



## Development of hospital patient apparel with enhanced functional, expressive, and aesthetic attributes

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### Introduction

Hospital patient apparel requires specific functionality for the wearer and healthcare providers. It has been widely reported that conventional patient apparel often hinders the wearer's body movement (Cho, 2006) and contributes to an increased infection rate due to loose sleeves or hanging strings that allow the wearer to sweep more surface area (Parker-Pope, 2008). Furthermore, it is a general misconception that because the wearers are isolated from social activities, it is not important to emphasize the apparel's expressive function. In reality, patients often establish personal relationships with their caregivers or with other patients, or host family members and friends during their hospital stay. Such design deficiencies negatively impact patient dignity and there is a need for better hospital patient apparel design. This project aims to address the ways that hospital patient apparel can improve its aesthetic appeal, enhance the wearer's mobility and comfort, and provide superior antimicrobial resistance.

### Methods

Guided by Ulrich and Eppinger's (2008) product development process, this study examined innovative design solutions that enhance functional, expressive, and aesthetic attributes to hospital patient apparel. In order to determine user needs for new patient apparel, this study administered two surveys, one for patients and the other for healthcare providers, at two large-scale hospitals, located in the Western region of the United States. The survey data provided guidelines for the phases of concept development (Phase 1) and detail design (Phase 3). Laboratory research was conducted in the phase of system-level design (Phase 2) to study the most effective antimicrobial treatment for medical textiles. Based on the results of Phases 1~3, prototypes were developed. Further modifications and refinements were sought with actual user groups, to evaluate functionality and medical practicality of the prototypes.

### Results

Survey data were collected from 176 users, including 105 patients ( $M_{age}=53.57$ ,  $SD=14.19$ , 44.2% males and 55.8% females) and 71 healthcare providers (26.8% MD, 66.2% RN, and 7.0% other). For patient data, out of 11 7-point rating questions, patients negatively rated on the following questions: "I feel dignified wearing the gown" ( $M=2.77$ ,  $SD=1.48$ ), "I feel insecure wearing the gown" ( $M=3.44$ ,  $SD=1.69$ ), "The quality of gown fabric is appealing" ( $M=3.44$ ,  $SD=1.59$ ), "The color and/or pattern of the gown are attractive" ( $M=3.45$ ,  $SD=1.53$ ), and "I feel embarrassed wearing the gown" ( $M=3.59$ ,  $SD=1.75$ ), while they positively rated on the question, "The design of the gown is practical for medical procedures" ( $M=5.79$ ,  $SD=1.66$ ). The rest of the questions showed neutral ratings on overall satisfaction, mobility, fabric texture, and comfort. On the other hand, healthcare providers displayed negative evaluations on the

practicality of the gown: “The fastener of the gown is practical for medical procedures” (M=3.86, SD=1.62), and “The opening of the gown is practical for medical procedures” (M=3.82, SD=1.69). It is interesting that while patients perceive the current gown practical for medical procedures, healthcare providers believe it is not practical. Design considerations identified from the survey data are summarized below:

1. **Fit:** 69.6% of male patients answered “doesn’t matter,” regarding the gown fit, while 34.5% of female patients responded so. 31.0% of female patients also preferred “a bit more fitted than the current gown.”
2. **Enclosure:** Patients (47.8% males and 58.6% females) preferred a front opening to a back opening or side opening. For healthcare providers, both a front opening (31.3%) and side opening (32.3%) were rated high, while a back opening was still favored (26.4%).
3. **Color:** Muted/pastel-toned color was most favored by patients (39.1% males and 41.4% females): 43.1% of female patients also favored bright color, while only 17.4% of male patients responded bright color as their preferred choice.
4. **Pattern:** Female patients showed an equal balance of preferences in fabric pattern, such as natural pattern (27.6%), no pattern (27.6%), and geometric pattern (22.4%). Male patients illustrated a strong preference in no pattern (43.5%).
5. **Length:** There was no strong preference in a particular category for sleeve/gown length.

These survey results guided the product development process and multiple design solutions were contemplated to meet the user needs. Different options for gown silhouette, location of opening, and textile design provided inspirations for design innovation. Several lines of textile design were developed using CAD software, in order to accommodate the complex preferences of the users, and they were digitally printed on cotton-polyester fabric. Laboratory findings, reported in a separate paper (Ranganath, 2011), determined that an antimicrobial agent based on triclosan was the most effective and durable agent for antimicrobial protection. The agent was treated on the prototype fabric. Multiple prototypes were produced and evaluated through a focus group discussion with actual users, including patients and healthcare providers.

### **Conclusion and Implications**

The outcome of this study is revolutionary, in a sense that the suggested designs illustrate “outside the box” solutions to the conventional patient hospital apparel, while enhancing medical practicality, patient mobility, and expressive and aesthetic quality. Real-setting applications and feedback from its users are anticipated to provide insights into what is needed for further improvement.

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