

ORIGINAL RESEARCH ARTICLE

Design features of work apparel for nannies' childcare tasks in families/households for sustainable child's health in Nigeria

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ABSTRACT

This paper describes the task-related apparel design features involved in developing prototypes for nannies. Clothes that are presently used in childcare tasks do not meet the users' needs for carrying out activities and tasks in families. This makes their tasks more cumbersome to perform, while comfort, health, and safety are not well guaranteed. Therefore, this work aims at identifying task-related design features and developing prototype nannies' work apparel that would facilitate babysitting tasks and minimize work hazards while ensuring the comfort, protection, and safety of children and users. A purposeful sampling technique was used to select 293 respondents. Questionnaires and body measurements were used to collect data and were analyzed with means, percentages, and Chi-square. Users were involved in the process of prototype development. The design was tested to assess its appropriateness and modified for final fitting.

Keywords: design features; work apparel; nannies; childcare tasks; sustainable child's health

1. Introduction

The family unit owes every infant or child the duties of adequate care, proper nutrition, love, and a good environment for required growth and development. This enables the child to grow and mature into a responsible and useful adult in society at large who can contribute to the future as a citizen. The United Nations Convention on the Rights of the Child^[1] states a child's right to include adequate care and love, play, protection, and early childhood education necessary for optimal development and wellbeing. These days, many women are at the forefront of the work force, either in the government, public sector, or self-employment or business, to lend support in meeting family needs and aspirations^[2,3]. Consequent upon this, the need arises for families to ensure their children are cared for while they work outside their home in order to meet their needs and demands. Therefore, the services of nannies are paramount to childcare when the parents are not readily available or at work to attend to and discharge the required care-giving tasks for the child at home.

A nanny is someone who takes care of infants or children in their homes when parents or any other person is readily unavailable for such care duties. A nanny is one that is employed by the family, either live-in or live-out, part-time or full-time based on circumstances, to undertake all tasks related to childcare^[4]. Their duties are generally restricted to babysitting/childcare, and other domestic tasks related to the care of children in a

ARTICLE INFO

Received: 7 November 2023 | Accepted: 7 December 2023 | Available online: 25 December 2023

CITATION

Azonuche JE, Akeni EJ, Okedi EA. Design features of work apparel for nannies' childcare tasks in families/households for sustainable child's health in Nigeria. *Sustainable Social Development* 2023; 1(3): 2370. doi: 10.54517/ssd.v1i3.2370

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family setting, while also helping to foster early child development. A nanny's primary and sometimes only function is limited to caring for the children in households^[5]. Childcare is focused on the ages 0–3 years for early childhood care; they learn family norms, practices, and values, as well as develop learning abilities in readiness for school^[6,7]. Nannies may or may not really have had any formal training, though legally they may have a fine deal of real-life experience, background, and special skills such as being bilingual. The basic job is to protect, love, and play with the child, provide a hygienic, stimulating environment, teach the infants/children in her care, and share her insight with the parents. Other childcare tasks include: to carry, curdle/pet, prepare their meals and feed them; train them in relation to talking; be respectful; toilet; and write; ensure the working environment is clean for the health, safety, and wellbeing of children and can take them to and from schools^[8–10]. Previously, nannies wore uniforms in historical practices, which are very rare in their present work activities of childcare giving and have far-reaching implications for both children and childcare workers.

To undertake childcare tasks, they move often within the house, in and out of the work environment, and are exposed to some work hazards based on the tasks performed. The conditions of serious work hazards can be ameliorated or prevented through the use of appropriate apparel that can protect against spills of liquid and dirt on clothes, dust particles, contamination and transmission of infectious diseases, and the transfer of heat from the body^[11,12]. Sustainable health is the right of the child in any family set up to live in society. Children should be raised in neat and clean childcare facilities, environments, and clothing, which, when neglected, can be detrimental to their wellbeing. Children's health is paramount to their optimal growth, development, and survival to meet Sustainable Development Goal 3: to promote good health and wellbeing for all ages. Nannies encounter challenges in garment usage that interfere with safety, the user's task accomplishment, and work productivity. Design features and styles in apparel to a great extent restrict body movements and postures, the absorption of moisture, and heat transfer from the body for conduction and temperature^[13]. Suitable clothing use in childcare tasks is paramount to the comfort, mobility, protection, health, and safety of the child and wearer. Clothes purposefully protect the wearers from weather conditions, give an aesthetic appearance, and express the wearer's roles^[14]. Although appropriate apparel design physically shows characteristic features and specific garment functions that allow freedom and match necessary mobility and postures when in use^[15,16].

2. Product design user needs

Apparel design approaches for functionality and appearance have consistently moved from “industry-need-driven to user –need-driven” not determined by the designer^[14]. In order to meet the needs of consumers in the clothing design process, a “user-centered or co-design” approach is adopted in some garment industries^[17]. In the product design process, knowledge of the user's needs, tasks, and working objects is a crucial starting point for garment development and production. This enables designers to obtain the main strengths and weaknesses of the object situation that are used to solve specific users' needs and meet and improve product standard^[18].

The conceptual framework used in this study was the functional, expressive, and aesthetic (FEA) need design process by Lamb and Kallal^[19] with emphasis on product functionality in mobility, protection during activity, and easy donning and doffing. In activity performance, the most crucial “values in functional apparel are the provision of comfort, safety, and protection for the user”^[20]. Environmental comfort and protection of the user during a task or activity, to an extent, determine efficiency and productivity at work.

3. User design need specification

The interaction matrix of functional specifications for neonates by Bergen et al.^[21], guided the inclusion of user-identified design features. The design criteria were cross-matched to assess conflicts. Any design specification that does not conflict is 1 and accommodated, while the one that does conflict is labeled 0 and considered unsafe. Specifications that conflict with others are labeled 2 and safe, viz., comfortable, safe, protective, accessible, and aesthetic.

Previous studies on women's garments in relation to function design include the sleep wear and lingerie needs of female breast cancer survivors, in which the prototypes incorporate functional design for comfort in seam placement in the surgery scare areas, torso, and neckline, using fabric that accommodates hot flashes resulting from chemotherapy^[22]. Another study on women's garments with environmental properties and functionality in terms of comfort, movement, fit, and protection^[23,24]. Another study shows a large pouch pocket, two cargo pockets on a loose garment, and a detachable belt as functional design features needed by natural disaster survivors^[25]. Sailors indicated a uniform with a fitted armhole and neckline that enable quick movements and postures without restriction in a confined workspace^[26]. Choi and Ashdown^[27] study shows the work clothing of female pear workers provides easy movement and comfort in standing posture with arms at a 90-degree angle and upward looking to enhance efficiency at work. Another study found that functional (fit and comfort) and aesthetic satisfaction are important to meet the apparel needs of tennis players^[28]. Agbo and Igbo^[29] found that garments for bedridden females or those with disabilities should be designed to allow independence, easy dressing and undressing, comfort, and use of limbs and torsos without restriction to the wearer^[30,31].

Han et al.^[32] found that hydrotherapy wet suits help to improve the rehabilitative health needs of the patients. Therefore, in order to facilitate the caregiving tasks of nannies for children, the use of appropriate clothing is very essential at the workplace. Though numerous studies have been done on the development of functional garments to meet users' needs, task-related design features in nannies work apparel for caregiving in childcare have not been studied in the product design industry or community and the need to develop such garments is yet to be considered. Hence, there is a need for design features in the work apparel of nannies for childcare tasks in families for a sustainable child's health. Specifically, the study identified the needs for nannies' work apparel, task-related design features perceived as necessary in nannies' work apparel for childcare, developed prototype clothing, and tested and modified prototype clothing.

4. User design need specification

The study was guided by these research questions:

- What are the identified needs for nannies' work apparel for childcare tasks in families?
- What are the task-related design features perceived as necessary in nannies' work apparel for childcare?

In addition, this hypothesis was proposed and tested at the 0.05 level of significance.

Hypothesis: There is no significant difference in the task-related design features in work apparel perceived as necessary between single and married nannies.

To achieve the purpose of the study, the research activities and development of the prototype include: product design user needs, focus group discussion, identifying task-related design features, development of prototype clothing, model testing, and modification.

5. Materials and methods

5.1. Focus group needs assessment discussion

A focus group of 10 people consisted of seven nannies and three parents selected by convenience sample. They were convened in one of the homes that had the facility characteristics. The interactive and discussion were carried out in a session. The focus group members were those who had at least 5 years of experience as nannies and parents of children in families. This is because they could help inform the necessary design features that would facilitate nannies' tasks on the job. Sketches of clothing were made available during the session to aid quick brainstorming and discussion of design features to be accommodated. This gave them the go-ahead to propose new and novel ideas that are not in conventional styles and designs. The discussion lasted for 1 h, all participants gave their consent and were fully involved. The researcher used open-ended and closed-ended questions as a guide for the participants to get their opinions. The discussion was on clothing challenges in performing tasks and desirable corresponding design features. Their opinions were sought regarding different functions, movements, protection, safety, and accessibility (donning and doffing).

5.2. Research instrument for data and analysis

A sample size of 293 respondents was selected by purposive sampling techniques from southern Nigeria. A structured questionnaire was developed from the focus group discussion, related literature review, and design purpose. The 22 items of the questionnaire were yes-or no options to get their opinions on the need for work apparel and task-related design features. Aldrich^[33] Standard Body Measurement Chart (SBMC) was adopted for taking body measurements and categorized sizes. The body measurements of participants were taken and categorized into small, medium, and large sizes. Five research assistants helped take the measurements. The data collected were analysed using percentage and chi-square with Statistical Package of Social Science (SPSS) version 18.0. Chi-square χ^2 statistical analysis $P < 0.05$ was rejected, and $P > 0.05$ was accepted.

6. Results

The mean was used to determine the average body measurement for the size categories. The mean of small size is bust = 84 cm, waist = 82.60 cm, and hip = 95.81 cm; medium size bust = 94.86 cm, waist = 86.45 cm, hip = 102.43 cm; and large size bust = 106.19 cm, waist = 96.00 cm, hip = 112.45 cm.

The results in **Table 1** showed nannies responses on the need for work apparel as follows: 88.6% to protect children from the spread of infections and diseases that can cause illness; 87.6% to keep nannies away from hazards and injuries; 86.6% to prevent restriction to movement and postures; 81.7% for safety at work and environment; 81.4% for comfort; 81% to protect nannies from liquid spills; 75.5% to increase efficiency in caregiving; and 72.8% to improve appearance. The indication is that nannies need work apparel to prevent the spread of infections and diseases, keep nannies away from hazards and injuries, prevent restriction of movement, for safety at work, comfort, protection from liquid splashes, increase task efficiency in caregiving, and improve their appearance.

The results in **Table 2** showed that 93.50% of respondents indicated a loose sleeve in the garment for arm stretching to receive children, and 94.70% indicated a loose hip and laps (loose garment) to allow postures when keeping children on beds and chairs. 93.50% indicated a large armhole in the garment for arm raising, 91.50% indicated a detachable cape or bib for putting children on the shoulder, 71.70% indicated a below-knee-length garment to allow postures and movement to change diapers and play with children, 88.70% indicated a short sleeve and low neckline to make beds, pets, and curdle babies, 87.50% indicated a detachable sleeve at the elbow point for toilet training, and 87.70% indicated a indicated a large pocket for care items.

The indication is that these apparel design features are perceived as necessary by nannies to facilitate childcare tasks.

Table 1. Percentage of responses of nannies on the need for work apparel.

S/n	Need for nannies' work apparel	Responses		Remarks	Rank
		F	%		
1	To improve appearance	211	72.8	Yes	8th
2	For comfort	236	81.4	Yes	5th
3	Protect nannies from liquid spills	235	81	Yes	6th
4	Protect children from spread of infections and diseases that can cause illness	257	88.6	Yes	1st
5	Safety at work and environment	237	81.7	Yes	4th
6	To increase efficiency in care giving	219	75.5	Yes	7th
7	Prevent restriction to movement and postures	251	86.6	Yes	3rd
8	Keep nannies away from hazards and injuries	254	87.6	Yes	2nd

Table 2. Percentage of responses of nannies on the necessary desirable design features.

S/n	Design features preferred for functional clothing based on tasks Caregivers tasks in the day care	Task-related design feature	Responses		Remarks rank
			F	%	
T1	Receive and give babies back to their parents	Loose sleeve	274	93.50	Yes
		Detachable sleeve	11	3.80	No
		Sleeveless	16	5.50	No
T2	Lay children down on the bed, while older ones are put on their chairs.	Loose shoulder, and hip (loose clothing)	274	93.50	Yes
		Tight shoulder and hip (tight clothing)	19	6.50	No
T3	Keep babies items/bags on wardrobe	Large armhole	273	93.20	Yes
		Small armhole	11	3.80	No
		Tight armhole	10	3.40	No
T4	Place children on the shoulder to pet them	Detachable cape/bib at the shoulder	268	91.50	Yes
		Non detachable cape at the shoulder	14	4.70	No
		No cape at the shoulder	11	3.80	No
T5	Place babies on the laps	Loose hip and laps	269	94.70	Yes
		Tight hips and laps	19	6.50	No
T6	Place children by the side while carrying them	Loose shoulder	266	90.80	Yes
		Tight shoulder	15	5.10	No
T7	Place babies at the back and front while carrying them	Detachable sailor collar (cape/bib)	260	88.70	Yes
		Fixed sailor collar	18	6.20	No
		No detachable sailor collar	15	5.10	No
T8	Giving the babies food	Loose garment	274	93.50	Yes
		Tight garment	14	4.70	No
T9	Rub babies back to burp after feeding	Detachable shoulder cape	250	85.30	Yes
		Fixed shoulder cape	26	8.90	No
		Bib	7	2.40	No
		No cape	10	3.40	No
T10	Curdle and pet babies to sleep	High neckline (3" from base of neck)	15	5.10	No
		Moderately low (4" from base of neck)	18	6.10	No
		Low neckline (5" from base of neck)	260	88.70	No
T11	Change wears, diapers and play with children	Loose garment above knee length	46	15.60	No
		Loose garment below knee length	210	71.70	Yes
		Tight garment below knee length	12	4.10	No
		Ankle garment	9	3.10	No
T12	Make baby's cot/bed	Garment that repels dirt	16	5.50	No
		Short sleeve	260	88.70	Yes
		Three quarter sleeve	18	6.20	No
T13	Give toilet training	Long sleeve	15	5.10	No
		Detachable sleeve at elbow point	256	87.50	Yes
		Detachable sleeve at shoulder point	22	7.50	No
T14	Carry children care items for easy reach and use	Sleeveless	19	6.50	No
		Large pockets	257	87.70	Yes
		Small pockets	19	6.50	No
		No pockets	17	5.80	No

N = 293, T = Task, F = Frequency, % = Percentage.

Hypothesis: There is no significant difference in the task-related design features in work apparel perceived as necessary between single and married nannies.

The result in **Table 3** shows there was no significant difference in the mean responses of single and married nannies on all the items. Probability values range from 0.110–0.982 greater than the 0.05 level of significance ($P > 0.05$). Hypotheses are not rejected. This implies that single and married women did not significantly differ in their desired design features of nannies' apparel based on tasks. This is because they carry out the same childcare tasks in families irrespective of status, but rather one of the apparel functions is to enable users perform tasks effectively.

Table 3. Percentage and Chi-square (χ^2) analysis of responses of single and married nannies on the mean rating of design features.

S/n	Design features preferred for functional clothing based on tasks		Single married		χ^2 value	Sig.	Remarks
	Caregivers tasks in the day care	Task-related design features	Yes	Yes			
T1	Receive and return baby back to their parents at closure	Loose sleeve	74	200	0.019	0.898	NS
T2	Lay children down on the bed, while older ones are placed on the chairs.	Loose shoulder, and hip (loose clothing)	73	201	0.875	0.350	NS
T3	Keep baby items/bags on wardrobe	Large armhole	75	198	0.542	0.462	NS
T4	Put baby on the shoulder to pet them	Detachable cape/bib at the shoulder	72	196	0.571	0.449	NS
T5	Putting baby on the laps	Loose hip and laps	74	195	0.389	0.533	NS
T6	Putting/carrying baby by the side torso	Loose shoulder	73	193	0.307	0.573	NS
T7	Carrying/putting baby on torso (back and front)	Detachable sailor collar (cape/bib)	70	190	0.103	0.749	NS
T8	Feeding the baby	Loose garment	75	199	0.052	0.819	NS
T9	Burping after feeding baby	Detachable shoulder cape	68	182	0.063	0.802	NS
T10	Curdling and petting baby to sleep.	Moderately low (4" from base of neck)	70	190	0.545	0.460	NS
T11	Changing clothing, diapers and playing with the baby	Loose garment below knee length	62	148	1.148	0.284	NS
T12	Making baby's cot/bed and cleaning work area	Short sleeve	72	188	1.183	0.277	NS
T13	Toilet training	Detachable sleeve at elbow point	72	184	2.059	0.151	NS
T14	Carrying baby's care items for easy reach	Large pockets	69	190	1.445	0.229	NS

N = 293, T = Task, F = Frequency, % = Percentage.

7. Discussion of findings

Finding from the result showed that nannies need work apparel to prevent the spread of infections and diseases, keep nannies away from hazards and injuries, prevents restriction of movement, for safety at work, comfort, protection from liquid splashes, increase task efficiency in care giving and improve their appearance. In consonance with this finding, Choi and Ashdown^[27], Thompson and Anyakoha^[34], Agbo and Igbo^[29] report that task-related clothing needs for female pear farmers, cosmetologists, and the disabled are directed towards users' enhancement of comfort, movement, safety, job efficiency, and attendance to daily duties and activities.

For the clothes to serve functional roles, needs assessment is important to enable designers to articulate design details into the apparel to meet its needs in task-related activities on the job. The comfort of users is important and highly needed in garment utility, usage, serviceability, and safety in the care of infants and children^[12,35,36]. This finding is in support of Merenstein and Gardner^[37] who stressed the effects of swaddling neonates in the intensive care unit for maximum comfort and survival. Children and infants in the care of nannies require adequate care, love, cuddling, and petting for comfort and survival. For hygiene and sanitation, a gown should be made with durable fabric that can withstand frequent washing and is not easily worn out. Chen et al.^[38] highlighted that clothing serves partially to satisfy the person's physiological and safety needs, that is, protection and comfort. These needs therefore culminated into the functional apparel design that allows easy movement and facilitate child care tasks performance in the child care tasks. This is because the garment does not have much style/design details that can affect movements or hinder the accomplishment of activities in the work environment.

Findings also showed that apparel design features perceived as necessary by nannies to facilitate child care tasks include a loose sleeve in the garment for arm stretching to receive children, loose garment with large armhole postures and arm raising, detachable cape/bib for putting children on shoulder, below-knee-length garment to allow movements to change diapers and play with children, short detachable sleeve at elbow point, and large pocket for care items, among others. Finding is in agreement with Han et al.^[32], McDonagh and Thomas^[39] report that users of functional products are in the best position to determine specific clothing designs that meet their needs in use and not producers of the products^[9]. Garment that is below the knee has a desirable shape and silhouette to enable easy posture and mobility^[40] as well as being fashionable and trendy with an appealing appearance. This study is similar to Honkanen et al.^[41] who identified garments with sewn soft pads in pull-up and wrap-round styles with Velcro fasteners to improve external hip protector adherence for the efficiency and comfort of caregivers and patients. Neat childcare stressed that uniforms are types of garments used for special occupations such as child care. Agbo and Igbo^[29] found that a shorter sleeve is appropriate for disabled wearers when using a wheelchair in motion to avoid entanglement of the garment. Detachable sleeves and bibs are easily removed after use to avoid contamination and the spread of infections and diseases. This agrees with the Mayo Clinic report that following sanitary procedures in caregiving prevents the spreading of infections, bacteria, and diseases through clothing that is being used for duties. The single and married nannies did not differ significantly in design features desired in work apparel based on their childcare tasks in the families.

8. Identification of design features and prototype development

The task-related design features needed were selected based on the data analysis from the survey. Items with the highest percentages were considered to have desirable design features. Pattern pieces were drafted. The necessary desirable design features are a loose garment below knee length, a short sleeve with a large armhole, a detachable sleeve at elbow point, a detachable cap/bib and large pockets.

The input responses of the users in relation to their needs are as follows:

- Loose-fitted apparel: The ease of the ease of the apparel design gives a better fit and safety to the child and user, avoiding injury during task performance. The fabric for the apparel was cotton made with an open seam, which is flat to the body in use. Apparel length was below knee to allow different movements, striding and postures in sitting, bending and torso twisting, to carry baby on laps, side and torso, sitting to feed and carry baby on the laps. Also bending to change diapers, play, make cot/bed, lay babies on bed and keep older children on chairs, as well as cleaning up any mess around the environment. Low neckline for comfort when petting and curdling the baby when crying or sleeping.

- Short sleeves: short sleeve with large armhole for arm stretch to receive and hand over children to parents, raising arm to lift and keep children's bags on shelf.
- Detachable sleeve: interlined with water-repellent fabric, attached to the shirt sleeve with Velcro at the elbow point, and finished with the cuff and the wrist. This is used when children want to poo-poo and during toilet training. The impermeable fabric protects the arm from liquid spillage. The user detaches the sleeve after each use for laundry.
- Detachable cape/bib: This is made with toweling or flannel fabric, interlined with water-repellent fabric. To carry babies on the shoulder, front, and back torsos, and also for burping after feeding. The fabric absorbs any liquid spills/vomits from belching and would not soil the garment due to the water-repellent fabric interlining. This prevents contamination and communicable disease from spreading between the baby and the nanny.
- Large pockets: Pockets are large, deep, shaped with elasticized hem as closure to prevent care items from falling off as shown in **Figure 1**. Carry small care items for easy access, such as powder, diapers, napkins, and cream, among others, when change is necessary.



Figure 1. Nanny's clothing design features.

9. Prototype testing and modeling

This was carried out in two phases:

Phase 1: Three models within the size categories of large, medium and small put on the apparel and perform some childcare tasks. This is to enable the assessment of movement/postures, protection, safety, accessibility (donning and doffing), utility and usage functionality in the preliminary testing as shown in **Figure 2**. Areas for modifications were identified and noted by the models and judges for modification.



Figure 2. Prototype testing.

Adjustment of garment:

- The neckline was widened for ease of donning and doffing over the head since the garment has no opening.
 - Pleats were adjusted at the knee point for movements/postures.
 - The pocket position was adjusted upward for accessibility.
 - Cape/bib were lengthened to accommodate the protection of the torso. The side tie string was changed to a strap with a Velcro fastener for ease of opening and closing without support or distraction to children.

Phase 2: Construction and assessment of the product

The modified apparel was constructed. The American Society for Textiles and Materials (ASTM F 1154) was adopted from Fowler^[42] to assess the task-related movements of users in caregiving such as bending, arm stretching, lifting up, carrying the baby, and toilet training. Sessions for task operations were recorded in a video, and data was analyzed. Results and reports from users showed that the garment accommodated necessary design features that are useful in task-related operations, as shown in **Figure 3**.



Figure 3. Model 1 of a joint model with modified link function.

10 Conclusion

A product for a special need particularly in the form of user-task-related-based design, is an important approach to user-directed and user-inclusive product development. It is of great importance that children in nanny care are healthy and not infected through poor hygiene or dirty clothing used in childcare tasks for sustainable health. Thus, this study affirmed that functional product design should fit the user's needs. This study has been able to ascertain desirable design features necessary for a nanny's task performance in childcare. $P > 0.05$ indicates that both the single and married nannies did not significantly differ in their desirable design features for tasks since they carried out the same tasks and functions. Since the product was perceived as appropriate, it can be introduced to the Ministry of Women Affairs, which is in charge of childcare outfits/homes and families.

Author contributions

Conceptualization, JEA and EJA; methodology, JEA, EJA and EAO; software, EAO; validation, JEA, EJA and EAO; formal analysis, JEA; investigation, EJA; resources, EAO; data curation, EJA; writing—original draft preparation, EAO; writing—review and editing, JEA; visualization, EAO; supervision, EAO;

project administration, JEA; funding acquisition, EJA. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare that they have no conflict of interest.

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