

# Sun-Protective Clothing Design for Wheelchair Users: Integrating Function and Accessibility

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## Abstract

Research on sun-protective clothing for wheelchair users is of great significance in advancing the development of accessible clothing. Currently, sun-protective clothing available on the market is mainly designed for the general public. Traditional sun-protective clothing has shortcomings in multiple aspects such as garment length and bottom hem circumference, failing to meet the daily wearing needs of wheelchair users. Based on this, this study aims to design sun-protective clothing that caters to the needs of wheelchair users. The study employed questionnaire surveys and interviews, identifying seven key design points, and proposed a systematic design method based on three functional areas: sun protection, breathability, and safety protection. In the sun protection functional area, the sun protection area is determined by integrating the characteristics of the fabric and the wearing scenario. In the breathable functional area, the breathable area is determined and suitable materials are screened. In the safety protection functional area, reflective materials are integrated into the clothing structure line. Based on this, this study designs barrier-free settings for sun protection clothing. Three testers were invited to conduct wear testing and evaluation. The results showed that the comfort and functionality of the sun-protective clothing have been significantly improved, providing new design ideas for accessible clothing and creating possibilities for wheelchair users to have more suitable sun-protective clothing in the summer.

*Keywords:* Sitting sun-protective clothing; Wheelchair users; Accessibility design; Parking Demand Study

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## 1 Introduction

In recent years, the general public has become increasingly aware of various health issues affecting humans. Sun-protective clothing has gradually become a popular type of garment, and the market for these products is rapidly expanding. China's Seventh Census shows that 13.50% of the nation's population is aged 65 and above [1]. Another important fact is that approximately 10% of the world population is estimated to have a disability, and 10% of this population group requires a wheelchair due to their limited walking capacity [2]. As wheelchair users form a large group of

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targeted consumers, existing barrier-free garments primarily include dresses, trousers, and down jackets [3]. However, sun-protective clothing for wheelchair users is rarely seen on the market. For wheelchair users, going outdoors on sunny summer days proves to be a struggle because many of them cannot spare a hand to hold a sun umbrella. Based on interviews conducted as part of this research, wheelchair users currently favor sun-protective accessories, including ice sleeves, caps, and sunglasses. These gadgets can only provide partial protection from the sun and are cumbersome to carry [4]. This research demonstrates that clothing designed for wheelchair users is a minor category, and specialized sun-protective clothing is scarce [5]. People generally believe that wheelchair users are unable to participate in outdoor activities and have thus neglected their unique clothing needs [6]. However, with the rapid development of technology and infrastructure, it is increasingly convenient for wheelchair users to travel outdoors. They, like others, need protection when exposed directly to sunshine. Currently, existing research is unclear about the actual demand for sun-protective clothing among wheelchair users. As such, it is necessary to establish a method of designing such clothing through a combination of investigation and interviews.

This study conducts a questionnaire survey among wheelchair users to identify issues with the functionality and structure of sun-protective clothing. Based on interviews with wheelchair users to analyze their needs, a design method for sun-protective clothing is developed, and an attempt is made to design such clothing. It provides references for relevant fields and offers the possibility for more wheelchair users to step out of their homes in summer and enjoy healthy sun protection.

## 2 Methods

### 2.1 Questionnaire and Interviews with Wheelchair Users

The target group is recruited through the Beijing Disabled Persons Organization. A preliminary screening is conducted before the participants join the interview. Based on the uniqueness of the interviewees, the interview process employs purposive sampling [7]. Ten subjects are identified and classified into two categories: (a) wheelchair users who have worn sun-protective clothing, and (b) wheelchair users who have never worn sun-protective clothing. Nine out of the ten subjects meet the criterion. Participants who meet the requirements are wearing sun-protective clothing aimed at able-bodied individuals.

To ensure the scientific and academic integrity of the process, three discussions are held to develop an ethical method of interviewing. Two simulated interviews are conducted. Due to unforeseen circumstances, all one-on-one interviews must be conducted online. Every interview lasts for 15-20 minutes.

### 2.2 Functional Design and Analysis

A new method of designing sun-protective clothing can be created. By using existing clothing as models, barriers can be identified and eliminated. The new clothing design must function normally as a sun-protective garment and also enhance the safety and comfort of wheelchair users when worn. Three functional areas are added to the new sun-protective clothing: the sunscreen area, the breathable/functional area, and the safety/protection area. Design other functional clothing