرتے ہوئے کیا آپ اپنے لباس کی تمام چیزوں میں ہم آہنگی کا خیال رکھتے ہیں۔

☆ بے اسبھا ضروری ☆ کچھ ضروری ☆ ضروری ہے غیر ضروری ☆ کچھ غیر ضروری ☆ بے اسبھا غیر ضروری

مروجہ انداز سے مختلف کپڑے پہننے کے بارے میں آپ کی رائے کیا ہے؟

☆ بے اسبھا ضروری ☆ کچھ ضروری ☆ ضروری ہے غیر ضروری ☆ کچھ غیر ضروری ☆ بے اسبھا غیر ضروری

نئے لباس کے بارے میں فیصلہ کرتے ہوئے رکھوں کی مناسبت کے بارے میں آپکی رائے۔

☆ بے اسبھا ضروری ☆ کچھ ضروری ☆ ضروری ہے غیر ضروری ☆ کچھ غیر ضروری ☆ بے اسبھا غیر ضروری

نئے لباس کا فیصلہ کرتے ہوئے کپڑوں کی قسم کا موسم سے مطابقت کے بارے میں آپکی رائے:

☆ بے اسبھا ضروری ☆ کچھ ضروری ☆ ضروری ہے غیر ضروری ☆ کچھ غیر ضروری ☆ بے اسبھا غیر ضروری

لہجے کے بعد مخصوص کپڑوں کے ڈیزائن کی کونسی خدمات کو آپ فوقیت دہن گے:

☆ میڈیکل کپڑے ☆ ماپ کے مطابق آرڈر پر میڈیا ☆ کچھ اور

لہجے کے حملہ کے بعد اپنے ملبوسات کی خریداری میں آپ مندرجہ ذیل پہلوؤں کو کیسے اہمیت دیتے ہیں:

☆ جمالیاتی سکون:

☆ بہت زیادہ ☆ کچھ زیادہ ☆ زیادہ کم ☆ کچھ کم ☆ بالکل کم

☆ معیار:

☆ بہت زیادہ ☆ کچھ زیادہ ☆ زیادہ کم ☆ کچھ کم ☆ بالکل کم

☆ کپڑے کی قسم:

☆ بہت زیادہ ☆ کچھ زیادہ ☆ زیادہ کم ☆ کچھ کم ☆ بالکل کم

☆ لباس کا انداز:

☆ بہت زیادہ ☆ کچھ زیادہ ☆ زیادہ کم ☆ کچھ کم ☆ بالکل کم

☆ بالکل کم	☆ کچھ کم	☆ زیادہ سے کم	☆ کچھ زیادہ	☆ بہت زیادہ	فٹنگ:
☆ بالکل کم	☆ کچھ کم	☆ زیادہ سے کم	☆ کچھ زیادہ	☆ بہت زیادہ	فیٹنگ کے مطابق
☆ بالکل کم	☆ کچھ کم	☆ زیادہ سے کم	☆ کچھ زیادہ	☆ بہت زیادہ	پائیداری:
☆ بالکل کم	☆ کچھ کم	☆ زیادہ سے کم	☆ کچھ زیادہ	☆ بہت زیادہ	سنبھال میں سہولت:
☆ بالکل کم	☆ کچھ کم	☆ زیادہ سے کم	☆ کچھ زیادہ	☆ بہت زیادہ	موٹی مناسبیت:
☆ بالکل کم	☆ کچھ کم	☆ زیادہ سے کم	☆ کچھ زیادہ	☆ بہت زیادہ	انظر ادرت:
☆ بالکل کم	☆ کچھ کم	☆ زیادہ سے کم	☆ کچھ زیادہ	☆ بہت زیادہ	رنگ:
☆ بالکل کم	☆ کچھ کم	☆ زیادہ سے کم	☆ کچھ زیادہ	☆ بہت زیادہ	قیمت:
☆ بالکل کم	☆ کچھ کم	☆ زیادہ سے کم	☆ کچھ زیادہ	☆ بہت زیادہ	

Adaptive Clothing Designing

(Questionnaire for nurses/family Caregivers)

Demographics

Name: -----

Address: -----

Select your gender

- Male
- Female

Select your age

- >15
- 16-20
- 21-30
- 31-40
- 41-50
- 51-60
- +60

Select your duration of service as caregiver to hemiplegia patient

- >1year
- 1-2 years
- 2-3 years
- 3-4 years
- 4-5 years
- < 5 years

Category1: Physical Comfort of Clothing

What changes do you feel in patients after onset of hemiplegia (select all that apply)?

- Restriction in movement due to joint incoordination
- Restriction in movement due to muscular incoordination
- Feeling of numbness and cold
- Difficulty in lifting
- Difficulty in repositioning
- Difficulty in turning
- Difficulty in holding
- Others-----

What are main areas of difficulty with regular clothing of patients (select all that apply)?

- Fitting issues due to new special needs
- Clothing challenges while putting on and off
- Position of fasteners
- Type of fastener
- Inadequate ease allowance at waistline
- Inadequate ease allowance at hipline
- Inadequate ease allowance at armhole
- Position of the seams
- Type of seam
- Location of openings
- Others

Which area of body of patient needs to be exposed for treatment (select all that apply)?

- Arms
- Shoulder
- Chest
- Legs
- Side
- Back
- Others -----

Which is more important criterion for physical comfort in patient's dress?

- Feel and type of material
- Style of dress
- Manner of sewing

If you could design garments for such patients, what features would you add or remove in regular clothing in order to make clothing suitable to special needs?

Category2: Economy

How often do patients purchase clothing items after onset of hemiplegia?

- 1-5 times a year
- 5-10 times a year
- Once a month
- 2-3 times a month
- 4-7 times a month
- More than 8 times a month

How much patients usually spend in summers on clothing after onset of hemiplegia?

- Less than 5000
- 5000-10000

- 10000-15000
- 15000-20000
- 20000-25000
- More than 25000

How much patients usually spend in winters on clothing after onset of hemiplegia?

- Less than 5000
- 5000-10000
- 10000-15000
- 15000-20000
- 20000-25000
- More than 25000

How much patients usually spend on one outfit in summers after onset of hemiplegia?

- Less than 500
- 500-1000
- 1000-1500
- 1500-2000
- 2000-2500
- More than 2500

How much patients usually spend on one outfit in winter after onset of hemiplegia?

- Less than 500
- 500-1000
- 1000-1500
- 1500-2000

- 2000-2500
- More than 2500

Category3: Management/Ease of Care

What is your opinion about easy wash ability of the clothing of patient?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
Slightly Nonessential ☐ Very Nonessential ☐

What is your opinion about quick drying of the clothing of patient?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
Slightly Nonessential ☐ Very Nonessential ☐

What is your Opinion about long term usability of the clothing of patient?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
Slightly Nonessential ☐ Very Nonessential ☐

What is your opinion about wrinkle free material of the clothing of patient?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
Slightly Nonessential ☐ Very Nonessential ☐

What is your opinion about ease of storage of out of season clothing of patient?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
Slightly Nonessential ☐ Very Nonessential ☐

Category4: Socio-Psychological

Do you think that patients feel embarrassed due to exposure while seeking medical help?

Very often ☐ Often ☐ Sometimes ☐ Never ☐

Who usually influences patients for their new purchase of clothing after the onset of hemiplegia?

- Family
- Doctor/Nurse

- Friends
- News paper
- People around your area
- Others

With whom patients mainly shop with for their clothing after onset of hemiplegia?

- Friend
- Family
- Partner
- Alone
- Do not bother

What can encourage patients to try any new type of clothing check as many options as apply

- Style
- Friend suggestion
- Family suggestion
- Doctor/Nurse suggestion
- Partner suggestion
- Comfort
- Durability

Do you think someone's self is reflected by what one wears?

Strongly Agree ☐ Slightly Agree ☐ Neither Agree nor Disagree ☐
Slightly Disagree ☐ Strongly Disagree ☐

Category5: Aesthetics

When planning new clothing items after onset of hemiplegia do patients care for matching outfit items?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
 Slightly Nonessential ☐ Very Nonessential ☐

What is your opinion about coherence to local style of a patient's garments?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
 Slightly Nonessential ☐ Very Nonessential ☐

When patients plan new clothing items do, they care for suitability of colors?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
 Slightly Nonessential ☐ Very Nonessential ☐

When patients plan for new clothing items do they care about seasonal suitability of type of material?

Very Essential ☐ Slightly Essential ☐ Neither Essential nor Nonessential ☐
 Slightly Nonessential ☐ Very Nonessential ☐

What kind of services an adaptive clothing designer should offer?

- Ready to wear
- Made to measure on order
- Others

What can be your criterion if you purchase clothing items for patients after onset of hemiplegia, rate each of the following factors according to your preference?

• **Physical Comfort**

Very High ☐ Slightly High ☐ Neither High nor Low ☐
 Slightly Low ☐ Very Low ☐

• **Quality**

Very High ☐ Slightly High ☐ Neither High nor Low ☐
 Slightly Low ☐ Very Low ☐

• **Type and feel of Material**

Very High ☐ Slightly High ☐ Neither High nor Low ☐

Slightly Low

☐

Very Low

☐

- **Style of garment**

Very High

☐

Slightly High

☐

Neither High nor Low

☐

Slightly Low

☐

Very Low

☐

- **Fitting**

Very High

☐

Slightly High

☐

Neither High nor Low

☐

Slightly Low

☐

Very Low

☐

- **Fashion Appropriateness**

Very High

☐

Slightly High

☐

Neither High nor Low

☐

Slightly Low

☐

Very Low

☐

- **Durability**

Very High

☐

Slightly High

☐

Neither High nor Low

☐

Slightly Low

☐

Very Low

☐

- **Ease of care**

Very High

☐

Slightly High

☐

Neither High nor Low

☐

Slightly Low

☐

Very Low

☐

- **Climatic suitability**

Very High

☐

Slightly High

☐

Neither High nor Low

☐

Slightly Low

☐

Very Low

☐

- **Uniqueness**

Very High

☐

Slightly High

☐

Neither High nor Low

☐

Slightly Low

☐

Very Low

☐

- **Color**

Very High

☐

Slightly High

☐

Neither High nor Low

☐

Slightly Low

☐

Very Low

☐

- **Price**

Very High ☐ Slightly High ☐ Neither High nor Low ☐¹⁸⁹
Slightly Low ☐ Very Low ☐

☆ کھلنے والی مٹی کا مقام ☆ اور کوئی ☆

علاج کیلئے مریض کو جسم کے کون کون سے حصے ظاہر کرنے پڑتے ہیں:

☆ بازو ☆ کندھا ☆ سینہ ☆ ٹانگیں ☆ اطراف ☆ کمر

مریض کے لباس میں جسمانی سکون کیلئے کون سا معیار اپنی رائے میں سب سے اہم ہے:

☆ کپڑے کی قسم اور احساس ☆ لباس کا انداز ☆ سلامتی کا انداز

اگر آپ مریض کا لباس خود بخود بزنس کریں تو عمومی لباس کے ضد خال میں کیا کی یا پٹنٹی چاہیں گے کہ مریض کا لباس موجودہ ضروریات کے مطابق ہو:

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=====

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2. اخراجات

فالج ہو جانے کے بعد مریض اپنے ملبوسات کی خریداری کتنی بار کرتے ہیں:

☆ ایک سال میں 1 سے 5 بار ☆ ایک سال میں 5 سے 10 بار ☆ مہینے میں ایک بار

☆ ایک مہینے میں 2 سے 3 بار ☆ ایک مہینے میں 4 سے 7 بار ☆ ایک مہینے میں 8 بار سے زیادہ

فالج ہو جانے کے بعد مریض کے گرمیوں کے ملبوسات کے اخراجات کتنے ہوتے ہیں۔

☆ 5 ہزار روپے سے کم ☆ 5 ہزار سے 10 ہزار روپے ☆ 10 ہزار سے 15 ہزار روپے

☆ 15 ہزار سے 20 ہزار روپے ☆ 20 ہزار سے 25 ہزار روپے ☆ 25 ہزار روپے سے زیادہ

فالج ہو جانے کے بعد مریض کے مردیوں کے ملبوسات کے اخراجات کتنے ہوتے ہیں۔

☆ 5 ہزار روپے سے کم ☆ 5 ہزار سے 10 ہزار روپے ☆ 10 ہزار سے 15 ہزار روپے

☆ 15 ہزار سے 20 ہزار روپے ☆ 20 ہزار سے 25 ہزار روپے ☆ 25 ہزار روپے سے زیادہ

فالج ہو جانے کے بعد مریض گرمیوں کے ایک لباس پر عموماً کیا خرچ کرتے ہیں:

☆ 5 سو روپے سے کم ☆ 5 سو سے 1 ہزار روپے ☆ 1 ہزار سے 15 سو روپے

☆ 15 سو سے 2 ہزار روپے ☆ 2 ہزار سے 25 سو روپے ☆ 25 سو روپے سے زیادہ

فالج ہو جانے کے بعد مریض مردیوں کے ایک لباس پر عموماً کیا خرچ کرتے ہیں:

☆ 5 سو روپے سے کم ☆ 5 سو سے 1 ہزار روپے ☆ 1 ہزار سے 15 سو روپے

☆ 15 سو سے 2 ہزار روپے ☆ 2 ہزار سے 25 سو روپے ☆ 25 سو روپے سے زیادہ

مریض کے نئے لباس کے بارے میں فیصلہ کرتے ہوئے رنگوں کی مناسبت کے بارے میں آپ کی رائے۔

☆ بے انتہا ضروری ☆ کچھ ضروری ☆ نہ ضروری نہ غیر ضروری ☆ کچھ غیر ضروری ☆ بے انتہا غیر ضروری

مریض کے نئے لباس کا فیصلہ کرتے ہوئے کپڑوں کی قسم کا موسم سے مطابقت کے بارے میں آپ کی رائے:

☆ بے انتہا ضروری ☆ کچھ ضروری ☆ نہ ضروری نہ غیر ضروری ☆ کچھ غیر ضروری ☆ بے انتہا غیر ضروری

مریض کے لئے مخصوص کپڑوں کے ڈیزائن کے اطلاق کی کوئی خدمات کو آپ فوقیت دیں گے:

☆ تیار کپڑے ☆ ماپ کے مطابق آرڈر پر تیار ☆ کچھ اور

فالج کے حملہ کے بعد مریض کے ملبوسات کی خریداری میں آپ کن پہلوؤں کو اہمیت دیں گے:

☆ جسمانی سکون:	☆ بہت زیادہ	☆ کچھ زیادہ	☆ نہ زیادہ نہ کم	☆ کچھ کم	☆ بالکل کم
☆ معیار:	☆ بہت زیادہ	☆ کچھ زیادہ	☆ نہ زیادہ نہ کم	☆ کچھ کم	☆ بالکل کم
☆ کپڑے کی قسم:	☆ بہت زیادہ	☆ کچھ زیادہ	☆ نہ زیادہ نہ کم	☆ کچھ کم	☆ بالکل کم
☆ لباس کا انداز:	☆ بہت زیادہ	☆ کچھ زیادہ	☆ نہ زیادہ نہ کم	☆ کچھ کم	☆ بالکل کم
☆ خشک:	☆ بہت زیادہ	☆ کچھ زیادہ	☆ نہ زیادہ نہ کم	☆ کچھ کم	☆ بالکل کم
☆ ارد گرد سے مناسب:	☆ بہت زیادہ	☆ کچھ زیادہ	☆ نہ زیادہ نہ کم	☆ کچھ کم	☆ بالکل کم
☆ پائیداری:	☆ بہت زیادہ	☆ کچھ زیادہ	☆ نہ زیادہ نہ کم	☆ کچھ کم	☆ بالکل کم
☆ سنبھال میں سہولت:	☆ بہت زیادہ	☆ کچھ زیادہ	☆ نہ زیادہ نہ کم	☆ کچھ کم	☆ بالکل کم
☆ موکی مناسبت:	☆ بہت زیادہ	☆ کچھ زیادہ	☆ نہ زیادہ نہ کم	☆ کچھ کم	☆ بالکل کم
☆ انفرادیت:	☆ بہت زیادہ	☆ کچھ زیادہ	☆ نہ زیادہ نہ کم	☆ کچھ کم	☆ بالکل کم
☆ رنگ:	☆ بہت زیادہ	☆ کچھ زیادہ	☆ نہ زیادہ نہ کم	☆ کچھ کم	☆ بالکل کم
☆ قیمت:	☆ بہت زیادہ	☆ کچھ زیادہ	☆ نہ زیادہ نہ کم	☆ کچھ کم	☆ بالکل کم

Adaptive Clothing Designing (Questions for Doctors)

Name: -----

Address: -----

Select your gender

- Male
- Female

Designation

Length of service

1. What is hemiplegia?
2. What are levels of severity of hemiplegia attack?
3. What is prognosis of this disease after its onset?
4. What physical changes are visible in the body of patient after the onset of hemiplegia?
5. What are the difficulties patients of hemiplegia and their caregivers face while dressing and undressing the patient?
6. Which area of regular clothing create discomfort while use for the patients of hemiplegia
7. What are new needs of hemiplegia patients with respect to their clothing after onset of hemiplegia
8. What new features are recommended by you to be incorporated in the dress of hemiplegia patients
9. What type of materials can be suitable for the clothing of hemiplegia patients?
10. What can be the part of appropriate clothing in socio psychological wellbeing of hemiplegia patient?

Appendix 13: Assessment of Physical Limitations

Evaluation of Physical Limitations

Data Collection Protocol

Greetings!

Hope you are doing good!

Today our short discussion will be about exploring deeply about probabilities of any issues and challenges regarding regular clothing you are using. This first round of our discussion will be mainly focusing on the experience of specific physical restrictions manifested after onset of hemiplegia. It is being assured that the collected data will be for the purpose of pure research only. Your anonymity will be promised, and your name will not be disclosed at any stage along with any other dimension that might disclose any identification associated with you. I have a list comprising of locations of different nine body areas that might be causing you some potential restrictions. As I enlist every area, it will be followed by a brief reasoning of how it might be a problem followed by ranking with increasing difficulty level. You are requested to choose all related problem areas according to your condition by choosing an applicable rank of difficulty. The given range of increasing difficulty level spans from zero to four, with zero indicating experience of no issue and level four equivalent to impossibility. In accordance with this pattern the mid-point, labeled as rank two is to correspond to the experience of some random issues. The chart is in front of you that will be used for recording your responses about expressed levels of difficulty. You are also requested to give short description of your condition for any specific area against which your response is greater than zero. Your detailed input will be documented to save your response. It is also being informed that this session will be audio tape recorded, just to facilitate me afterwards for true transcription of this interview. In case you want to discontinue the discussion session, please inform me your will to withdraw.

With your permission I will begin the discussion.

Assessment of Physical Limitations

(Adapted from Enabler Diagram)

0 No Problem, 1 Potential Problem, 2 Occasional Problem, 3 Problem, 4 Impossibility

Area of Physical Limitation	0	1	2	3	4	Comments
1. Incoordination						
2. Limitation of Body Strength						
3. Limitation of Head Movement						
4. Limitation of Stamina						
5. Limitation of Sensation						
6. Difficulty Lifting, Reaching or Carrying						
7. Difficulty Handling and Fingering						
8. Inability to Use Extremities						
9. Difficulty with Range of Motion of Body						
10. Others						

Explanation of Upper Body Limitations

Detailed description of Upper body restrictions experienced by hemiplegia patients.

1: In coordination

Restricted use of body extremities while reaching, placing, or controlling.

2: Limitations in upper body strength

Decreased power felt in part of upper body while strength is applied for some task and/or decreased period of stamina.

3: Limitations of head movement:

Need of struggle while ordinary rotation of head to view upwards, viewing downwards, or movement of head from side to side.

4: Limitations of stamina:

Shortened span of energy, experiencing more fatigue, difficulty in breathing along with any issue of unusual blood pressure reading after any kind of physical effort.

5: Limitations of sensation:

Lack of capacity to sense variation in temperature along with loss of ability to feel pain or knowledge of pressure exerted at some area of body.

6: Difficulty in lifting, reaching, or carrying:

Decreased range of movements to lift, reach or carry ordinary usable items.

7: Difficulty in handling or fingering:

Lack of agility of hand and finger movements along with decreased range of movement and magnitude of strength.

8: Inability to use upper extremities:

Extreme loss in synchronization of movements and absence of bilateral balance.

9: Difficulty with range of motion of upper body

Decreased range of physical effort with reduced capacity of reachability

Appendix 14: Participant Body Measurement Chart

Participant Body Measurements in Inches

Participants	01	02	03	04	05	06
	Female			Male		
Across Back						
Chest/Bust						
Waist						
Hip						
Center Back Length						
Hip Depth						
Height						
Arm Length						
Girth						
Elbow Length						
Trouser Length						
Crotch						

Standardization of Sizes in Inches

	Extra Small	Small	Medium	Large	Extra Large
Male					
Chest	30"-32"	34"-36"	38"-40"	42"-44"	46"-48"
Waist	26"	28"-30"	32"-34"	36"-38"	40"-42"
Neck	13"- 13 ½"	14"-14 ½"	15"-15 ½"	16"-16 ½"	17"-17 ½"
Female					
Bust	33"	34"-36"	37"-39"	40"-42"	43"-45"
Waist	26"	27"-29"	30"-32"	33"-35"	36"-38"
Hip	35"	36"-38"	39"-41"	43"-45"	46"-48"

Appendix 15: Assessment of Potential Clothing Problems

Evaluation of Probable Clothing Complications

I am going to read you a list of problems, which have been found in previous research to be problematic for people with physical limitations.

Data Collection Protocol

Greetings!

Hope you are doing good!

Today our short discussion will be about exploring deeply about probabilities of any issues and challenges regarding regular clothing you are using after onset of hemiplegia. It is being assured that the collected data will be for the purpose of pure research only. Your anonymity will be promised, and your name will not be disclosed at any stage along with any other dimension that might disclose any identification associated with you. I have a list comprising of issues, which have been established in existing literature to be challenging for individuals experiencing any kind of physical restrictions. As I enlist every area, it will be followed by a brief reasoning of how it might be a problem followed by ranking with increasing difficulty level. You are requested to choose all related problem areas according to your condition by choosing an applicable rank of difficulty. The given range of increasing difficulty level spans from zero to four, with zero indicating experience of no issue and level four equivalent to impossibility. In accordance with this pattern the mid-point, labeled as rank two is to correspond to the experience of some random issues. The chart is in front of you that will be used for recording your responses about expressed levels of difficulty. You are also requested to give short description of your condition for any specific area against which your response is greater than zero. Your detailed input will be documented to save your response. It is also being informed that this session will be audio tape recorded, just to facilitate me afterwards for true transcription of this interview. In case you want to discontinue the discussion session, please inform me your will to withdraw.

With your permission I will begin the discussion.

Assessment of Potential Clothing Problems

0=No concern, 1=Light concern, 2=Moderate Concern, 3 High Concern, 4= Very high Concern

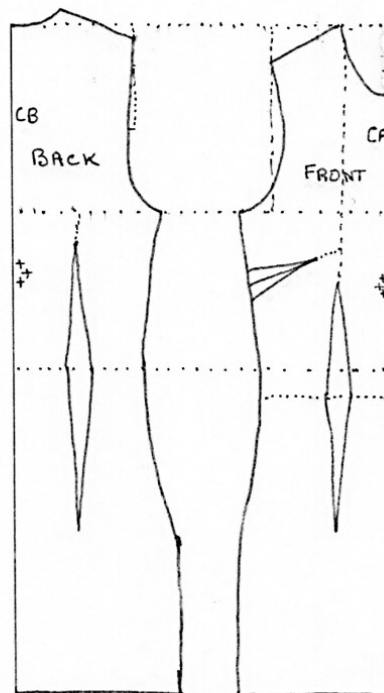
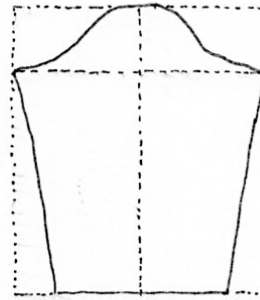
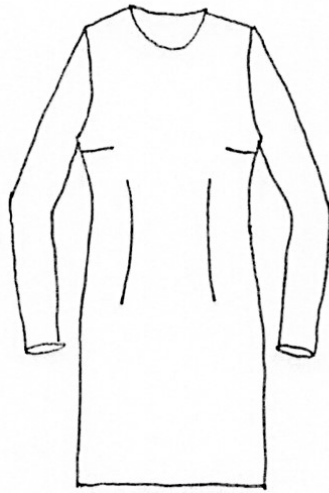
Clothing Problems	0	1	2	3	4	Comments
Putting on and Taking off Dress						
Managing Fasteners of Dress						
Freedom of Movement after Dressing						
Quality of Fabric of Dress						
Coverage of the Body by Dress						
Style of Dress						
Construction Quality of Dress						
Irritating Features in Dress						
Aesthetics of Dress						
Cultural Conformance of Dress						
Cost of Dress						
Storage of Dress						
Wash ability of Dress						
Facility of Features for New Needs						
Durability of Dress						
Overall Comfort of Dress						

Appendix 16: Assessment of Time Taken for Use of Regular Clothing

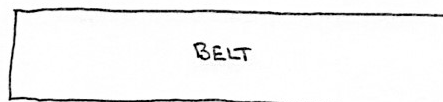
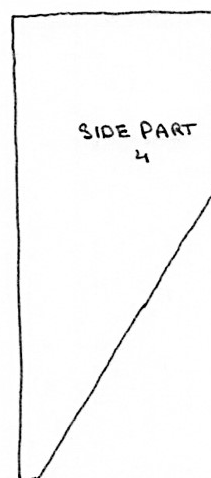
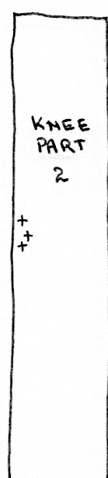
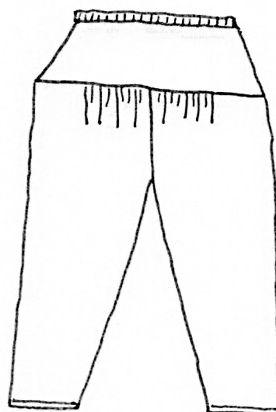
Assessment of Time Taken for Dressing of Regular Clothing by Study Participants

	Participants					
	1	2	3	4	5	6
Minutes						

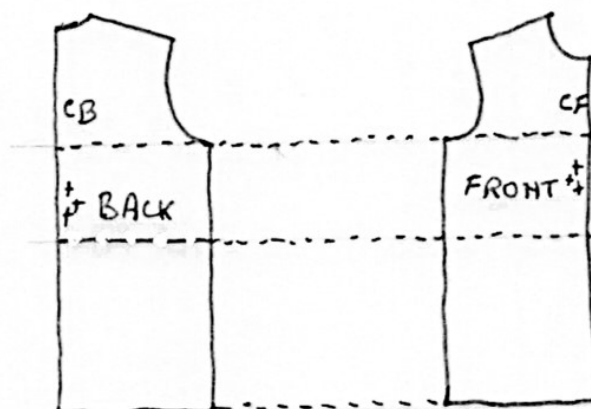
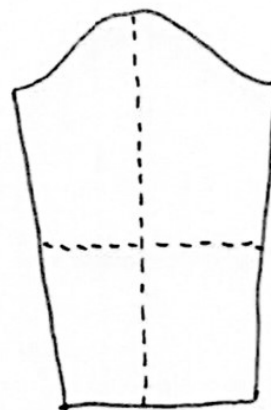
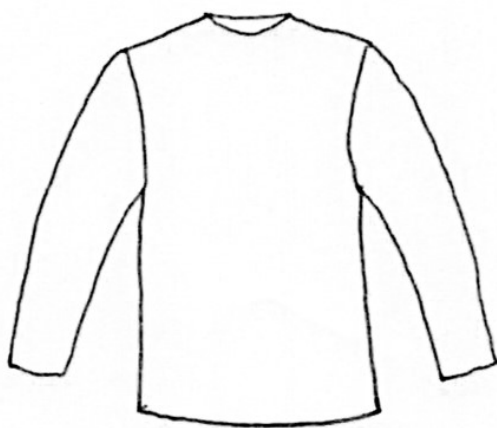
Appendix 17: Basic Body Block Pattern Female Shirt

Basic Body Block Pattern Female Shirt

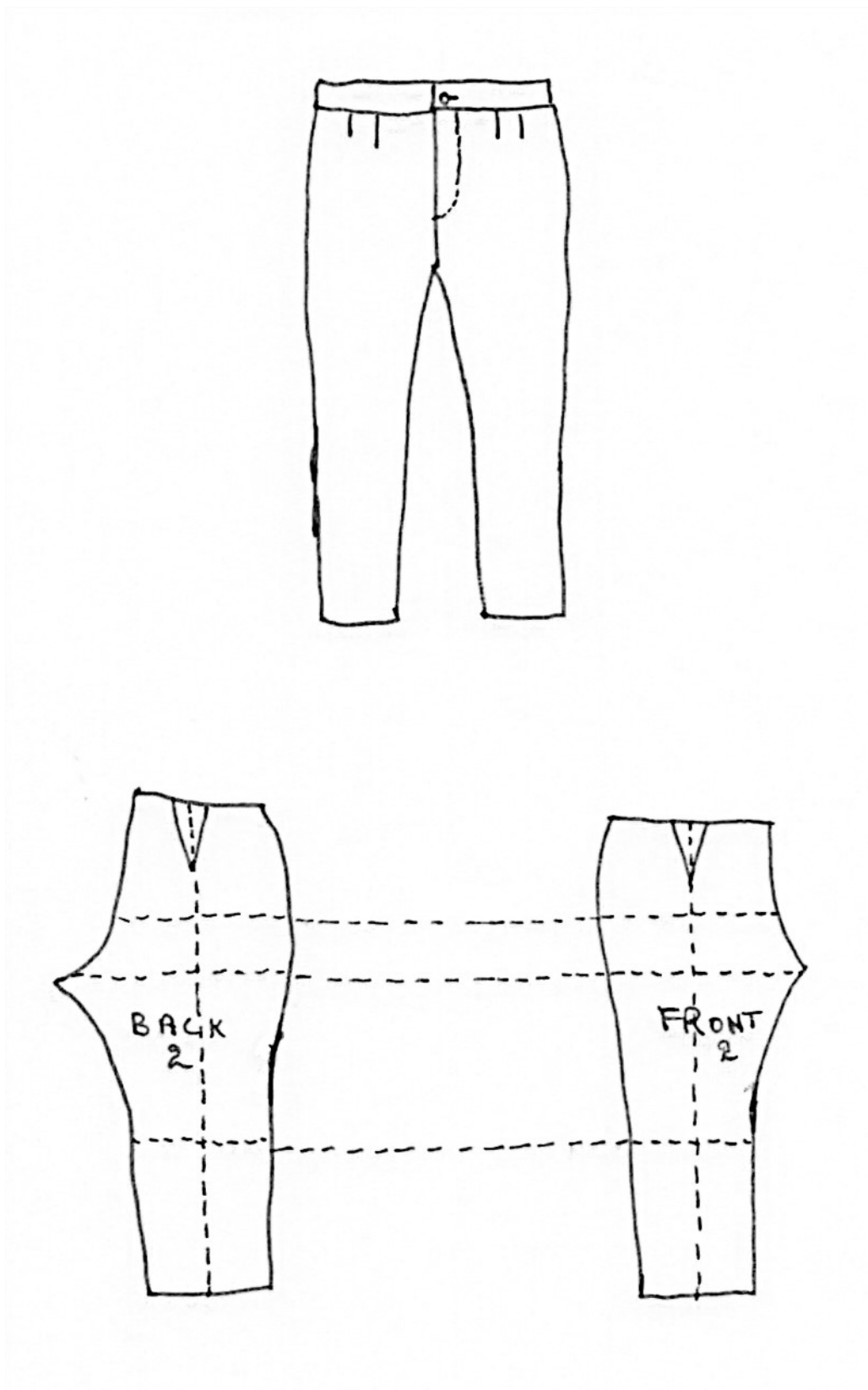
Appendix 18: Basic Body Block Pattern Female Eastern trouser

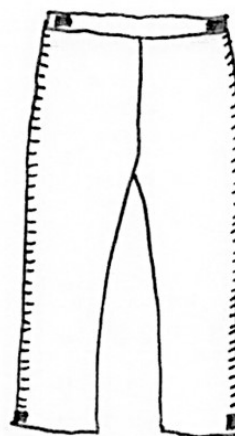
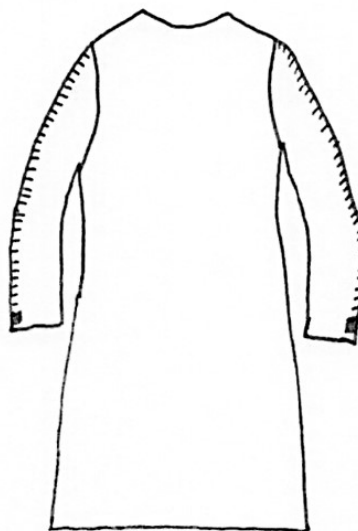
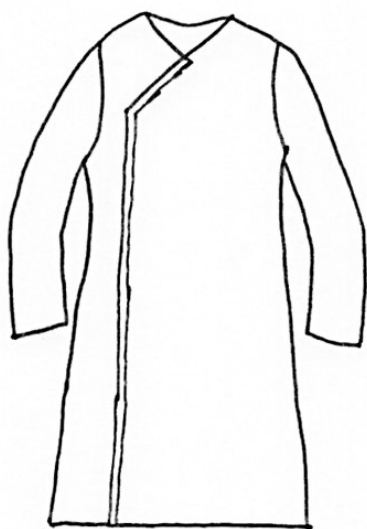
Basic Body Block Pattern Female Eastern trouser

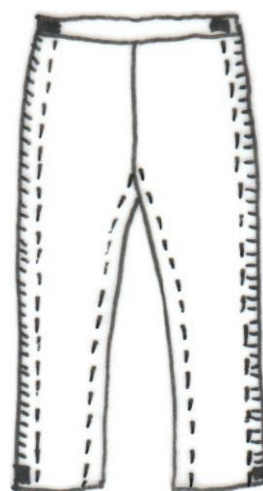
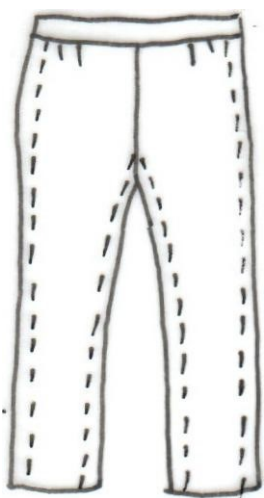
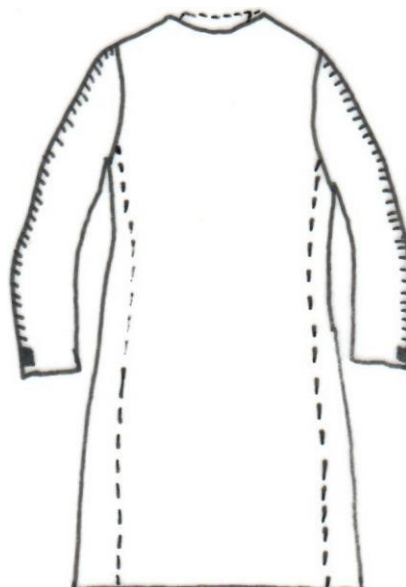
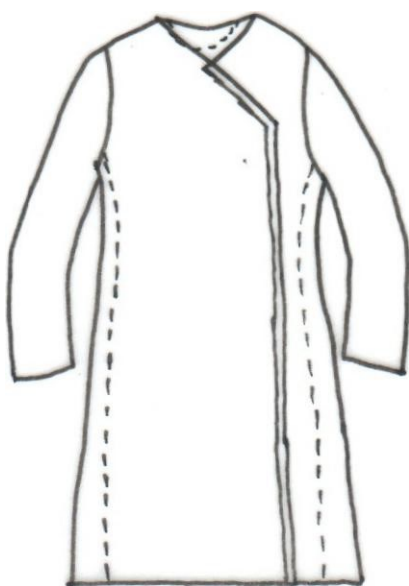
Appendix 19: Basic Body Block Patterns Male Shirt

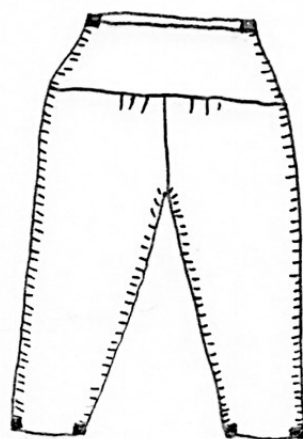
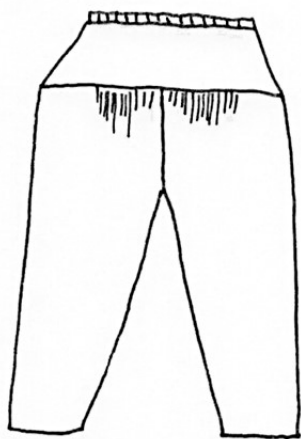
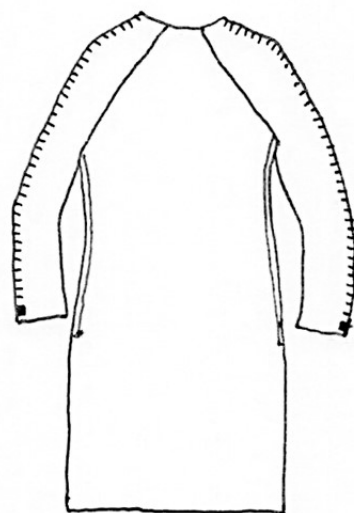
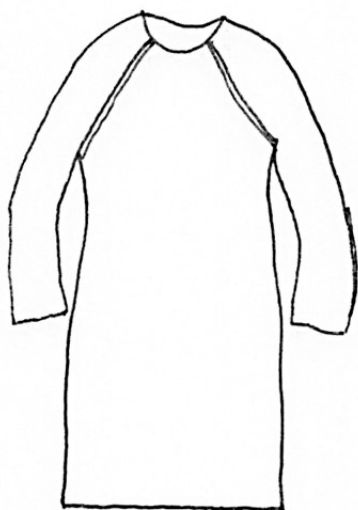
Basic Body Block Patterns Male Shirt

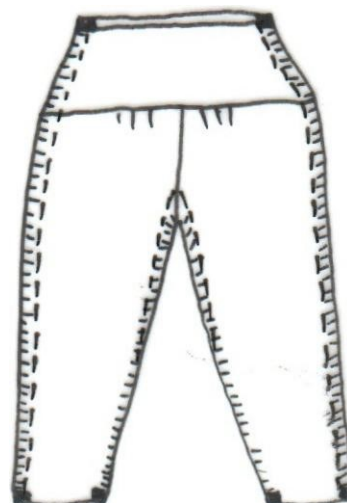
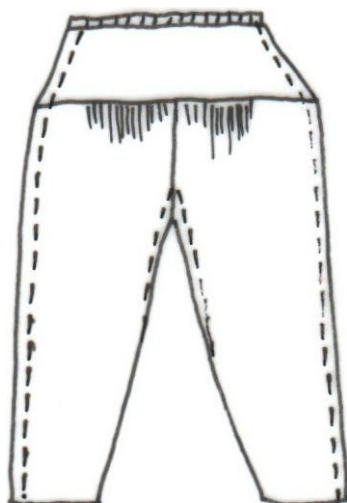
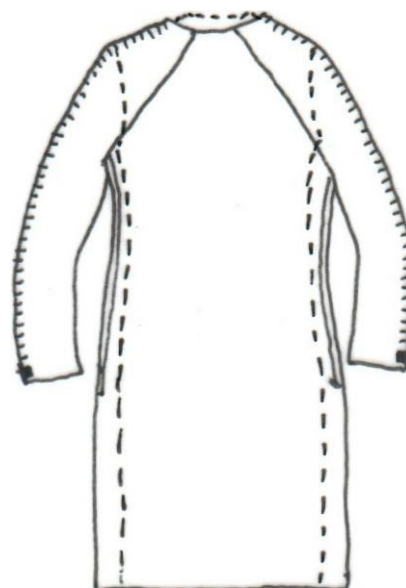
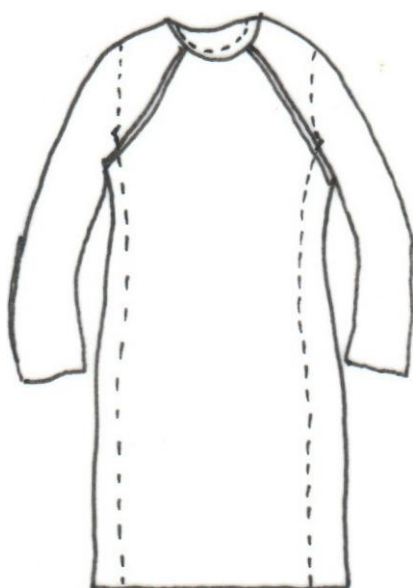
Appendix 20: Basic Body Block Patterns Male Trouser

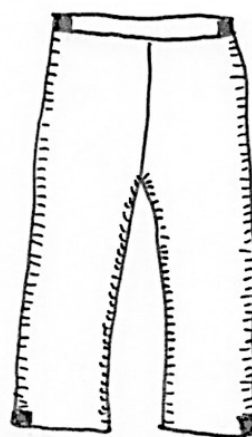
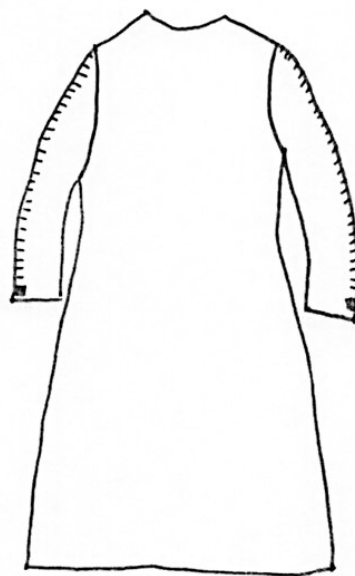
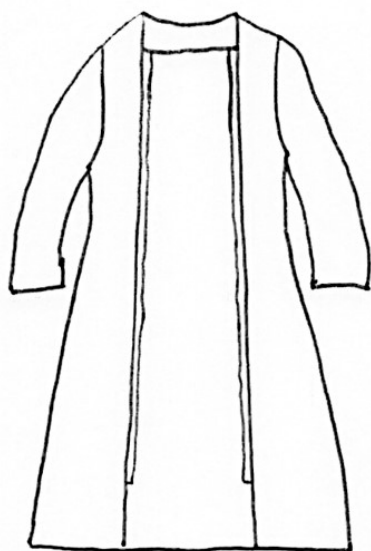
Basic Body Block Patterns Male Trouser

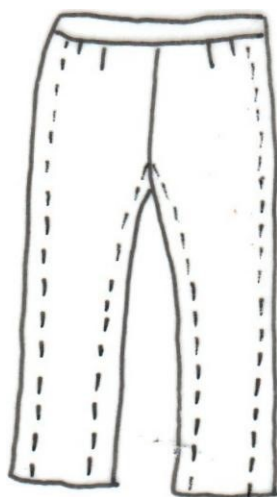
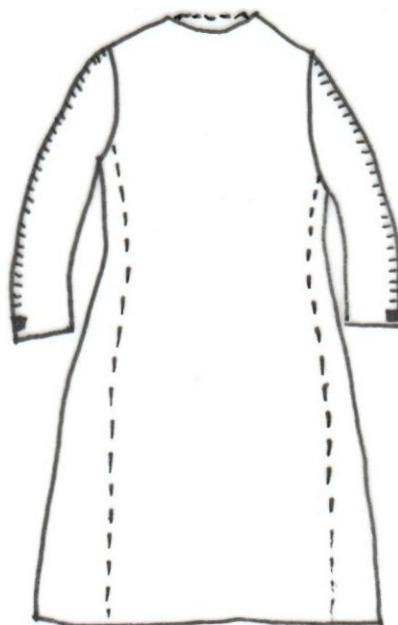
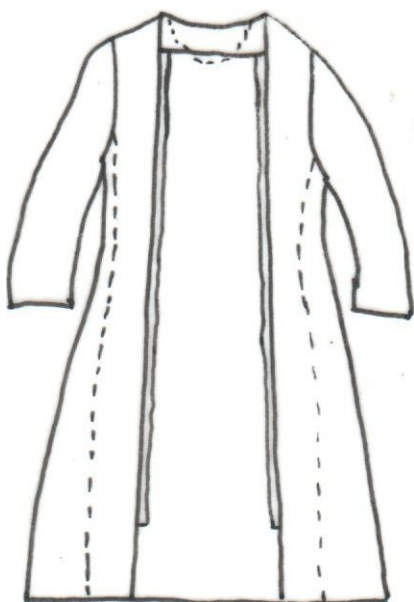


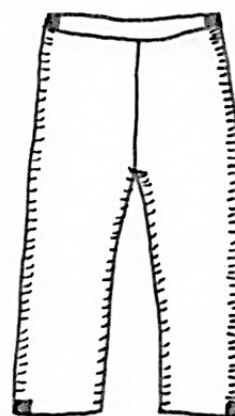
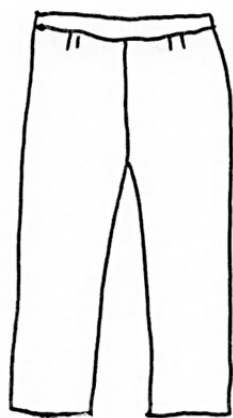


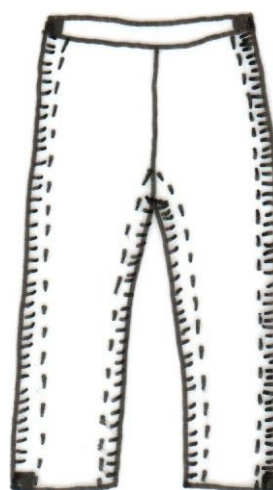
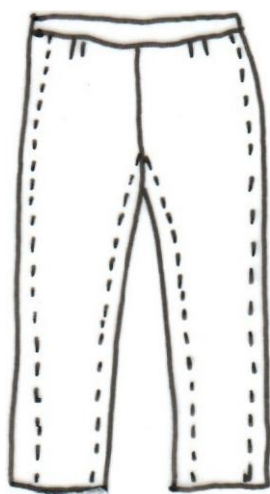
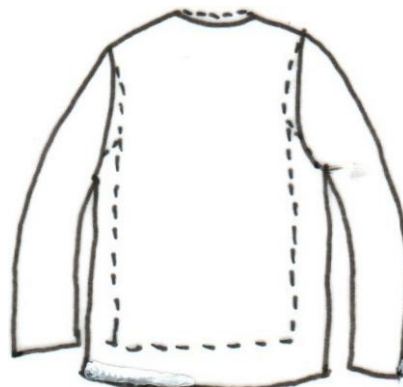
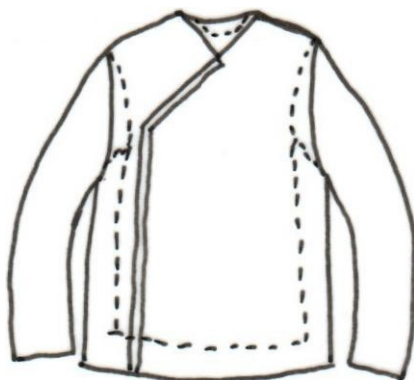


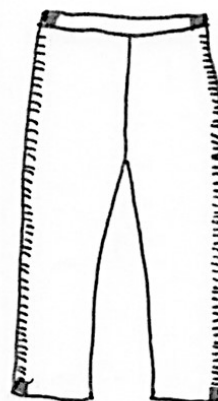
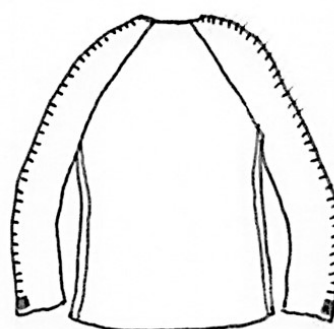
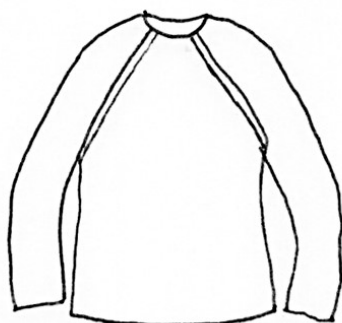


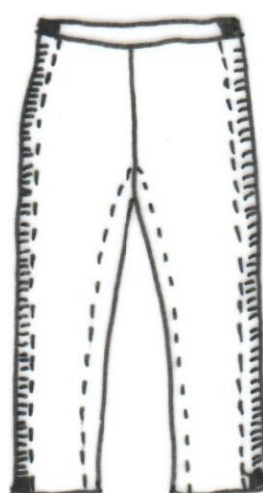
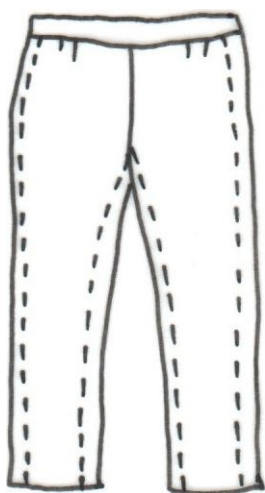
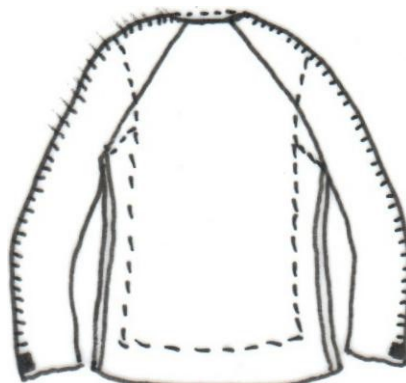
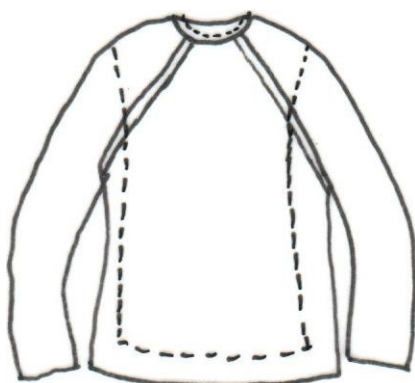


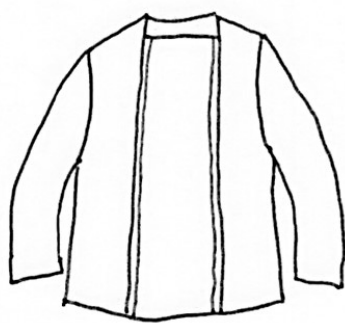


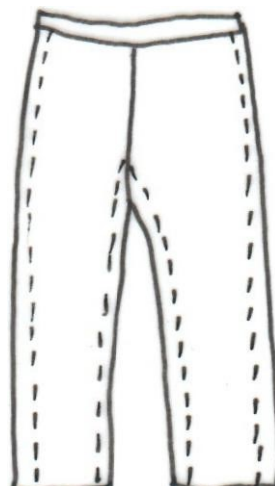
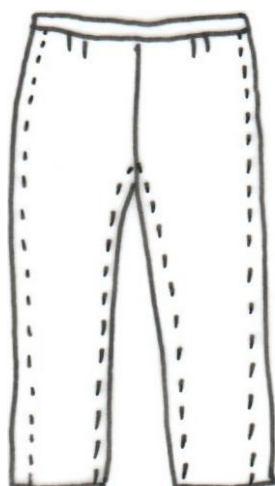
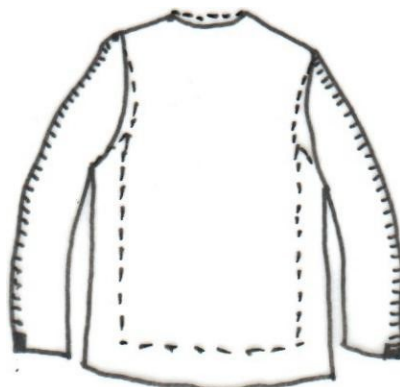












Appendix 33: Specifications of Selected Fabric for Adaptive Clothing



Quality Control Lab

Doc# lab-report-01

Date:22-09-18

Revision:0

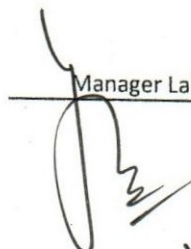
Date	19-07-2019
Customer	MAD. ASNA
Color/Design	PFD
Protocol	General

Quality	4040/10064
Weave	Plain
Composition	Cotton
Lot No	-

Test	Test Method		Standard	Results	Pass/Fail
GSM	ASTM D3776			109	
Width	ASTM D3774	Inch		40	
Absorbency	AATCC-179	mm		25	
pH	Surface			6.5	

Remarks:

Lab Officer _____


 Manager Lab & QC

20/7/19.

Appendix 34: Procurement of Selected Fabric for Adaptive Clothing

**HUNBULTEX (PVT) LTD**

22 K.M Ferozpur Road, 3.5 KM Rohi Nala, Lahore

Provisional Invoice

DATE:
BUYER'S NAME:
ADDRESS:

20-Jul-19
MADAM ASNA
LAHORE

DESCRIPTION OF GOODS	QUANTITY.		RATE	Value
	Grade	QUANTITY		
40*40 120*68 PFP FABRIC	A	100.00	125.00	12,500
Total		100.00		12,500

NOT A SALES TAX INVOICE

Prepared By

Authorised By

HUNBUL TEX PVT.LTD

Post. Date: 20.07.19

Date 20.07.19

Time 14:18

Details:

Journal Entry**171064**

G/L Account/BP Name	Debit	Credit	Description	Remarks
Cash In Hand (SBU-6)-D&P	PKR 12,500.00		Cash received from Asna fabric against sale of pfp fabric qty:100@125	
ASNA FABRICS		PKR 12,500.00	Cash received from Asna fabric against sale of pfp fabric qty:100@125	

PKR 12,500.00

Cash Received

HunbulTex
Future.fashion.fabrics

Out Ward Gate Pass (Fabric)
Digital Printing

Date: 20-7-19 Sr.# _____

Despatch to: MADAM ASNA Purpose: Sample

Driver Name: _____ Vehicle # _____ GPR# _____

By Hand: _____ Ref: _____ Time Out Am/pm _____

Sr.#	Description of Goods	Unit	Quantity	Remarks
1				
2	40x40 120x60	m	100	100@Rs 125
3	(PFP)			
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
	TOTAL	m	100	

Prepared by _____ Checked by _____ Security Checked by _____ Authorised by _____

Appendix 35: Specifications of Auxiliaries for Adaptive Clothing Construction

Construction Specifications of Velcro Sew-On Hook and Loop Fasteners	
Material Hook and Loop	Nylon
Material Backing	Polyester
Color	White
Thickness Loops	0.08"
Thickness Hooks	0.07"
Thickness engaged	0.11"
Number of Hooks per inch	88
Number of Loops per inch	1000
Width	1" and 2"

Technical Specifications of Velcro Sew-On Hook and Loop Fasteners	
Sheer Strength (1"X 1" overlap)	Strong (0.98 kg per cm square)
Peel Strength	Strong (0.54 Kg per 25mm width)

Construction Specifications of Zipper Tape and Slider	
Tape	Polyester
Zipper Chain/ elements	Plastic coil (5 mm)
Slider	Non lock Plastic

Technical Specifications of Zipper Tape and Slider	
Chain crosswise strength per 2.5 cm	strong
Top stop holding strength	strong
Separating unit crosswise strength	strong

Appendix 36: Specification Sheet for Female Shirt

Description of trial adaptive design				
Measurments of dress in inches				Design details and sketches of front and back of trial adaptive shirt design
Bust				
Waist				
Hip				
Full Length				
Sleeve Length				
Sleeve Opening				
Across back				
Slits				

Appendix 37: Specification Sheet for Male Shirt

Description of trial adaptive design				
Measurments of dress in inches				Design details and sketches of front and back of trial adaptive shirt design
Chest				
Waist				
Hip				
Full Length				
Sleeve Length				
Sleeve Opening				
Across back				
Side Slits				

Appendix 38: Specification Sheet for Eastern trouser

Description of trial adaptive design				
Measurments of dress in inches				Design details and sketches of front and back of trial adaptive eastern trouser design
Belt				
Waist				
Hip				
Belt Length				
Paincha Width				
Paincha Opening				
Paincha Length				
Crotch				

Appendix 39: Specification Sheet for Trouser

Description of trial adaptive design				
Measurments of dress in inches				Design details and sketches of front and back of trial adaptive trouser design
Belt				
Waist				
Hip				
Belt Length				
Paincha Width				
Paincha Opening				
Trouser Length				
Crotch				

Appendix 40: Material Consumption for Each Adaptive Clothing Construction

Fabric Consumption in Shirt	2 ½ Meter
Fabric Consumption in Trouser	2 ½ Meter
Zipper Consumption in Shirt	1 ½ Meters
Zipper Consumption in Trouser	3 Meters
Velcro 2” width Consumption in Shirt	1 ½ Meter
Velcro 1” width Consumption in Shirt	½ Meter
Velcro 1” width Consumption in Trouser	½ Meter
Total Fabric	5 Meters (40” width)
Total Zipper Length	4 ½ Meters
Total Sliders	8
Total Velcro 2” width	1 ½ Meter
Total Velcro 1” width	1 Meter

Appendix 41: Evaluation of Trial Garment Intervention

0= Not wearable, 1=worse than expected 2=Just as Expected, 3=Better than expected,
4=Exceptional

Clothing Dimension	0	1	2	3	4	Comments
Putting on and Taking off Dress						
Managing Fasteners of Dress						
Freedom of Movement after Dressing						
Quality of Fabric of Dress						
Coverage of the Body by Dress						
Style of Dress						
Construction Quality of Dress						
Irritating Features in Dress						
Aesthetics of Dress						
Cultural Conformance of Dress						
Cost of Dress						
Storage of Dress						
Wash ability of Dress						
Facility of features for new needs						
Durability of dress						
Overall comfort of dress						

Appendix 42: Comparison of Time Taken for Dressing

Comparison of Time Taken for Dressing of Regular and Adaptive Clothing

	Participants					
	1	2	3	4	5	6
Minutes (adaptive clothing)						
Minutes (regular clothing)						
Difference						

Appendix 43: Trial Adaptive Garment Prototype for Female



Appendix 44: Shirt Front Side Opening Adaptation



Appendix 45: Shirt Front Complete Removal Adaptation



Appendix 46: Sleeve Shoulder Opening Adaptation



Appendix 47: Sleeve Shoulder and Lower Arm Opening Adaptation



Appendix 48: Sleeve Lower Arm Opening Adaptation



Appendix 49: Shirt Top Opening Adaptation



Appendix 50: Trouser Side Opening Adaptation



Appendix 51: Trouser Top Partial Opening Adaptation



Appendix 52: Trouser Top Complete Opening Adaptation





1st Research Colloquium November 9 2018
Research Progress Report
PhD TEX

**Adaptive Clothing Designing for Special Needs
of Physically Challenged Hemiplegia Patients**

**School of Textile and Design
University of Management and Technology**

Submitted By
Asna Mubashra
ID: 13001118001

Supervised By
Dr. Nabeel Amin
Dr. Abher Rasheed



2nd Research Colloquium 14th June 2019
Research Progress Report
PhD TEX

**Adaptive Clothing Designing for Special Needs
of Physically Challenged Hemiplegia Patients**

**School of Textile and Design
University of Management and Technology**

Submitted By
Asna Mubashra
ID: 13001118001

Supervised By
Dr. Nabeel Amin
Dr. Abher Rasheed



3rd Research Colloquium 4th February 2020
Research Progress Report
PhD TEX

**Adaptive Clothing Designing for Special Needs
of Physically Challenged Hemiplegia Patients**

**School of Textile and Design
University of Management and Technology**

Submitted By
Asna Mubashra
ID: 13001118001

Supervised By
Dr. Nabeel Amin
Dr. Abher Rasheed



4th Research Colloquium September 2020
Research Progress Report
PhD TEX

**Adaptive Clothing Designing for Special Needs
of Physically Challenged Hemiplegia Patients**

**School of Textile and Design
University of Management and Technology**

Submitted By
Asna Mubashra
ID: 13001118001

Supervised By
Dr. Nabeel Amin
Dr. Abher Rasheed

Appendix 54:1st Research Update to Supervisory Panel

Minutes of the Supervisory Panel Meeting

It is to express my deep gratitude to Dr. Nabeel Amin and Dr. Abher Rasheed for their participation in the supervisory panel meeting held on 15th October 2018 for a detailed discussion on the proposed questionnaire and future roadmap of approved doctoral research proposal titled "**Adaptive Clothing Designing for Special Needs of Physically Challenged Hemiplegia Patients**"(UMT).

The meeting was held at the Board Room of Punjab Health Facilities Management Company (PHFMC), situated at Bahawalpur House (GOR 2), Qartaba Chowk, Ferozpur Road, Lahore. Meeting started at 11:00 am and ended at 2:00pm. Attached to this mail are pictures of the meeting (CCTV footage) and few documents presented and discussed in the meeting. Following are the highlights of meeting.

- The panel reviewed the approval letters from three teaching hospitals situated in Lahore as the sites of data collection. Panel passed satisfactory remarks for these sites of data collection.
- Proposed questionnaire was deliberated in detail from question to question. Few amendments and recommendations were forwarded which will be included in the second draft of questionnaire
- It was emphasized that questions are to be asked around five dimensions clearly mentioned in the approved research proposal and each dimension needs to be kept same to give similar importance to all dimensions and to remove any bias.
- Revisions and recommendations are to be incorporated in the next draft of questionnaire which will be translated in Urdu after approval
- A supervisory committee was also recommended to review the approved draft comprising of a medical doctor, a specialist from the field of statistics and a

specialist in field of garment manufacturing to further validate the content of questionnaire

- It was decided that a separate questionnaire will be proposed by scholar for nurses and caregivers and a semi structured interview protocol will also be proposed for specialist medical doctors. Both of these data collections tools will go through similar process of review.
- A meeting every month was decided by the supervisory panel along with meetings called for some urgent input required around research.
- Emphasis was made on the authenticity of process of data collection by keeping the personal information of study participants
- A road map of activities for next six months were discussed step by step, which included selection of study participants for quantitative and qualitative data collection after approval of site of research.
- Inclusion and exclusion criterion of study participants as patients, nurses, family caregivers and doctors were reviewed again, and it was brought into limelight that selection of nursing staff and doctors will be made from variety of years of experience and available job designations of that domain
- Participation in local and international conferences and preparation of publications was highly emphasized.

Asna Mubashra

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Minutes of the Advisory Board Meeting

Held at National Textile University, Faisalabad

21 March 2019

It is to convey great gratitude to Dr. Abher Rasheed and Dr. Baber Ramzan for their precious time and valuable intellectual contribution in the doctoral advisory board meeting held at the office of Dr. Abher Rasheed, National Textile University Faisalabad on 21st March 2019. It is very kind of both esteemed personalities to graciously give time during the COVITEX and DICE 2019 event held at NTU on the same date. Meeting started at 2:00 pm and ended by 3:00 pm. Discussion about the intervention phase of research project was the basic agenda. Following are the main highlights of this meeting

- Advisory board was informed about the data collection process of questionnaires from patients and caregivers from selected health facilities. Satisfactory remarks were passed on data collection procedures.
- Advisory board was told about the data collected from the case study participants
- A prototype of female adaptive clothing, trouser and shirt, according to the preference of study participants in local style, created on quarter scale from simple cotton material, was presented before the members of the meeting for brainstorming (pictures are enclosed).
- The quarter scale model garment was created from the basic pattern of female eastern trouser and shirt as per measurements of one participant, with larger ease allowances, simple and deeper neckline and raglan sleeves with full length opening on both sides.

- It was highlighted that the individual measurement can be compared to the standardized market sizes of small, medium, and large. By doing so the complete practice of adaptive pattern making will easily be categorized as small, medium, large, or extra-large.
- The diagonal line of the raglan sleeve was an opening at both sides with button and buttonholes as closers, but it was suggested that the type of closer be changed to Velcro fasteners
- Side opening had Velcro fastening strips that folded on itself at back. It was recommended that the velcro fastening strips should not be closing as folded on themselves. To get rid of the extra bulk of such closer, it was proposed that strips should be fastened at front of dress.
- It was highlighted that best quality velcro fasteners are to be used with higher number of hooks per inch for better grip and fastening ability.
- Types of seam and seam finishes were also discussed, and it was decided that plain reinforced seam type will be best suitable and economical.
- Evaluation of the quarter scale model of adaptive eastern trouser was made and velcro fastener fastening as folding on itself at the waist was advised to be changed as fastening at the front piece of the belt portion of eastern trouser
- Provision of full-length opening at sides of the eastern trouser with a zipper having double sided roller movement was appreciated that can create ease of access for physiotherapy or other treatments like acupuncture and will not leave whole body exposed.
- Similar decisions of the type of velcro as for adaptive shirt were recommended for eastern trouser

- Finest type of zipper with minimum bulk and fine zipper stoppers along with provision of double rollers which are able to close zipper on opposite directions are recommended.
- It was proposed that fastening ability of different velcro types can be analyzed by some testing method to decide best fit for the adaptive garment.
- It was emphasized again to use cotton material only for an economical and sustainable product design
- It was further brainstormed that for research intervention only dyed range of selected material can be used to control the effect of the influence of print detailing.
- Scholar was encouraged to look for the auxiliary materials in local market and online.
- Further design development was decided to be done on technical drawings of adaptive design and full-scale patterns indicating all details of fasteners.
- It was decided that as the details are finalized the intervention suits can be prepared and handed over to the study participants for the suggested trial period leading to a follow-up feedback.

The meeting ended after an hour's duration.



Update on Research Activities for the Supervisory Panel

Considering the suggestions of the first advisory meeting the research process is being taken further and following tangible targets were met.

- Data collection tools were developed
- Data collection tools were examined by three experts a doctor, a garment specialist, and a statistics specialist
- Questionnaires were translated in Urdu for ecological validation
- A Small-scale field testing was done to keep Urdu vocabulary easy and understandable
- Informed consent letter was composed for every study participant
- Required number of copies of each data collection tool were made, each along with consent letter
- Each bundle of every data collection tool is numbered to keep its track, while data analysis and during data collection.
- For each hospital required number of each type of data collection tool is grouped
 - Permission letter of the hospital
 - Interview with specialist doctor (audio recording) 3
 - Questionnaire to be filled by patients 45
 - Questionnaire to be filled by caregivers 45
 - Complete data of female patient for case study 1
 - Complete data of male patient for case study 1
- For first meeting. appointment was arranged with the head of medicine department, Jinnah Hospital, Lahore. After describing the research objectives, it was identified that such patients can be found in three types of hospital wards:

medicine, neurology, and physiotherapy. It was further discussed that the nature of hemiplegia patients is **acute** (initial phases) visiting the medicine and neurology wards and nature of hemiplegia patients is **chronic** (prolonged) visiting the physiotherapy ward.

- This research stresses upon responses from chronic hemiplegia cases to fulfill the objectives.
- Physiotherapy wards of three selected hospitals were visited, permission letters were shown and initial discussion about research was done.
- Due to severe winters, there is decreased trend of such patients, but as per discussion within charge of these wards an average of 15 case of targeted special requirements visit the ward per week for physiotherapy.
- It is estimated that data collection will span across prolonged duration to reach out to the true participants.
- A schedule of visits is set with each hospital and process of data collection has started.
- Interview appointments are also requested from the doctors and will start as per availability.
- SPSS sheet is prepared so that data can be entered as soon as it is collected following the number assigned to each tool in each category.
- Case study participants are contacted and primary interviews, to break the ice, are in process; along with in depth interviews body measurements will be taken for the construction of adaptive garment
- Guidance is requested for the material selection phase. As per previous discussion the choice will be kept limited to local materials and materials from natural fiber contents. It is anticipated to propose a list of suitable local materials for summer and winter.

- Pattern making and garment construction detailing are proposed next phases after material selection
- A research paper was presented at Kinnaird College, Social Science Conference, topic was regarding user centered design
- An invite to present research is received from UMT for upcoming conference organized by STD.
- A research paper is accepted as virtual presentation at International Conference on “Design, Principals and Practices” to be held at Russia, topic is regarding theory of user centered design.
- Among the accepted journals according to JCR 2018 only two journals were found regarding design science. These are targeted for publication.
- From JCR2018 few journals on aging, inclusive social systems and about special needs are targeted for publication.
- Enrollment request to next semester is sent
- Request for extension in time for completion of PHD is forwarded to STD, since December 2018 but response is awaited.
- Chapter one of dissertation is drafted for review.

Asna Mubashra

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13001118001 PHD Textiles Update

September 2019

Following are the major research activities completed in the final data collection phase of research project. The flow of the activities is in accordance with the timeline suggested in the approved research proposal.

- Completion of patient survey. Data entry in SPSS is in progress for descriptive analysis.
- Completion of attendant survey. Data entry in SPSS is in progress for descriptive analysis
- Completion of doctor interviews. Transcription is in progress for qualitative analysis
- Completion of material procurement
- Extended Textile Testing of material has to be done
- Completion of procurement of auxiliaries for adaptive dress making
- Completion of garment construction according to technical drawing of discussed layout as per individual body measurements.
- Completion of 6 case studies
 - Initial survey questions
 - Detail interviews
 - Assessment of limitations by enabler diagram
 - Observations
 - Body measurements
 - Timed dressing of current clothing
 - Dress intervention
 - Follow up timed dressing of adaptive clothing

- Follow up observation
 - Follow up interviews
 - Evaluation
- Case study data is being compiled/transcribed, each case is compiled separately
- Individual case analyses and cross case analysis will be done
- Dissertation compilation has started as per UMT requirements.



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Authors: Asna Mubashra

Dear Author,

I am pleased to advise that after review, your paper entitled:

User Centered Design Conceptualization of Upper Body Clothing for Female Hemiplegia Patients

has been **Accepted** for publication in the International Journal of Innovation, Creativity and Change. Your paper will be published in a forthcoming 2020 edition.

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User Centred Design Conceptualisation of Upper Body Clothing for Female Hemiplegia Patients

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Clothing is one of the essential human needs and is a subject of universal interest and has a multidimensional approach. Ever increasing dimensions of clothing designing has recently developed its focus on fulfilling special needs of consumers who are physically challenged. The understanding of adaptations required in the upper body clothing designs for the special group of physically disabled female consumers is the focus of this research paper. This qualitative study incorporated user centred designing approach for exploring appropriate solutions. This multistage clothing design campaign propagated as a case study research and involved in depth assessment of specific needs from three selected female study participants suffering from physical challenges due to hemiplegia. Fundamental activities of this user centred clothing design campaign incorporated creation of three adaptive clothing designs for the upper body as line sketches, prototyping and construction of one as dress trial intervention by same study participants to assess effectiveness of the proposed adaptive clothing. Conclusively it was found that a specially designed adaptive clothing solution for the upper body which prioritised user centred needs helped selected physically challenged female consumers to obtain quality of life, maintain dignity, and make the tasks of dressing and undressing easy.

Key words: *user centred design, special needs, adaptive clothing, functional design.*



Introduction

Clothing is one of the essential needs of all people and is a subject of global interest. This subject has a multidimensional approach (Na, 2007; Behrens, 1963). Normal people have very little difficulty in purchasing attractive and fashionable clothing in standard sizes that satisfy their personal and social needs, but the problem of satisfying clothing needs is very difficult or impossible to meet for those who are suffering from some physical challenge (Deepti, 2011; Kidd, 2006). Physical, social, psychological and personal needs are simultaneously fulfilled by clothing (Katherine E. C., 2001). Clothing is an important facet of the human constructed environment surrounding an individual and, therefore, has bearing on quality of life (Boettke & Zook, 1956). Clothing is required for three reasons: protection, comfort, and dignity. Individuals who are affected with a physical challenge are 'differently able' and they need clothing for the same reasons with a certain impact on the comfort which suits their health at that time (Yassi & Hancock, 2005; Reich & Otten, 1991).

Adaptive clothing is a clothing design concept that helps to minimise joint movements performed by the wearer and decreases the amount of manual repositioning of the sufferer by attendants (Yassi & Hancock, 2005). The outcome is reduction in pain and discomfort for both attendant and patient (Garg & Owen, 1992). Clothing problems arising from a medical situation and knowledge of this medical state along with physical limitations and problems faced in daily life by such special need consumers, helps to develop an approach of adaptive design ideas for the garments (Ali, 2004). The concept of physical challenges in special need consumers is very difficult to define or measure specifically due to the diverse nature of its various manifestations in the human body; therefore, conceptual clarity is fundamental to the development of a working theoretical base for clothing research. In general, physical challenges are the various impacts of chronic and acute conditions on the functioning of specific physiologic systems on basic human performance. It affects people's functioning to perform necessary, usual, expected, and personally desired roles in society (Kidd, 2006). The physical challenge begins with an effect at the organ level, then at the body level, expands to affect broad aspects of human performance, and finally, impacts an individual's interaction with society. A physical challenge can manifest itself in many forms at many body levels, and can be very visible or not at all visible to outsiders. Due to the variations of physical challenges that exist among special need consumers, identification of a framework within which unique clothing issues might be clearly defined and organised, is a complex but necessary process (Azhar, Saeed & Kalsoom, 2015). A clothing design conceptualisation for understanding and recognition of the requirements of special need users becomes a prerequisite for appropriate modifications of adaptive clothing designs.

Hemiplegia affects people in different degrees resulting in a restraint in range of motion of one lateral side of body. Such a state of impairment is usually caused due to certain neuro disorders which affect the opposite cerebral hemisphere than the apparent side of weakness. One significant effect of a physical challenge due to hemiplegia is restricted mobility. Mobility is



also a major issue for use of clothing. In this situation especially the act of getting dressed is very painful. (Meinander & Varheenmaa, 2002). If clothing impedes the normal range of body movements, physical and mental fatigue results. Clothing can be made more mobile in relation to an individual's specific needs by varying the construction as well as by using suitable materials to facilitate movement.

In contemporary complex socio-technical systems of human society, activities of design have a diverse range of applications (Beamish, 1999). User-centred designing is considered as a planned problem-solving activity, involving multi-stage decision making where needs of users dominate the ultimate design. The user centred design approach requires a great deal of involvement from the users during the process of design formulation. Carrying out this approach often includes collecting the end users' opinion right before the start of the design development, as well as during the design process, and in due course designing with them. People suffering from a specific physical challenge, no less than the rest of us, desire good design in the clothes they wear (Meinander & Varheenmaa, 2002). The ethics dictate that the needs of such people should be realised in order to provide opportunities of a better life for them. Better appearance through improvement of clothing will help these people to believe that they have worth in the sight of others and in their own view. Such solutions substantially improve the quality of life of special need users by providing better choices of good looking, purposeful clothing options (Kottke, 1982). Making the most for a consumer's convenience regarding clothing is a step toward self-reliance, and a feeling of acceptance and belongingness. The purpose of this study was to understand and explore deeply the possibilities of making suitable clothing for the upper body of special needs of female users suffering from hemiplegia.

The study specifically aimed to find answers for the following for the selected special needs consumers:

1. What are the physical limitations of the upper body that require clothing adaptations?
2. What are the adaptations required in regular upper body clothing and how to design these?
3. How effective is the suggested adaptive clothing design for the upper body?

Historical Background of Adaptive Clothing Designing

The problem of finding suitable clothing for individuals with physical disabilities has been a topic of concern for clothing, medical, and rehabilitation researchers for over half a century. Beginning in the 1940s, clothing and medical professionals started to examine the relationship between clothing and physical disability. Subsequent research in the latter part of the twentieth century explored the psychological issues of 'functional' clothing, primarily by assessing the importance of clothing as an appearance management tool. Literature suggests that there are several essentials that adaptive clothing designs must have. Schematic representation of the factors affecting adaptive clothing is shown in Fig 1. Successful adaptive designs consolidate all these factors.



Figure 1 : Factors affecting adaptive clothing (Source: Kidd, 2006).

The physical aspect is associated with comfort with respect to the type of material and manner of construction of the product. Adaptive clothing has to be convenient to put on and take off (Ali, 2004; Beamish, 1999). Clothing must not cause any kind of discomfort while it is being used. In the socio-psychological aspect, looking good, feeling good, and having the right clothes that promote independence in dressing can increase self confidence and self-esteem. Thus, appropriate adaptive clothing can provide an immense socio-psychological boost among the individuals with special needs (Azhar, Saeed & Kalsoom, 2015). In the aesthetic aspect, all clothes need to be attractive and fashionable showing off the wearer's good points and concealing the disablement. For a fashionable look, changes in the adaptive clothing should be invisible when the garment is worn (Lamb, 1993). In the management aspect it is required that garments are made of strong enough material and reinforced construction methods saving the wearer from damage or pressure sores (Kottke, 1982). The economic concern emphasises greater consideration for proposing products at affordable prices as people with special needs have higher living costs (Azhar, Saeed & Kalsoom, 2015).

Need for a concise, distinct classification system to help clothing designers systematically group physical limitations into manageable and mutually exclusive segments has been strongly felt. Such systems have been developed by Yep (1977), Reich and Shannon (1980), and Newton (1984-85) to address the clothing needs of the special need users and to guide research in this area. Reich and Shannon (1980) proposed a simpler system based on empirical data obtained from approximately 300 Arizona residents with various types of physical disability. These researchers developed a grouping of six common physical limitations across disabilities to help address the clothing needs of physically challenged population. These groups are lower leg, lower torso, upper torso, hand, arm, and neck (see figure 2).

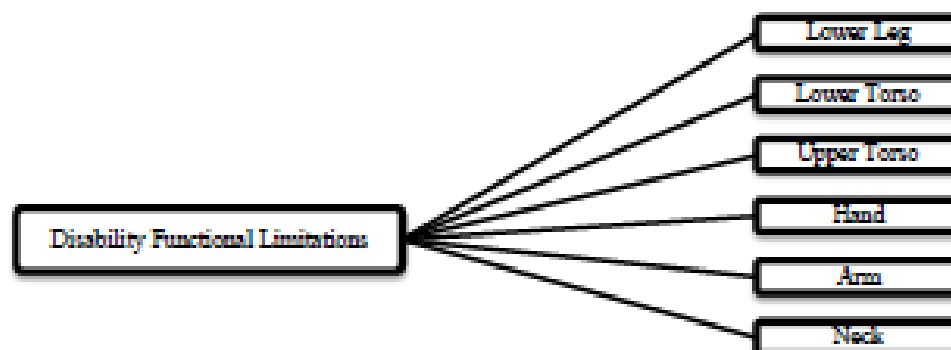


Figure 2 : Grouping Of Physical Limitations For Clothing (Source: Reich & Shannon,1980)

Another possibility of classifying disability for use with clothing research is presented by the Enabler system (see Figure 3); it defines disabilities as combinations of limitations in various parts of the body. This system has been in existence since the 1970s for use in ergonomic design, architectural design, and product design. The Enabler system is an effective way of defining specific limitations in an initial data gathering phase to determine the extent of limitations within the body (Beamish, 1999).

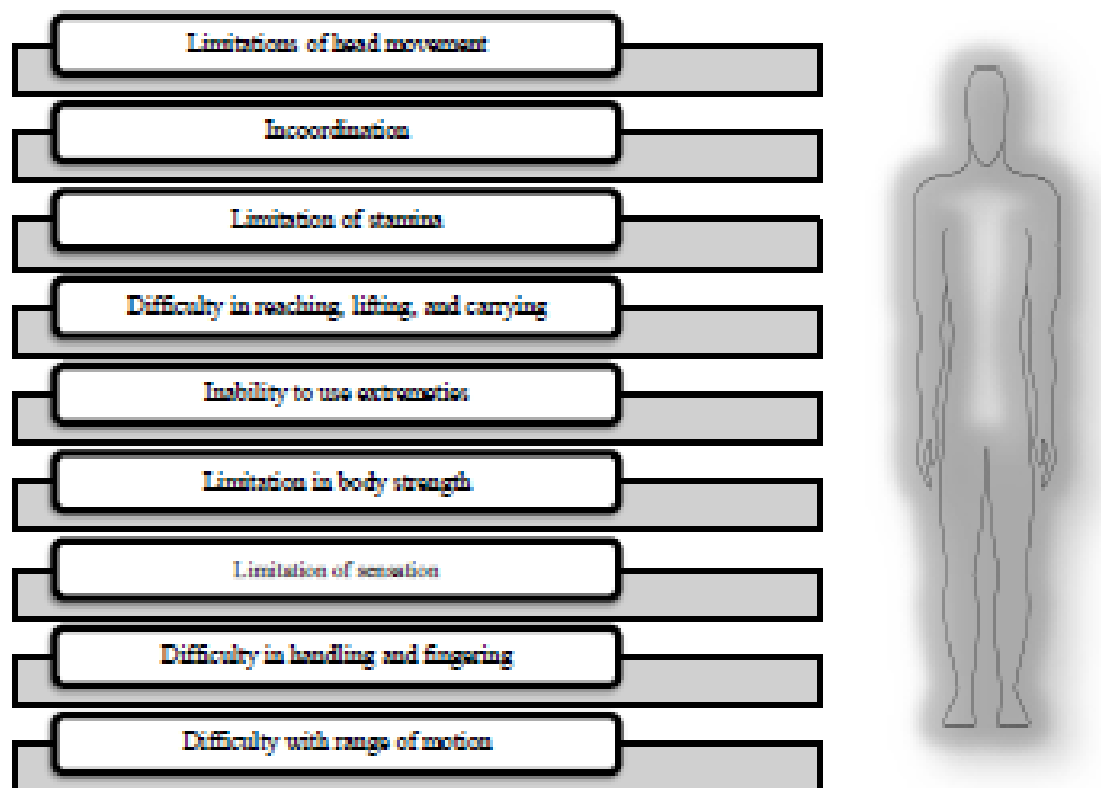


Figure 3 : The Enabler figure (Source:Reich & Otten, 1991)

Absence of adaptive clothing was consistently being felt and some informal activities were seen before Katherine (2001) presented her doctoral research addressing the lack of appropriate products for working women with physical disabilities. The matter of appropriate clothing for disabled people has been rigorously researched in this millennium. Clothing and textile requirements of the elderly and disabled were studied by Meinander and Varheenmaa (2002). They brought in to the lime light the probability of significant improvement in the lives of the disabled and elderly, with an availability of charming dresses with special functional features. Efforts towards inclusion of disabled people within the main stream population were carried out in different regions of the world. A significant work was conducted by the Californian health and Human Services agency (2003) regarding the special type of care needed for children and adults with developmental disabilities. Continuation of similar investigations was found in the study of Kidd (2006) which focused on the development of formal occasion fashionable clothing for special needs of young ladies. Similarly, adaptive clothing issues were explored for Dementia patients by the dementia behaviour management advisory service (2012) as use of clothing becomes a complex phenomenon for such patients. Focused researches in the field of adaptive clothing proved to be more convincing to bring out the best solution according to the nature of each disability. Smith (2013) was inspired by the increasing number of hemodialysis patients in America.



Literature indicated that effective adaptive clothing can provide greatest service to the physically challenged person only if it is specifically improved for specific individual needs of such users. The literature reviewed suggests a gap addressing a dire need for real need realisation of special need clothing users. Thus, it is of much importance to develop a specialised fashion design approach regarding adaptive clothing designing as a user centred design activity in which needs identified by the real end users, prior to the process of design, contribute significantly to adaptive clothing design formulation and construction. Furthermore, the realisation of special needs for adaptive clothing of hemiplegia sufferers is not evident in existing literature.

Theoretical Framework of the Study

User centred design approach or Function-Behaviour-Structure ontology conceptualises design objects in three categories: function (F), behavior (B), and structure (S); they have been utilised in the design practice as a base for exhibiting the procedure of designing as a set of discrete actions. For the current study the model is modified to incorporate major factors of concern for adaptive clothing (see figure 4).

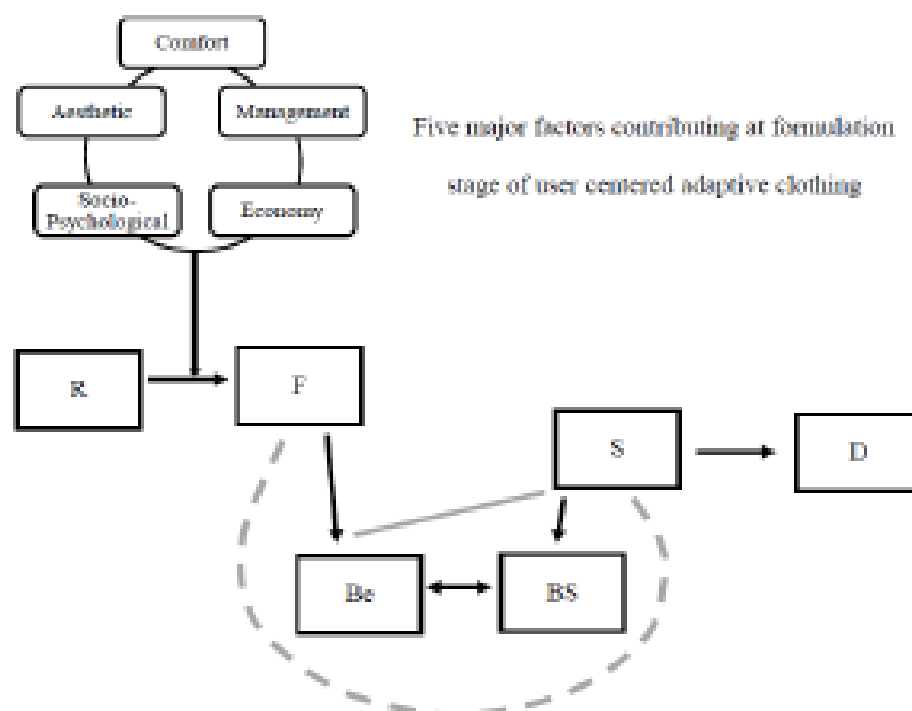


Figure 4: The function behaviour structure framework modification for the current study

According to basic function behaviour structure framework the design activity starts with identification of original requirements, shown as R in figure 4. The phase of need realisation leads to the design formulation stage, shown as F in figure 4, leading to the construction of the



product incorporating realised behaviour in designs, shown as Be in figure 4. Later, the stage of synthesis, shown as S in figure 4, involves trials of constructed design and its analysis which might reiterate the construction, shown as BS in figure 4. If further amendment is not needed, the phase of construction (Be) and design evaluation (S) leads to the last phase of documentation of the complete process of design, shown as D in figure 4. The documentation of the user centred designs must reveal all the necessary details of the process of design and it becomes a base for replication or future reformulation of the design. For this study, the first phase of the framework designated for assessment of requirements from end users is further reinforced by specially focusing five major areas of adaptive clothing design consideration as indicated by the literature.

Materials and Methods

This study aimed to design a suitable adaptive clothing design solution for upper body garment for special needs female users suffering from hemiplegia with following objectives:

1. To find the physical limitations of upper body that demand for clothing adaptations.
2. To find areas of upper body clothing that require adaptations and to design adaptations.
3. To determine effectiveness of suggested upper body adaptive clothing

A qualitative research approach as exploratory case study research methodology was found most appropriate for this user centred clothing design campaign for upper body apparel, accommodating the special needs of female consumers suffering from hemiplegia. For the intricate interpretations of experiences of human participants in complex settings of socio-cultural setups, the qualitative manner of studying a research issue is preferred (Babbie, 1992). Qualifying potential study participants were chosen with the consultation of a specialist doctor. Selected participants were contacted in person; upon their permission, formal consent forms of study were signed. Purposively drawn, a small sample size of study participants helped to yield a larger bulk of true in-depth data. In-depth multiple interviews revealed a correct approach of real end users of this adaptive clothing design campaign. This manner of qualitative interviews had also been found in related literature that helped to collect exhaustive data in various details of clothing issues. This set of participants gave the researcher extended information into the specific nature of each of their problems. Validity and reliability of data collection was carefully sought. The data served as a strong base for combining functional clothing solution with user centred preferences. The study followed a linear progression of data collection and analysis (see figure 5).

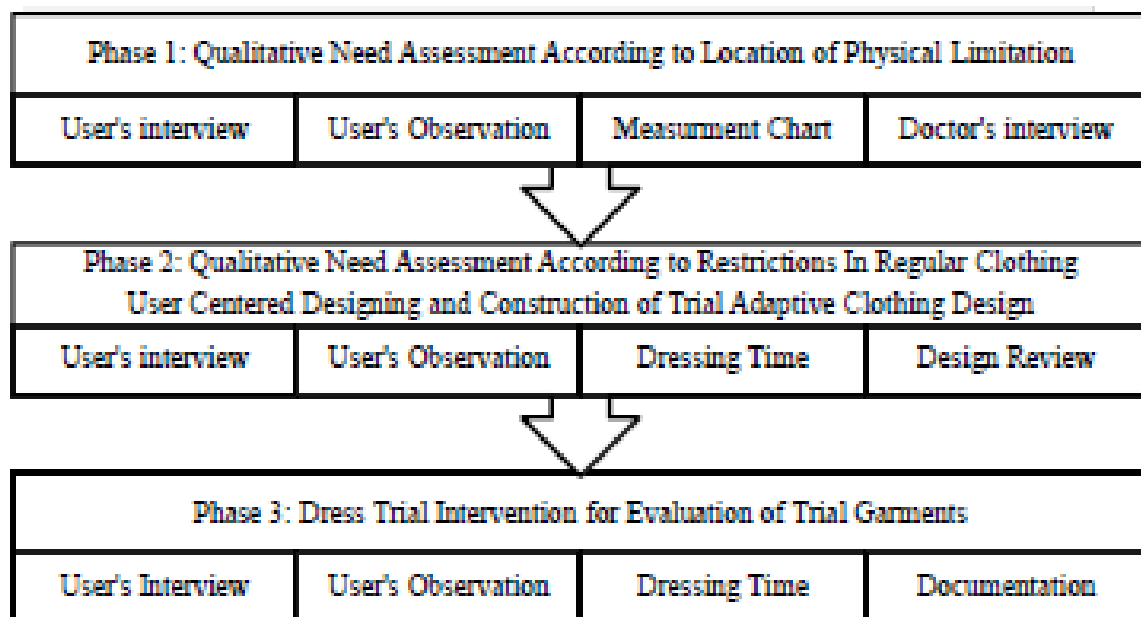


Figure 5: Flow chart of research activities for current study

Table 1 shows list of instruments which were used to gather data from study participants.

Table 1: List of Instruments Used in Each Stage of Study

	Study Phase	Instrument	Description
1	One	Instrument IA	Partial Enabler figure for physical limitations.
		Instrument IB	Body Measurement chart
2	Two	Instrument IIA	List of potential clothing problems.
		Instrument IIB	Line drawing from basic bodice block
		Instrument IIC	Specification Sheet for construction.
3	Three	Instrument III	Wear test about clothing relief.

The study was divided into three phases: Phase one focused on gathering data from participants to provide necessary information for need assessment according to the location of the physical limitation of this specific group of female users of adaptive clothing. Instrument one, section A was used to gather information regarding their physical limitations and its B section was used to record their body measurements. The measurements recorded were bust, waist, hips, arm length, across back and centre back. Observations of participants for the limitations of



movements were recorded and a medical specialist was consulted to enhance the understanding of physical limitations.

Phase two of the study focused on areas of concern in regular clothing and creation of design according to the expressed requirements. Instrument two, section A was to identify the nature of clothing problems for each participant. Time taken to dress by regular clothing was recorded. The latter part of this phase was focused on user centred designing of adaptive clothing. Instrument two section B comprised of basic bodice blocks that were used as standard while sketching the adaptive clothing design. The information obtained from the study participants provided needed guidelines. The designing phase was interactive and participants were asked to make their opinion while the sketches were in initial stages. The completion of detailing of the sketches was the outcome of co-designing efforts of the researcher and study participants. The instrument two section C consisted of a specification sheet. This specification sheet served to combine the selected design and body measurement sets gathered in Instrument one, so that the trial adaptive garment could be constructed for every participant. All construction details were written carefully in the specification sheet of every part to ensure conformance to recommendations. This step also ensured replicability of the current study. The phase two ended with the construction of the three sets of the same trial adaptive garment in the required size of each participant.

Phase three aimed at wear testing of the constructed trial adaptive garment for the upper body with the same group of participants. Information was collected about their experience after three weeks of use. Instrument three consisted of an evaluation questionnaire. Participants were asked to rate features of the trial adaptive garment using a three-point Likert-type scale anchored at one (worse than I envisioned) to three (better than I envisioned), and centred at two (just as I envisioned). This phase concluded with interview questions relating to the overall relief felt by the participants and record of time taken for dressing.

Researcher documented responses to all interview questions in different phases of the study; these interviews were also audio-taped to help in later detailed writing of notes. Each case was individually analysed first to exclusively know each participant's real needs then their cross case examination further elaborated similarities and differences expressed by the participants. Cross case consolidation revealed desired performance requirements of comfort, management, economy, socio-psychological and aesthetics with regard to the nature of the material and the manner of structural design of adaptive clothing for the upper body for female hemiplegia patients.

Results Discussion and Conclusion

Nine areas of potential limitations were recognised by the participants which were also identified from the literature. These areas were (a) in-coordination, (b) limitations in body strength, (c) limitations of head movement, (d) limitations of stamina, (e) limitations of



sensation, (f) difficulty in lifting, reaching or carrying, (g) difficulty in handling and fingering, (h) inability to use extremities, and (i) difficulty with range of motion of the body. The data gave the researcher expanded information into the particular nature of each participant's problem.

Information produced from each participant's clothing issues was analysed and it identified nine potential clothing problems listed as: (a) difficulty putting on and taking off (donning and doffing) clothing, (b) difficulty managing fastenings (e.g., hooks and eyes, zippers, buttons) due to restricted use of hands and lack of mobility, (c) lack of freedom of movement for a variety of activities (e.g., crutch walking, sitting in a wheelchair), (d) inappropriate and uncomfortable style, (e) inadequate coverage of the body, (f) some features are irritating and get in the way, (g) styles of clothing can be constricting and uncomfortable especially during temporary changes in size (periods of weight gain and loss), (h) construction quality inadequate for stress exerted by user, and (i) not all clothing solutions are aesthetically pleasing. Afterwards, the ideas given by all participants were consolidated into three complete sketches of adaptive clothing designs for upper body female garment (see figure 6). A standard bodice block of a female fitted long shirt was manipulated by the researcher to achieve the adapted styles.

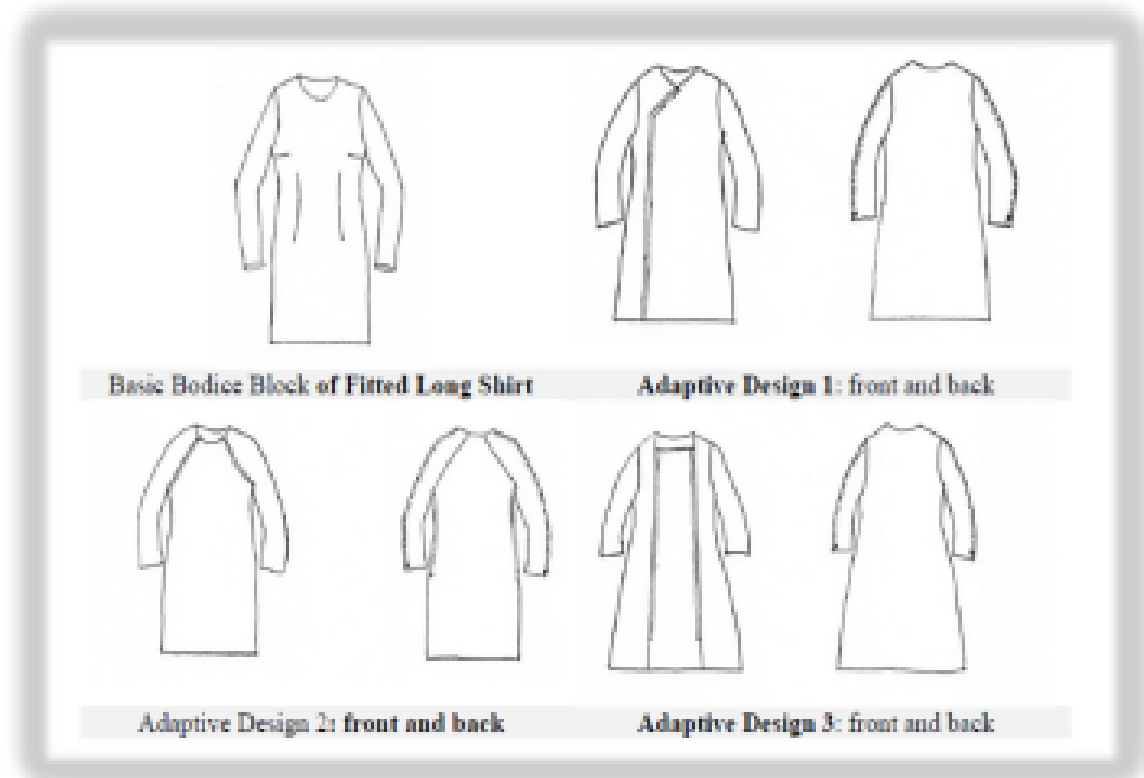
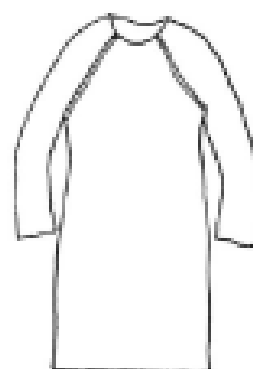


Figure 6: Sketches of Proposed Adaptive Clothing Designs for This Study

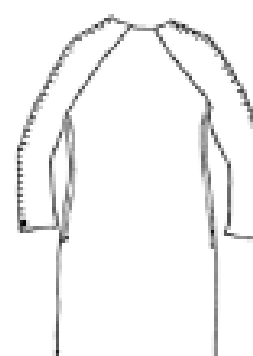


Details for construction of a trial adaptive garment were shown in a specification sheet (see figure 7). From this specification sheet three sets of trial adaptive garment were made for each participant.

Description of trial adaptive design	A loosely fitted long shirt with round neckline having full opening at both sides with velcro strips attached to both sides of back of shirt and corresponding soft part of velcro on both sides at front, as clouser in stead of side seams.		
Measurements of dress in inches	1	2	3
Bust	23	25	26
Waist	21	23	24
Hip	25	27	28
Full Length	39	36	40
Sleeve Length	21	20	21
Sleeve Opening	6.5	6.5	7
Across Back	14.5	15	16
Side Slit	19	17	20



Front



Back

Figure 7: The Specification Sheet for the Trial Adaptive Garment for This Study



Specific physical limitations that were common to this group ($n=3$) of special needs female users suffering from hemiplegia were grouped into the following categories, (a) range of motion, (b) motor planning, (c) strength, (d), sensory, (e) stamina, and (f) other. All categories impacted both the wearing of clothing and styling of clothing. The clinical definition of a disease appeared to be consistent to the identification of physical limitation categories. This finding supported previous clothing research by Yep (Yep, 1977), Reich and Shannon (Reich & Shannon 1980), and Newton (Newton, 1984) who arrived at similar conclusions with different categories of physical limitations. Physical limitations impacted the ability of such women to find suitable clothing in a number of ways. The problems with constricting styles were solved with designing garments that had plenty of room built into them for ease of movement. Using a user centred technique, the researcher established common clothing features preferred among study participants, which were put into a trial adaptive clothing solution. These included a loose, unfitted shape; no defined waistline area; a front or side opening; a simple basic neckline with no collar; raglan, deep set in, and sleeve with gusset. All participants wanted to find clothing that was easy to move in, easy to dress or undress and fasten, and which maintained a suitable appearance. As one participant stated, "women with physical disabilities want clothing that does not set them apart from other women." With the accepted linkage between disability and limitations, these features are also applicable for upper body adaptive clothing for female populations with a range of similar physical disabilities.

The Authors declare that there is no conflict of interests.



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