

RAE 2020

**Development of new anti-strip
jumpsuit for the residents with
mental disorders**

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PolyU UoA 38

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Development of new anti-strip jumpsuit for the residents with mental disorders

Descriptor

One function of anti-strip jumpsuit is to prevent the wearer from disrobing. However, nurses at some care centres reported that current anti-strip jumpsuits do not address this problem because:

- The residents can take off their diapers and soil themselves
- The fabric of current jumpsuits is not comfortable for residents
- The fabric and accessories are not durable under a rigorous laundering and drying procedures

In this project, new functional anti-strip garments were designed for residents staying at care centres of the Tung Wah Hospital Group, a collaborative charity group in Hong Kong. Many residents in these centres have mental and/or physical disorders. The new design not only solved the main problems of the current anti-strip jumpsuit but also enabled residents to dress smarter.

The research team analysed data from a focus group interview with carers, nurses, and family members of residents. Wearer trials involving 30 participants were conducted to test the design. A list of fabric tests were also designed to ensure that the quality of fabric and accessories were suitable for this specific type of garment. Finally, 500 sets of new jumpsuits (8 styles) were produced for approximately 200 residents living in more than 30 care centres in Hong Kong in an effort to improve their comfort and hygiene. Additionally, a new image was successfully created for the residents to improve their overall appearance. The product specifications, testing requirements, and the details of fabric properties were listed in the technical manual for future re-ordering of the garments.

The impact of the research was not limited to academia or collaborators, but has also benefited the entire community. The project leader was invited to write a book chapter to share the knowledge he gained throughout the project to inform other carers who care for persons suffering from dementia residing at home. (299 words)

Researcher's background

Dr. Ho's research focus is on the investigation of functional clothing. He had experience to design functional uniform for Hong Kong sport team and adaptive clothing for health care centres. Apart from the practice-based research, he also investigates the relationship between design and comfort level of clothing with the support of scientific data. The examples included the development of design details to enhance garment's thermal comfort; and the evaluation of garment construction to fit Chinese men with apple body shapes.

Research Context

Nurses and carers at some care centres reported that the current anti-strip jumpsuit found from the market could not solve the problem effectively. In some cases, residents in care centres could take off their diapers and soil themselves. This behaviour led to personal hygiene problems and pressure on the staff. However, limited research had been studied to suggest effective design to improve the anti-strip garments.

Through observation and interview with carers, nurses and residents' family, we identified that the needs varied between the residents and thus devised different designs to meet their various needs. As a result, 8 anti-strip garments were created for the Dementia residents from adult to seniors, with or without physical disorders.

This project was 100% funded (HK\$ 1.3M) by the Hong Kong Government (Innovation and Technology Funding).



What constitutes the research output / body of work

1. New anti-strip jumpsuits

500 sets of new jumpsuit were adopted in care centre to reduce the hygienic problem of residents which was caused by disrobing (2015 – 2017)

2. Technical report and specifications

The product specification include design, analysis of questionnaire, material use and the full data of testing results were provided for future product development and re-ordering (2017)

3. Knowledge sharing

- Exhibition in the community to promote the design and sense of caring to residents (Jan, 2018).

- Invited talk to share the knowledge to other carers at hospital and care centres (Feb 2018) .

- A book chapter has been published to suggest useful tips to carers to customize household garments to prevent the wearer from disrobing (2017).

- Newspaper report (30 Oct 2016)

- Youtube videos and report on government website to promote the new image and technical advancement of the new design (Oct 2016 & Feb 2017).



Research questions

The research sets out to

1. Develop series of new anti-strip jumpsuits to the residents with mental disorders;
2. Evaluate the quality of the new anti-strip jumpsuit (included design, fabric and accessories) through lab test and wearer trials;
3. To promote the new design to the community to raise the sense of caring of Dementia patients.

Research material

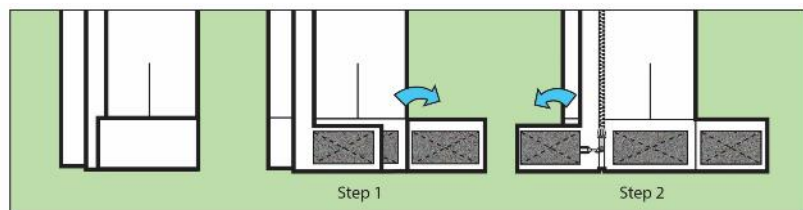
Behavioural expression consists of two main categories: distress, such as hitting, vocalisation, etc., and disinhibition of disrobing (Capezuti et al., 2014). The tendency to remove one's clothes is a common symptom for seniors with dementia and Alzheimer's disease (Maville & Huerta, 2013). At this stage, it is difficult to explain this phenomenon. There are some assumed reasons for seniors' inappropriate disrobing, such as discomfort, hallucinations and sexual reasons (Giving Care Team, 2017). With the risk of incontinence, many patients wear diapers. However, this causes discomfort to their skin. Sometimes they strip because they are too hot or because they cannot think logically. While hallucinations often happen at a later stage of dementia, patients may believe that they must undress due to the hallucination of bedtime or crawling bugs on their clothes, for example. In some cases, Alzheimer's patients may disrobe to fondle themselves unconsciously without realising that it is inappropriate to do so in public. There is no clear way to understand the behaviour of the patients, so inappropriate undressing is often a problem in hospitals and care centres.



Residents in anti-strip jumpsuit
sourced from the market

Research material

The research under discussion in this paper arose from the identification of a behavioral tendency common among patients suffering from conditions such as dementia. It involved the development of a garment, hereafter referred to as an 'anti-strip' jumpsuit, designed to deter such patients from removing their outerwear. The main purpose of this garment type is to prevent the patients/residents from tearing or taking the garment off. In the development of such garments, there should be more emphasis on functionality, fabric quality and cost control.



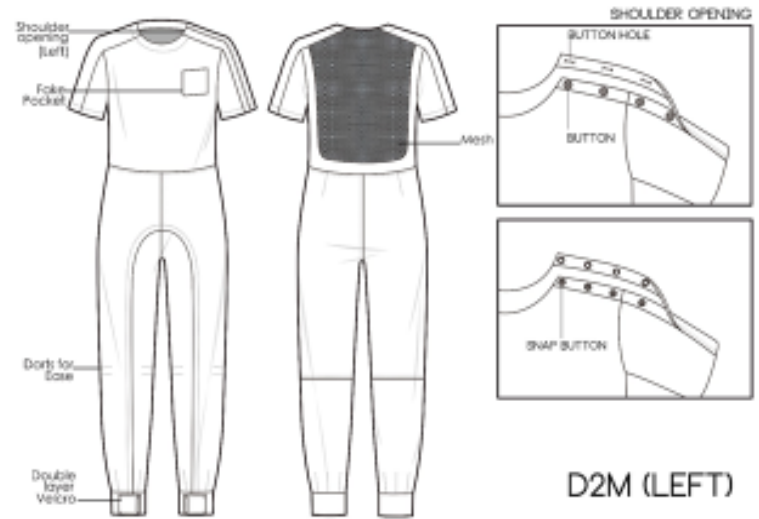
Design sketch of safeguard detail at the bottom hem



One of the final prototypes for senior residents

Research material

Examples of the technical specification: Product specification, design details and size specification



D2M (LEFT)

款号:	C4	23/8/2016
名称:	中法防撕片褲	
订布单号:		
布料名称:		
部位:(单位:CM)	TOL +/-	S
A	1/2胸圍(夾下2CM度)	54
B	胸圍	42
C	身長(前膊位至腰中)	51
D	身長(前位至膝)	143
E	前領深(前膊位度)	11
F	領橫	19
G	後領高	4.5
H	袖長(由膊頂度至袖口邊)	25
I	1/2袖圍	21
J	1/2袖口	15
K	1/2腰圍	54
L	1/2坐圍(前腰度下20cm)	58
M	1/2 脚圍	36
N	前浪	35
O	後浪	42.5
P	1/2 褲脚圍(縮起計)	12.5
Q	外長	91
R	內長	61
S	腰帶長	186
	5號掛字闊尾/長闊吋之闊吋	69"
	5號掛字闊尾/長闊吋之闊吋	18 1/2"
	後領1.5吋帶	17"

Design description:

1. Mesh panel at the back
2. Double layers of Velcro
3. One way zipper (with buckle) as opening
4. 3D cutting at the waist and knee parts
5. Fabrication: 150g/m² 100% cotton
6. Snap button as opening at shoulders for patient with hemiplegia problem (right side)

Research material

Anti-strip jumpsuits were reordered by more care centres

To Ho, Chu Po [ITC]

From: Ho, Chu Po [ITC] [<mailto:chu.po.ho@polyu.edu.hk>]
Sent: Tuesday, October 17, 2017 10:22 AM
To: Audrey Yip
Cc: Yan Chan
Subject: RE: Order confirmation from TWGHs for **Jumpsuits**

Dear Audrey,

I am pleased to know this good news. Hope that in near future we can work together again to contribute the industry and the society. Thanks!

Rgds,

Po

From: Audrey Yip [<mailto:audreyyip@hkrita.com>]
Sent: Tuesday, October 17, 2017 9:04 AM
To: Ho, Chu Po [ITC] <chu.po.ho@polyu.edu.hk>
Cc: Yan Chan <yanchan@hkrita.com>
Subject: Order confirmation from TWGHs for **Jumpsuits**

Hi Dr. Ho,

I would like to pass over the good news to you that we have got the confirmed order from TWGHs for 315 pcs of the Anti-Strip **Jumpsuits** for 25 elderly centres. The delivery is scheduled for 16 March, 2018. We will send over the acknowledgement letter to you for your contribution to this project and the order later, thank you.

Regards,
Audrey Yip
Business Development Manager

THE HONG KONG RESEARCH INSTITUTE OF TEXTILES AND APPAREL
Tel: (852) 2627 8177 | Email: audreyyip@hkrita.com | Website: www.hkrita.com



Disclaimer:

Research methodology

Problem Definition and Research

Before starting a new set of anti-strip garment designs, the research team organised field trips to five targeted care centres to observe

- 1) the dressing process of residents with the help of carers,
- 2) the appearance of current jumpsuits and
- 3) the laundry facilities used in care centres.

During each visit, in-depth interviews with carers and nurses were conducted to analyse aspects of current jumpsuits that were satisfactory and those that were not.

In general, current jumpsuits did not perform well, with carers and nurses worried about some specific aspects of these jumpsuits. At this stage, the problems of the current anti-strip garments were summarised based on feedback from frontline personnel and the research team's observations.



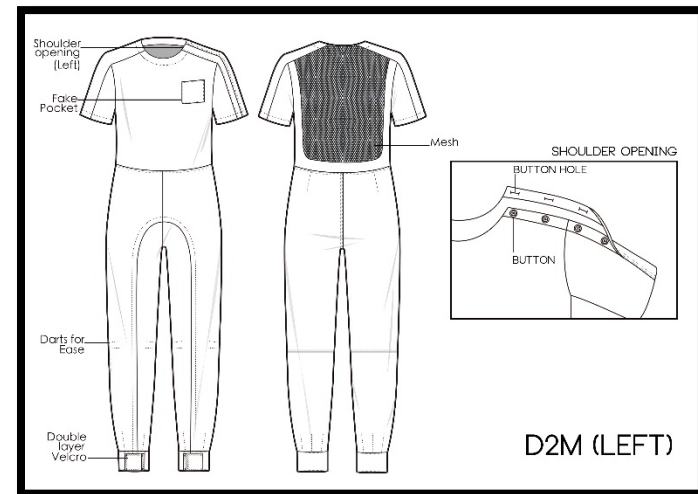
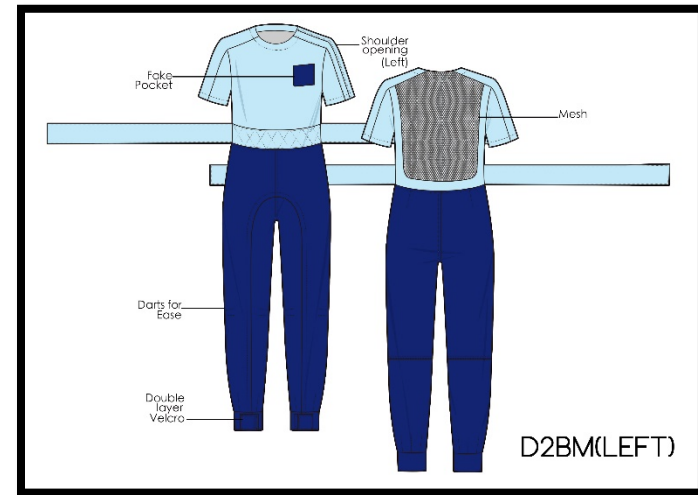
Interview with carers and nurses

Research methodology

Creative Exploration

The design of this anti-strip jumpsuit remained a jumpsuit, adopting the same zipper placement as the currently available jumpsuits on the market. Based on the data obtained from the centres and the observations of the research team, two versions were created to meet the specific needs of the residents.

In the new design, a mesh panel was placed under the back panel. The thin, spongy mesh not only enhanced the breathability in the back area but also facilitated heat and water vapour transmission. It was also durable and more resistant to laundry than a thin single layer of sports net mesh. A design with hard objects, like buckles or zippers, should be covered with fabric, as it might injure the wearer or cause skin allergies (Weckmann, 2011; Caldas, Carvalho, Lopes & Souza, 2019).



Design presentation to care centres

Research methodology

Wearer trials

In this research, two rounds of wearer trials were conducted with the focus group before the final prototype was manufactured. Each wearer trial lasted four weeks. As the residents were unable to respond to the research team with questions, the letters of consent were signed by their family members. After the end of each wearer trial, in-depth interviews with carers, nurses and the families of the subjects were conducted to obtain feedback and suggestions before producing the final prototype and giving it to each collaborating care centre. During the wearer trial, the carers and nurses recorded the pros and cons of the new design, and also the reaction and behaviour changes of the residents that they could observe in the wearer trials.

Totally more than 30 participants were involved in wearer trial and their age range was 40 – 85.



Figures showing the wearer trials on different designs

Dissemination and distribution of outcomes

Year	Details
Artefact	
2015-2017	Adoption of 500 sets of jumpsuits for more than 30 care centres in Hong Kong
Exhibition	
2018	Exhibition in the community (Hong Kong). January 2018
Online documentary/video	
2017	Anti-strip Jumper - Innovative and intimate apparel design for the people who need special care, Newsletter published by Innovation and Technology Commission (HKSAR)
2016	Anti-stripe Jumper: Integration of Design and Function. Youtube clip, published from Hong Kong Research Institute of Textile and Apparel. 18/10/2016
Knowledge sharing	
2018	Invited talk to care centres and hospitals (by TWGHs). Feb 2018
Book chapter	
2017	Invited chapter writing for Alzheimer's Community Support Centre, Full Life Day Care Centre for the Elderly, TWGHs
Newspaper report	
2016	New technology boosts safety and hygiene in Hong Kong's care homes, South China Morning Post. 30/10/2016
Evaluation report	
2017	Evaluation report and appreciation from the TWGHs

Dissemination and distribution of outcomes

Exhibition in the community (January 2018, TKO, Hong Kong)



Dissemination and distribution of outcomes

Invited knowledge sharing to care centres and hospitals (10 Feb 2018)

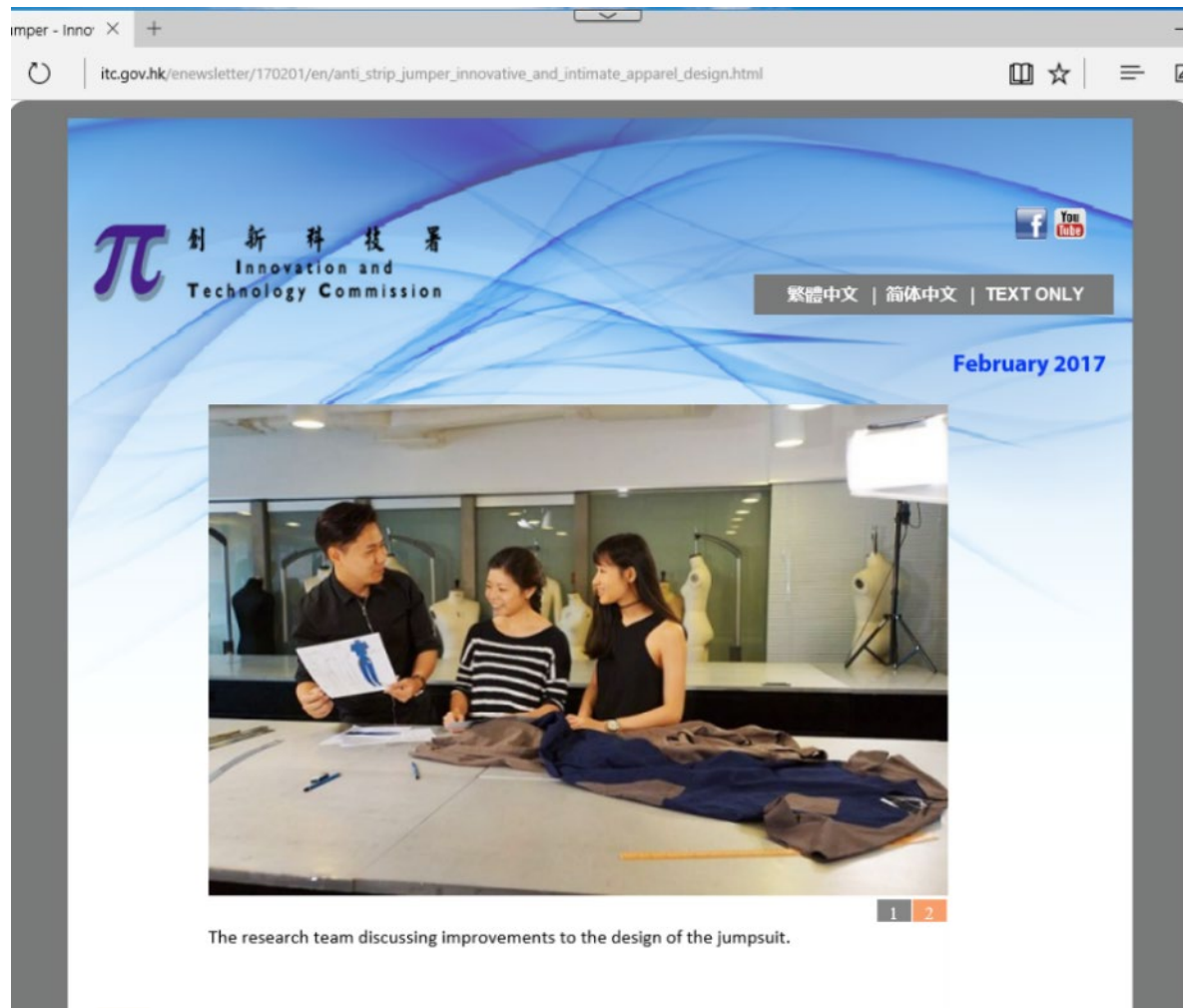


Dissemination and distribution of outcomes

Newsletter published by Innovation and Technology Commission (HKSAR) Feb 2017

Anti-strip Jumper - Innovative and intimate apparel design for the people who need special care

Link: https://www.itc.gov.hk/enewsletter/170201/en/anti_strip_jumper_innovative_and_intimate_apparel_design.html



Dissemination and distribution of outcomes

Newsletter published by Innovation and Technology Commission (HKSAR) Feb 2017

Anti-strip Jumper - Innovative and intimate apparel design for the people who need special care

(Captured from the website)

Innovative apparel designs, combined with unique capabilities and intimate care and concern, can benefit all sectors of society, including people with emotional or behavioural disorders who need special care. The "Anti-strip Jumper", recently developed by [The Hong Kong Research Institute of Textiles and Apparel](#) (HKRITA), is a good example. The new jumpsuit's thoughtful design is more comfortable than the previous attire and deters the wearers from removing their diapers at inappropriate times, thus improving their quality of life through better hygiene. At the same time, it gives caregivers in care centres more time to take care of their other needs.

The improved design of the "Anti-strip Jumper" developed by the research team includes mixing and matching different materials for a trendy style, thus getting rid of the labelling effect of traditional jumpsuits which look more like a medical uniform in terms of design and colour. Intensive testing for breathability, water resistance and breaking load was undertaken with a variety of fabrics, to withstand the rigorous demands of the laundry process in care centres whilst also addressing the issue of the sensitive skin of elderly patients. These tests ensured that the fabric used in the new jumpsuits would meet international standards for function and durability, and also be comfortable for the wearers.

Functional darts were incorporated into the jumpsuit design to better fit the 3D contours of the body, allowing a greater range of unrestricted movement for the wearer. A double layer of velcro and a stand collar design were found to act as an effective barrier to prevent the wearer from spontaneously removing their diapers. In order to provide easier dressing for patients with impaired mobility, a Velcro opening was added on one side of the shoulder position of the jumpsuit. In addition, a mesh panel was placed in the upper back area of the jumpsuit so as to increase the breathability of the whole garment.

Four centres under the Tung Wah Group of Hospitals were invited to take part in the project trial. The care homes participated in three wearer trials, each lasting two weeks, during the project period. After each trial, researchers collected opinions from caregivers to improve the design, comfort and functionality of the jumpsuits. The research results will also provide a comprehensive reference for similar organisations.

Established in April 2006 under the funding of the Innovation and Technology Commission of the HKSAR Government, HKRITA aims to provide a one-stop service for applied research, technology transfer and commercialisation, and to help facilitate the textile and clothing industries to enhance their high value-added manufacturing and servicing activities, helping to sharpen Hong Kong's competitive edge in the global textile market.

Dissemination and distribution of outcomes

Newspaper report: South China Morning Post. 30/10/2016

Title: New technology boosts safety and hygiene in Hong Kong's care homes

Dr Ho Chu-po with a pair of anti-strip overalls, which he designed. Photo: David Wong



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Link: <https://www.scmp.com/news/hong-kong/education-community/article/2041362/new-technology-boosts-safety-and-hygiene-hong>

Dissemination and distribution of outcomes

Youtube clip, published from Hong Kong Research Institute of Textile and Apparel. 18/10/2016

Topic: Anti-stripe Jumper: Integration of Design and Function



Video link: https://www.youtube.com/watch?v=typEeK_RY2w

Dissemination and distribution of outcomes

Book chapter (written in Chinese) (Publisher: Tung Wah Group of Hospitals)

In Hong Kong, many people suffer from varying degrees of cognitive impairment. The disease directly affects the ability to receive external signals, sometimes producing unusual responses. Patients, many of whom are older, are not aware of their strange reactions. In addition to cognitive problems, as they age, the physical condition of their bodies declines. Some of the elderly have damage to parts of their bodies, so they cannot do things that are normally simple. When so many effects are combined, such people cannot take care of daily actions themselves, such as dressing and eating. These patients thus require care from others. However, as described above, this places stress on those who take care of them (often the family members of the patient or the external medical staff).

The author has worked with day care centres at the Tung Wah Group of Hospitals to study and design uniforms to serve patients with cognitive impairment. From the study, we started with the use of cloth: to improve the size and fit of the jumpsuit, the research team designed various functional clothes for elderly patients. Some of the patients needed to remain in bed for long hours; others spent the majority of their time in a wheelchair. Some had behavioural disorders such as taking their own diapers; others were physically handicapped. Based on past experience and our observations of their daily lives, we can develop clothes that enable caregivers to more easily or more efficiently solve some of these daily life problems. Here, we will classify the patient's situation and then introduce some of the ideas.



Dissemination and distribution of outcomes

Book chapter (con't)

1. Taking off own diaper

Due to incontinence, some patients need to wear a diaper, but because of a loss of awareness or other reasons, some patients may take off or tear off their own diapers. Doing so makes them dirty. The anti-strip jumper can help resolve this problem. A one-piece jumper design is normally adopted to achieve this function (Figure 1): the caregiver can change the diaper for the patient by easily unzipping the jumpsuit. However, some designs cannot prevent the patient from taking off his or her diaper because the patient can also unzip the jumper easily. To solve this problem, we suggest that the caregiver can sew stronger Velcro at the end of the zipper or the hem level of the jumper: a patient cannot take off the Velcro easily. To reinforce this design, caregivers can attach another layer of Velcro for 'double protection' (Figure 2). As the two layers of Velcro attach to each other, the elderly may not be able to tear them off to find the zipper end in a short time because their hands are relatively weak and they are inflexible. In some cases, a small buckle can be added to the zipper end and attached to the pants. Even if the patient can remove the two layers of the Velcro barrier, his or her hands may not be flexible enough to open such a small buckle to unfasten the zipper.

In addition, some patients take off the diaper by putting their hands through the large openings of cuffs and necks. In the design of clothes, we can consider the size and shapes of the collar and cuffs and make sure that they are not too big. Furthermore, designing a small stand collar on the clothes can make the design look better and prevent the patient from inserting his or her hands.

2. Daily changing of clothes

Many caregivers found that some patients cannot lift their arms to dress or take off their clothes. This may be because the patient cannot successfully understand or follow instructions for 'arms up'. In other cases, it may be that the patient feels pain when moving his or her arms at such an angle. One of the easiest ways to solve this problem is to avoid using garments with front openings. For some pullover garments, the caregiver can cut the clothes on the sides and add buttons or zippers to attach the front and back together (Figure 3). Thus, even if the patient's arms are down, caregivers can easily help them change their clothes. This technique can also be used for pants. If the patient has difficulty lifting his or her legs, we can cut the pants through the two sideseams and then attach buttons or zippers on both sides of the pants. This will greatly reduce the inconvenience of the caregiver when changing patients' clothes.

Dissemination and distribution of outcomes

Book chapter (con't)

3. Material

Some patients may have skin problems. When they feel itchy, their temper worsens. This poor temper may affect the relationship between patients and caregivers. Therefore, in the choice of fabric, we should start with breathability. For patients who are often in bed or sitting in a wheelchair, use of mesh fabric in the right places, such as the back and underarms, is recommended. In addition, the choice of fabric should work with the temperature and humidity of the home centre to ensure sure the patient does not become hot easily. A patient experiencing heat may suffer from itchiness. Experience has shown that the right choice of a breathable fabric can remedy skin problems and improve patients' moods, making them calmer and more stable.

4. Colour

In the use of colour, caregivers can observe the preferences of the patient and pick the right colours and patterns for them. Caregivers should avoid using some bright colours because they may overstimulate the patient. Soft, natural colour tones are recommended.

Conclusion

Patients behave in their own ways in daily life, and one or two designs may not meet all daily needs. We may not easily find perfect designs for the market. Caregivers can thus make small modifications to existing clothes. With serious cases such as patients with particular behaviours, caregivers may need to obtain professional assistance to design suitable clothing.

Dissemination and distribution of outcomes

Evaluation report and appreciation from care centres

V. Feedback / Evaluation from User(s) *(to be completed by the user(s) / user organisation)(Note)*

(Note: the Project Coordinator should collect feedback from each user or user organisation who/which should each complete section V separately and enclosed with the report.)

1. Are you satisfied with the trial results delivered?
 - Satisfied
 - Not satisfied. Reasons: _____

2. Do you think that the project results / technology will bring benefits to the operation of your organisation(s)?
 - Yes → Go to Q3 and Q4
 - No → Go to Q5

3. In what area(s) do you think the project results / technology are of benefit to your organisation? (Please indicate by putting in 'x' to all applicable choices)
 - Improve production capability
 - Improve product quality
 - Improve service quality
 - Reduce production / product cost
 - Enhance job opportunities
 - Gain reputation from the industry
 - Process enhancement
 - Others (Please specify _____)

4. Are you willing to adopt the project results / technology if they are available in the market (e.g. through tender or procurement)?
 - Yes/Likely. Details of any plan to procure the service/product (if any):
To purchase anti-strip jumpsuits for more residents of residential care homes
 - Not sure. Reasons: _____
 - No/Unlikely. Reasons: _____

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5. Why do you consider the project results not useful to your organisation? (Please indicate by putting in 'x' to all applicable choices)

- The prototype or trial results/ technology are not delivered as expected
- The project results / technology are no longer relevant to the needs of my organisation (Reasons: _____)
- Not cost effective for my organisation to realise / make use of the results
- Others (Please specify _____)

6. Do you have any suggestions for further improving the project results / technology from a user's point of view?

- a) To use special material of clothing for those persons with skin problems.
- b) To design fashionable style for the mentally handicapped persons to increase their motivation to wear jumpsuit.
- c) To explore different design for persons with special needs, e.g. disorder in sensory integration.

7. How satisfied are you with the overall performance of the Project Coordinator or project team (e.g. in terms of management of the trial or assisting users to make use of project results / technology)?

The overall performance of the Project Co-ordinator and project team is excellent. They are very professional to identify our problems, propose alternate solutions and provide a variety of design of jumpsuit. Besides, they are very responsive to our feedback to make prompt improvement on the product. We found the jumpsuit very useful and helpful to the daily care to our frail elders/disabled persons.

(To be signed by user / representative of user organisation)

Signature: _____

Completed by
(Name / Post / Organisation):

HO Yuk-mei, Rosana
District Co-ordinator (KC/YTM/KT)
Tung Wah Group of Hospitals

Tel. No. / Email address: _____

2715 5933

Date of Completion: _____

27 July 2017

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Declaration

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