

AWARENESS AND CLOTHING SELECTION TO MITIGATE THE EFFECT OF ULTRAVIOLET LIGHT ON PRE-SCHOOL CHILDREN IN ESWATINI

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ABSTRACT

Sun protection has become crucial due to the effects of climate change that has resulted in effects such as extremely high temperatures. Early exposure of children to ultraviolet rays (UVR) makes them vulnerable to developing sun-related diseases later in life. Sun protection through clothing is the most affordable option to use for many people. The study assessed the awareness of sun protection for pre-school children among parents, and awareness of retailers about children's clothing with sun-protective finishes. This exploratory and descriptive study was conducted to describe the prevailing awareness of sun-protective clothing using a questionnaire that was hand-delivered by children to their parents. A target convenience sample was selected with 20 children in each of four pre-schools from the four administrative regions of Eswatini. A research assistant interviewed managers of purposefully selected retail outlets on whether managers are aware of clothing for children with sun-protective finishes. Results showed that a majority of parents were not aware of the need to protect their children against sun exposure. Those parents who were aware mainly used clothing as a preventative measure against sun exposure. Parents, who viewed sun exposure as a health hazard, were likely to be aware of sun-protective clothing and accessories. Thus, these parents generally selected garments made from light-coloured cotton fabric. Only one retail outlet stocked merchandise with specialised tags for sun-protective clothing. In conclusion, most parents were not aware of the effects of sun exposure and the hazards associated with prolonged exposure to the sun. Only one retail outlet stocked merchandise with sun-protective finishes. The recommendation is to introduce educational programmes in schools and for consumers on protecting children against sun exposure.

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INTRODUCTION

Sun protection has become more crucial than ever before due to the effects of climate-change that include extremely high temperatures. Global warming due to the depletion of the ozone layer not only has adverse effects on the climate, with ramifications on food security, but it also affects the health of people. Given that excessive sun exposure during childhood contributes towards the development of skin cancer, parents must apply measures to protect their children against the sun (Sümen & Öncel, 2018).

Children are in a dynamic state of growth and are believed to be susceptible to ultraviolet rays (UVR)-induced long-term harmful effects that are latent until later in adulthood. They experience moderate to high levels of sun exposure during their daily lives, especially whilst participating in outdoor activities (Al Robaee, 2010; Green, Wallingford & McBride, 2011). Although sun exposure is prevalent over a person's lifetime, prevention of excessive sun exposure during childhood ought to start early. Hence, children are dependent on their parents to ensure protection against sun exposure (Thoonen *et al*, 2019). Childhood is a critical time to form life-long prevention habits as attitudes and lifestyle patterns are still being formed, and children are most malleable during this period. Positive and negative preventive health behaviours are shaped in the family during the socialisation process at home, followed by the school and social environment (Thoonen *et al*, 2019). Hence, it is important to assess the awareness of parents on clothing choices for their pre-school children that would mitigate the effects of sun exposure, and explore whether retailers are aware of clothing with sun-protective finishes.

Creating awareness at an early age is successful if correct information and good habits are instilled (Sümen & Öncel, 2018). When awareness of a phenomenon is created during childhood, probability of adoption for required and beneficial behaviour is more likely to take place. Hence, when parents instil sun protection measures to their pre-school children, those habits will help mitigate the effects of sun-exposure on children and will be practised even at adulthood stage. There is no documentation of a study on sun protection of children in

Eswatini, and limited studies have been undertaken in Southern Africa yet high temperatures are becoming a challenge through climate change. Therefore, awareness on measures against sun exposure for children is crucial in mitigating the effects of the sun on humans generally, even at adulthood stage. Awareness of sun exposure may motivate educational institutions to offer instructional programmes on sun protection to increase awareness for the general public to take heed in protecting children against the sun.

LITERATURE

Literature to be reviewed will cover the effects of the sun on human skin, preventative measures against sun exposure, and studies on sun exposure of children and parents.

Effects of sun exposure on human skin

The skin is the human body's largest organ, with an area measuring 2 m² for an average adult and it comprises 15% of total adult body weight (Lawton, 2019). The skin is the body's first line of defence against sun radiation, heat, cold, trauma as well as toxic chemicals. The sun produces ultraviolet radiation, which can cause irreversible damage to the skin. Some results of this damage are premature skin ageing, wrinkling, skin cancer, moles, cataract and immune system diseases (Rahman & Ramachandran, 2015; Ray *et al*, 2020). Evidence suggests that behavioural and environmental factors, like outdoor activities without sun-protective measures, increase the incidence of skin damage from UV radiation (Green *et al*, 2011).

There are three types of UVR: ultraviolet A (UVA), ultraviolet B (UVB) and ultraviolet C (UVC). Ultraviolet rays from sunlight are an invisible form of radiation. The UVA penetrates the skin more deeply than UVB, while the latter penetrates the clouds, causes sunburn, and has the most impact between 10am and 4pm. The UVC is the most deadly to humans but fortunately it is absorbed by atmospheric gases before it reaches the earth's surface (Rahman & Ramachandran, 2015).

The cumulative effects of sun exposure weaken

the skin's elasticity resulting in sagging cheeks, deeper facial wrinkles, and skin discolouration later in life (The Skin Cancer Foundation, 2020). Young children are particularly vulnerable to the photo-carcinogenic effects of excessive sun exposure due to underdeveloped vital functions of the body, such as the immune system. Infants and children below ten years may be at an increased risk of retinal injury. The ultraviolet radiation can further contribute to the development of age-related cataract, photo dermatitis, and cancer of the skin around the eyes; thus, some 16 million people worldwide are currently blind as a result of cataracts as a contributory factor among other factors (The Skin Cancer Foundation, 2020).

With increased sun exposure during childhood, parents must take precautionary measures to protect their children against the sun in this period. Parental behaviour plays a crucial role in protecting children against solar radiation, particularly when parents serve as role models for their children (Sümen & Öncel, 2018). Protection of the skin against the sun can be done in several ways.

Preventative measures used against sun exposure

The extent to which one is exposed to the sun depends on several factors including length of exposure, time of day, geographic location, and weather conditions (Shiel, 2020). Prolonged exposure to the sun adversely affects the skin even when people are just after getting a skin tan. Furthermore, it is advisable to avoid sun exposure between 10 am to 4 pm because that is when the rays are most intense. People that live along the equator are most prone to sun burn due to longer days and high intensity of the sun. Sun protection could be through using sunscreen, wearing protective clothing and through avoiding high intensity of solar radiation (Ray *et al*, 2020).

Sunscreen is a cream or lotion which blocks out the burning rays of the sun. It has a combination of an organic compound that absorbs UVR and dissipates them in the form of heat and an inorganic compound that protect from UVR by reflecting them from a surface (Jindal *et al*, 2020). Its efficacy is measured by the amount of the sun-protective factor (SPF) in the product.

The SPF is a number on a scale for rating the degree of protection provided by sunscreen, and the number ranges from 2 to 100. Sun exposure in children could be reduced by sunscreens with an SPF greater than 30, and by limiting sun exposure time, particularly during the high-intensity peak sun hours of 10 am to 4 pm (Glenn *et al*, 2015). The use of sunscreen may perhaps be the more costly but commonly used method to avoid UVR in developed countries (Jindal *et al*, 2020).

Protective clothing is the least costly preventative measure that can be used to mitigate the effects of sun exposure. Sun-protective clothing includes: caps, hats, three-quarter or long-sleeved tops, three-quarter or long-legged apparel and full-body swimsuits (Dobbinson *et al*, 2011).

Protective clothing is made from textiles with physical, structural and chemical properties that assist in controlling the transmission of ultraviolet radiation. Ultraviolet rays on fabrics may be reflected to the source, absorbed into the fabric or transmitted through the fabric (Ray *et al*, 2020). The measurement of transmission of UVR through fabric is referred to as the ultraviolet protection factor (UPF), which indicates how much ultraviolet radiation (both UVB and UVA) penetrates the fabric to reach the skin (Ray *et al*, 2020). A UPF of 30 to 49 offers very good protection, while UPF of 50+ offers excellent protection; a value above 50 blocks 98% of the sunrays and allows only 2% to penetrate to the skin (The Skin Cancer Foundation, 2020).

Fibre composition has a bearing on the UPF. Synthetic fibres have a high UPF value due to their aromatic polymeric chemical structure compared to natural cellulosic fibres. Blends of synthetic and natural fibres perform better than using only cellulosic fibres. (Dubrovski, 2010). Greige cellulosic fabrics have a better UPF value than bleached ones due to the presence of the lignin and waxes in the natural fibre state (Ray *et al*, 2020).

Fabric structure has an equally critical factor in determining the UPF. Knitted fabric has lower UPF compared to woven fabric due to large interstices. Within woven structures, tightly woven, dense, thick, heavy and dark coloured

fabrics have a higher protection factor than loosely woven, thin and light weight and light-coloured fabrics. A UPF of 30 to 49 offers very good protection (Zuo *et al*, 2019).

In the dyeing and finishing processes, finishes are used to stabilise the dye molecules against ultraviolet radiation (Zuo *et al*, 2019). Dyes and fluorescent brighteners act as absorbers of UVR, thus increase the UPF on fabrics (Ray *et al*, 2020). Some finishes have ultra-violet absorbers, which are organic and inorganic substances used to selectively absorb solar radiation in the range of 280-400nm. A special inorganic finish of note is titanium dioxide that has improved sun protection achieved through reflection and scattering UV rays on the fabric surface (Bajaj, Kothari & Ghosh, 2000; Das, 2010).

Other preventive measures include the use of accessories like umbrellas, sunglasses and scarves. Some people also use specialized ultraviolet protective equipment including tents and pushchairs (Glenn *et al*, 2015). Avoiding the sun by using shades is another precautionary measure especially when the rays are intense between 10 am and 4 pm. Shades, from using an umbrella or standing under a tree, prevent direct exposure to sunlight, although the UVR can still reach the skin. Furthermore, using shades also reduces the heat effect of sunlight. Avoidance of sunlight as much as possible and use of protective shades are cost-effective measures for protection against UV rays (Jindal *et al*, 2020).

Studies on sun exposure of children and parents

Several studies on UV radiation have been conducted in developed countries (Dobbinson *et al*, 2011; Glenn *et al*, 2015; Green *et al*, 2011; Lingham *et al*, 2018 Littlehood & Greenfield, 2018; Welch, Chang & Taylor, 2016). Some of these studies are on sun-protective practices, sun exposure of children whose parents have skin cancer and intervention for parents to promote sun protection for pre-school children. In developing countries, particularly in Africa, very few studies have been conducted (Robinson, Rademaker & Sylvester, 2007; Vladimir & Bajie, 2002; Wright *et al*, 2014) to assess people's awareness of people of the

effects of the sun and how to protect themselves from UV radiation effectively, despite the fact that parts of the developing world, especially Africa, face some of the harshest hot temperatures.

According to Wright *et al* (2014), South Africa has a high incidence of skin cancer, followed by 11.5% of skin rashes and 5.5% of eye disorders due to the high number of sunshine hours per day. The prevalent ailments are the highest among white South Africans (Wright *et al*, 2014). Although skin cancer cases in the black African population may have not been a significant problem in the past given their dark coloured-skin (Black *et al*, 2001), recent data has recorded increasing cases of skin cancer among black South Africans who are HIV positive (Wright *et al*, 2014). There is a high prevalence of skin rashes, cataract, and itchy eyes among children in Africa, with cataract a leading cause of blindness in South Africa (Wright *et al*, 2014).

Based on limited studies in Southern Africa on sun protective clothing, most parents send their children to pre-schools with no direct protection from sun exposure. Hence, it is crucial for parents to be aware of the effects of the sun on the health of their children, and to ensure that children are protected. Given that children spend more time engaged in outside activities when parents are at work, are in a dynamic state of growth and are more susceptible to environment conditions than adults, what is the awareness of parents on the detrimental effects of the sun on pre-school children? What is the awareness level of retailers on children's wear that has sun protective finishes?

The aim of the study was to investigate the awareness of parents on sun protection of pre-school children and the awareness of retailers on clothing with sun-protective finishes sold in children's wear. The objectives of the study were to:

- i. Determine the parents' awareness and understanding of sun protection of children attending pre-school;
- ii. Identify the preventative measures used by parents to limit sun exposure of pre-school children;

- iii Determine the influential factors on awareness of health hazard associated with prolonged exposure of children to the sun.
- iv. Characterise the clothing selected by parents for sun protection of pre-school children, and determine the awareness of clothing with sun-protective finishes from retailers that stock children's wear.

METHODOLOGY

The limited research undertaken in Southern Africa means this study is exploratory and descriptive, reflecting the current status of variables, or where independent variables were not controlled (Creswell, 2014). Parents were to indicate their awareness of ultraviolet protective clothing for children and possible preventative measures that could be used to reduce sun exposure on children. A convenience sample of four pre-schools was selected in each of the four administrative regions (Hhohho, Manzini, Shiselweni and Lubombo) of the country, giving a total of 16 pre-schools. Pre-schools were the focus because of the vulnerability of children at that age as posited by Thoneen *et al* (2019). A convenience sample of 20 children in each pre-school was targeted for the study. The children were given a questionnaire to be hand-delivered to their parents for data collection, which would have given a total of 320 parents to complete the questionnaires.

Apart from a section requesting basic demographic information, the questionnaire had five major questions: awareness of sun-protective clothing and accessories; knowledge on preventative measures used against sun exposure; awareness of health hazards associated with prolonged exposure to the sun; clothing selected by parents for their children; and if parents purchased clothing with sun protective labels. There were also contingency open-ended questions to these major questions. The questionnaire was self-administered by parents to assess their awareness of UV protection on their pre-school children. Teachers were requested to follow-up with parents to improve the response rate. A response rate of 54.7% completed questionnaires was achieved, which was above the average response rate of 52.7 % for response rate on surveys targeted at

individuals as opposed to lower response rates received from organisations (Baruch & Holtom, 2008).

An interview guide used with retail managers had four questions on awareness of sun-protective clothing and accessories: if the shops stocked merchandise with sun-protective finishes; where such merchandise is procured from; and to indicate the price difference from ordinary merchandise. Store managers of five purposively selected departmental shops that sold children's wear in major cities were identified. The interviews were used to collect data on the managers' awareness of clothing with sun-protective finishes in the selected retail outlets. Retail outlets in the cities were selected to determine if managers were aware of whether stocked merchandise had sun-protective finishes. Interviews conducted by a research assistant with managers in outlets in the cities were done for convenience and with the knowledge that departmental stores also had branches in small towns, which meant that if the shop stocked clothing with sun-protective finishes, be it located in the city or small town, such merchandise would be available elsewhere if a customer wanted it. Data collected from only three retail outlets in two major cities in the country were eventually used in the study because managers from other retail outlets were not aware of clothing with sun protective finishes.

The STATA (2017) was used for the inferential statistical analysis to determine influential factors on awareness of parents to health hazards associated with prolonged exposure of children to the sun. A bivariate logistic regression model was conducted to measure the crude association between each independent variable and the awareness of Ultraviolet light. At this stage, the results were presented in terms of Odds Ratios (ORs) and 95% Confidence intervals (95% CIs). Finally, a multivariable logistic model was used to measure the adjusted odds ratios (AORs) along with their 95% CIs. All variables that were significant at $p \leq 0.05$ in the bivariate model were retained in the final model. The analysis was deemed to be significant when $p \leq 0.05$. Other data were analysed using frequencies and percentages, presented in tables or bar charts.

TABLE 1: DISTRIBUTION OF PARENTAL DEMOGRAPHIC INFORMATION (N=133)

Characteristics	n	%
Gender		
Males	37	27.8
Females	96	72.2
Total	133	100
Education		
Primary	16	12.0
Secondary (Grade 8-10)	20	15.0
High School (Grade 11-12)	39	29.3
Tertiary	58	43.6
Total	133	100
Region		
Hhohho	23	17.3
Manzini	31	23.3
Shiselweni	41	30.8
Lubombo	38	28.6
Total	133	100

% under education rounded to one decimal point

RESULTS AND DISCUSSION

Demographic information

From the 175 returned questionnaires, only 133 completed questionnaires were usable after data cleaning. Parents who responded to the questionnaire comprised mostly (72.2%) female parents seen in Table 1. The age range of the children who attended the pre-schools was from three to six years.

Parents with tertiary educational level were 43.6% of the sample size, which included the following three qualifications: a certificate, diploma or degree qualification. The results were not disaggregated according to regions. Some parents who were degree holders worked for industrial companies not situated in the regions with the major cities in the country, and the pre-schools of those companies were part of the sample of pre-schools selected.

Awareness of parents on sun protection for children

Parents were asked to indicate if they were aware of sun-protective clothing and accessories. Figure 1 shows that most parents from Lubombo region were not aware of sun-protective clothing (65.9%), closely followed by parents from the Shiselweni region (65.8%). Findings suggest that most parents in these two regions were not aware of protecting their

children against sun exposure. The region with the highest awareness among parents of sun-protective clothing was the Hhohho region (56.5%), followed by Manzini region (51.6%). The latter two regions have the two major cities in the country, which are Mbabane in the Hhohho region and Manzini in the Manzini region. From anecdotal information, the two regions have a number of recreational facilities where leisure activities like swimming are common. Some parents in these cities might be more likely to protect their children from sun exposure in those recreational facilities. Littlewood & Greenfield (2018) affirm that parents with increased awareness of protecting their children against the sun protect them more effectively.

On the contrary, unawareness of parents on sun-protective measures would increase the incidence of skin damage from ultraviolet radiation (Green *et al*, 2011). Accessories are unpacked under precautions used by parents against sun exposure.

Preventative measures used by parents to limit sun exposure of pre-school children

The subsequent question presented to parents was on what preventative measures they used to mitigate sun exposure on their pre-school children. From the 133 completed questionnaires only 57 parents (42.9%) responded on precautions used to limit the

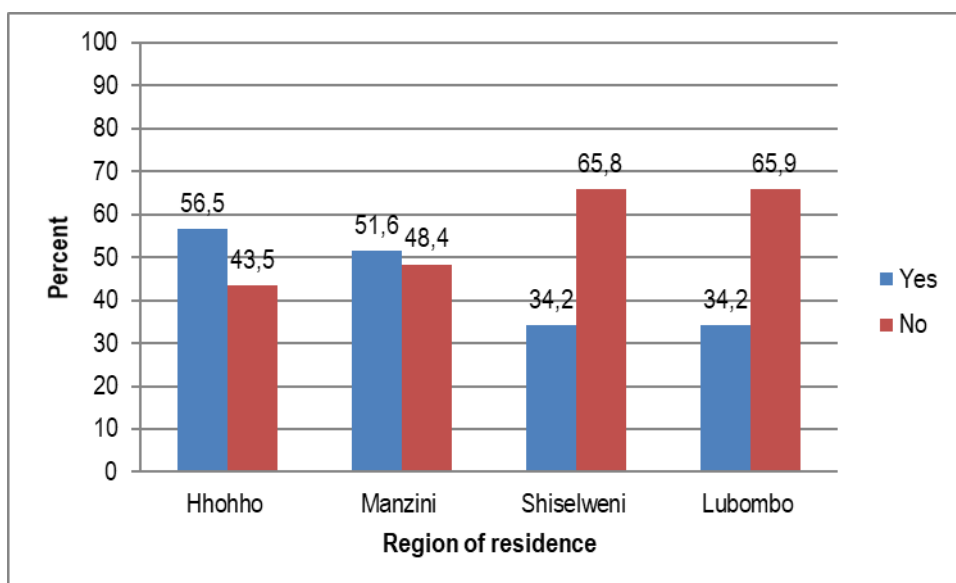


FIGURE 1: DISTRIBUTION OF PARENTS ON AWARENESS OF SUN-PROTECTIVE CLOTHING AND ACCESSORIES

exposure of children to the sun, as shown in Table 2. The low responses could be attributed to some parents underestimating the importance of the study. Thirty five parents (61.4%) out of the 57 parents that responded used clothing as a preventative measure to limit their children's exposure to the sun. The findings indicate that the use of clothing as a preventative measure was particularly prevalent in the Manzini region (68.8%) due to higher summer temperatures in this region compared to the Hhohho region (Thompson, 2019).

The use of accessories was the second most popular preventative measure used by the parents (26.7%). Accessories may be viewed as a luxury because they include things like scarfs, umbrellas, hats, caps and sunglasses. From the 57 parents who responded, 15 (26.3%) of the parents used accessories to mitigate sun exposure of their children, and 5 (8.8%) used sunscreen. When parents were asked to indicate accessories used by their pre-school children, responses were summarized to include hats, caps, sunglasses and umbrellas presented from the most mentioned to least mentioned accessory. In the Lubombo region, five out of the 15 preferred clothing accessories (hats) as a preventative measure. The high usage of hats in the Lubombo region could be due to the expense associated with other preventative measures. This region also has very high summer temperatures (Thompson 2019), which

rationalise the use of hats as a precautionary measure without incurring much expense, as supported by Dobbins *et al* (2011) who also found hats and caps to be the prevalent precautionary measures used that were inexpensive and presented sustainable ways of mitigating the effects of sun exposure.

Sunscreen use is another preventative measure that can be used to mitigate the effects of UV rays. Findings from the study show that five parents used sunscreen on their children. This could be attributed to unawareness of sunscreens for parents, lack of knowledge on the use of such products, and expensiveness of the product. Three of the five parents who used sunscreens on their children were from the Hhohho region, where the capital city is located. Overall, few parents used sunscreen as a preventative measure against sun exposure. Lower levels of sunscreen use on children was also found by Black *et al* (2001) with parents who applied sunscreens to their children that attended day-care only when swimming due to the high cost of purchasing the products. Findings of this study are contrary to the findings of Thoonen *et al* (2019) who investigated the relationship between sun safety behaviours of parents and children. They found that when comparing sun safety behaviours of parents and children, sunscreen appeared to be most frequently used, followed by wearing sun-protective clothing.

TABLE 2: PRECAUTIONS USED BY PARENTS AGAINST SUN EXPOSURE OF THEIR CHILDREN

Precautions taken to protect sun exposure against children	Hhohho n(%)	Manzini n(%)	Shiselweni n(%)	Lubombo n(%)	Total n(%)
Through clothing	6(46.2)	11(68.8)	8(61.5)	9(64.3)	35(61.4%)
Use of clothing accessories	3(23.1)	4(25.0)	3(23.1)	5(35.7)	15(26.3)
Use of sunscreen	3(23.1)	1(6.3)	1(7.7)	0	5(8.8)
Missing value	1(7.7)	0	1(7.7)	0	2(3.5)
Total (n)	13	16	14	14	57

TABLE 3: DISTRIBUTION OF RESPONSES ON UNDERSTANDING OF UPF N=133

Response	Frequency	Percentage
Correct explanation	9	6.8
Incorrect explanation	18	13.5
Did not know	30	22.6
No response	76	57.1

When parents were asked to indicate the type of sunscreen they used, four parents from Manzini and Hhohho regions used a variety of sunscreen lotions on their children. There were three commonly used sunscreen brands that were Sunscreen A, Sunscreen B, and Sunscreen C. Parents in the Hhohho region seemed to prefer Sunscreen B. In the Shiselweni region, one parent used the Sunscreen C product that was sold by a teacher in one of the primary schools that had a pre-school.

When participants were asked to indicate the SPF value of the sunscreen used by their children, all five parents indicated they used sunscreen with SPF value of between 15 and 30. The findings are below the recommendation by Glenn *et al* (2015) who recommends an SPF value of above 30 to effectively reduce the effects of sun exposure on children.

Parents' understanding of Ultra-violet Protective Factor (UPF)

The ultraviolet protection factor (UPF) is the measurement of transmission of UVR through fabric, which indicates how much ultraviolet radiation (both UVB and UVA) penetrates the fabric to reach the skin (Ray *et al*, 2020). When parents were asked what they understood UPF to be, results in Table 3, based on an open-ended question, were summarized into four categories, and they revealed a general lack of understanding of UPF. Only 9 (6.8%) of the parents understood what is UPF. From the rest of the parents, 57.1% did not respond to the

question, 22.6% did not know what is UPF and 13.5% gave an incorrect explanation.

All nine of these parents were aware of retailers that stocked merchandise with sun-protective finishes. They further indicated that such retail outlets were not in the country and the merchandise was expensive. As a result of the above, parents preferred other familiar sun-protective measures that were inexpensive. Only one parent had purchased a clothing item with a UPF value of 40, which was within the recommended UPF range of 30-49 that offers very good protection (The Skin Cancer Foundation, 2020). For the parent who had purchased clothing with a UPF value, she got it from a retail outlet in South Africa.

Awareness of parents on health hazards of sun exposure

Health hazards associated with prolonged sun exposure included eye soreness, headache, heat rash, sun-burn, skin cancer, dehydration, skin damage, flu, sight defect and blindness, wrinkling, moles, and immune system disorders (Rahman & Ramachandran, 2015; Ray *et al*, 2020). Figure 2 shows that 69 (51.9%) of parents were not aware of health hazards of sun exposure and 64 (48.1%) were aware. Parents who responded to the open ended question on what were the hazards indicated the following in a summary form from the most mentioned to least mentioned hazard, rashes, heat exhaustion, eye infection, sunburn, headaches, dermatitis, and excessive vitamin D.

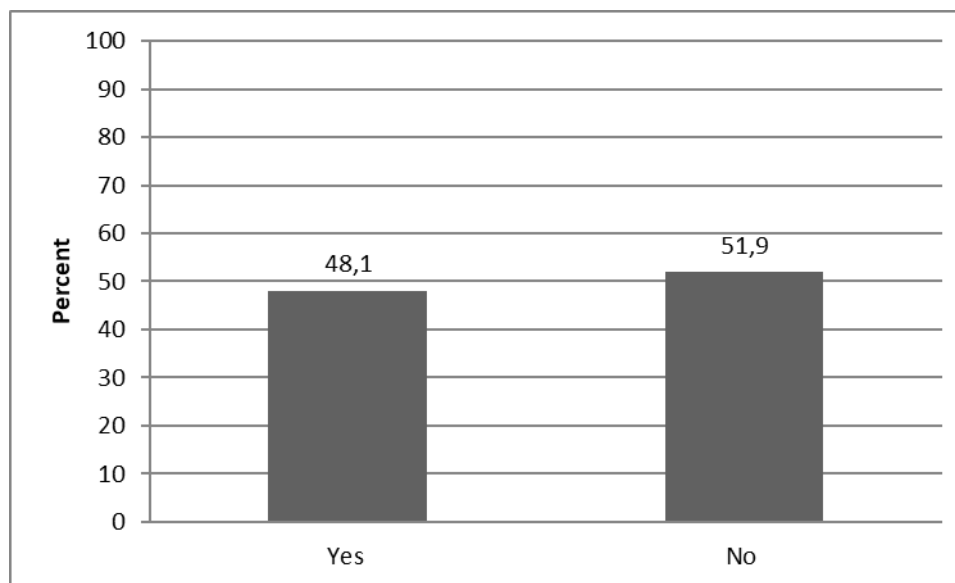


FIGURE 2: AWARENESS OF PARENTS ON HEALTH HAZARD OF THE SUN N=133

Determinants of parents' awareness of sun exposure as a health hazard

The bivariate and multivariate factors are shown in Table 4. In the bivariate models, the awareness of sun-protective clothing and accessories were significantly associated with the awareness of sun exposure as a health hazard at $p=0.001$. After controlling for other factors, awareness of sun-protective clothing and accessories was significantly associated with awareness of the sun as a health hazard. Parents that were not aware of sun-protective clothing and accessories were 75% less likely to be aware of sun exposure as a health hazard, (AOR=0.25; 95%CI: 0.12, 0.50) when compared to those that were aware of sun-protective clothing and accessories.

The likelihood of parents not using sun-protective clothing and accessories is indicative of lack of awareness of the risks inherent in exposing children to the sun. This notion is supported by Littlewood & Greenfield (2018) who stated that parents with greater awareness of the risks of sun exposure protect their children more effectively.

Types of clothing selected by parents for sun protection of children

Clothing selection bears a big role in protecting children against sun exposure. Parents were requested in an open-ended question to indicate

the types of clothing items they select for their children when going to school. Responses from parents were summarized and tallied in Table 5. The findings included clothing items and clothing descriptors that were listed by parents. From the results, parents predominately selected light coloured clothing for their pre-school children as shown by 13 out of 23 (56.5%) parents in the Hhohho region. A similar trend of selecting garments made from light coloured cotton clothing was observed for 16 out of 41 (39%) parents in the Shiselweni region, followed by 12 out of 38 (31.5%) parents in the Lubombo region, and lastly in the Manzini region indicated by 9 out of 31 (29%) parents. The result on the use of light coloured clothing by parents differs from Zuo *et al* (2019) who recommend tightly woven, dense, thick, heavy and dark coloured fabrics that have a higher protective factor than loosely woven, thin and light weight and light-coloured fabrics.

The next commonly selected clothing type was the full body covering cotton clothing which was indicated by 13 out of 31 (41.9%) parents in the Manzini region, followed by 13 out of 41 (31.7%) parents in the Shiselweni region and 12 out of 38 (31.6%) parents in Lubombo region. Body covering is one of the mitigating measures used to avoid high intensity of solar radiation (Ray *et al*, 2020).

TABLE 4: INFLUENCE OF INDEPENDENT VARIABLES ON AWARENESS OF HEALTH HAZARDS

Characteristics	COR (95%CI)	p-value	AOR(95%CI)	p-value
Gender				
Males	1			
Females	1.03(0.48,2.20)	0,94		
Mean Parent age	1.00(0.97,1.04)	0,819		
Parent educational level				
Primary	0.45(0.15,1.42)	0,174		
Secondary	0.51(0.18,1.42)	0,196		
High School	0.59(0.26, 1.33)	0,2		
Tertiary	1			
Region				
Hhohho	3.00(1.04,8.64)	0,043	2.44(0.80,7.48)	1,117
Manzini	2.34(0.90,6.10)	0,082	1.99(0.72,5.49)	0,182
Shiselweni	1.93(0.78,4.77)	0,155	2.07(0.80,5.39)	0,136
Lubombo	1		1	
Aware of sun-protective clothing and accessories				
Yes	1		1	
No	0.24(0.12,0.50)	<0.001	0.25(0.12,0.5)	<0.001

Notes: COR-crude odds ratio, AOR-adjusted odds ratio. Model fit=0.7055, p<0.05

TABLE 5: DISTRIBUTION OF CLOTHING TYPES SELECTED BY PARENTS FOR SUN PROTECTION OF PRE-SCHOOL CHILDREN

Region of parent's residence	Types of clothing	Frequencies
Hhohho (23)	Light coloured clothing	13
	Long-sleeved cotton clothing	6
	Trousers and t-shirts	3
	Long skirts and dresses	1
Manzini (31)	Cotton full body covering clothing	13
	Light coloured clothing	9
	Long-sleeved clothing	4
	Bright coloured clothing	2
	T-shirts and vests	3
Lubombo (38)	Cotton clothing	5
	Long-sleeved clothing	6
	Light coloured clothing	12
	Full body covering clothing	12
	Light weight clothing	2
	Vest	1
Shiselweni (41)	Light coloured clothing	16
	Full body covering clothing	12
	Bright coloured clothing	2
	Long-sleeved clothing	2
	T-shirts and long-sleeved shirts	5
	Heavy weight clothing	2
	No response	2

*n=133

Awareness of retailers that stock clothing with sun-protective finishes

Managers of three retail outlets were available for the interviews. The three managers when asked if they were aware of sun-protective

clothing with sun-protective finishes applied on fabric. All three interviewed store managers were aware of clothing for children with sun-protective finishes applied on the fabric. When managers were asked if the shop stocked such clothing in their stores? One manager stated

that “there were inquiries made by customers on whether the shop stocked such merchandise for infants with ages ranging from six months to one year, unfortunately the shop did not stock such clothing”. Another manager indicated that “customers were unaware of such clothing and did not request for such clothing items”. The unawareness or limited stock of sun-protective clothing in retail outlets by parents is a global problem, which was also reported by Black *et al* (2001) in a study done in the United States of America. Hence, there is a need for educating buyers of retail outlets to avail clothing with sun-protective finishes for consumers who want such garments and to stock enough of such apparel in the shops for customers who can afford.

The third manager stated that “the shop stocked merchandise with sun-protective finishes, which included children’s shirts and shirts for teens, young adults and adults”. She further stated that “such products were requested and bought by adults from the shop for their children”. Regarding where such merchandise is sourced, the manager indicated that “it is sourced from main branches or headquarters of the retail outlet in South Africa. From observations, the merchandise had specialised hang-tags that were clearly labelled as having sun protective finishes. On the pricing of the garments with sun-protective finishes, the third manager noted that “garments with sun-protective finishes were limited in stock and priced slightly higher by 25% than ordinary garments”.

CONCLUSION

With the prevailing climate change effects experienced globally, sun protection is imperative, particularly for children. Children have a higher vulnerability to detrimental effects of excessive sun exposure because they have sensitive skins. The findings of this study highlight the reality that many parents of children in pre-schools are not aware of the detrimental effects of sun exposure. This lack of awareness is further demonstrated by their lack of understanding of the UPF. The lack of knowledge on preventative measure towards sun exposure was common with most parents in all the regions of Eswatini.

The study also found that parents who were

aware of sun-protective clothing accessories related to the use of clothing as a sufficient preventative measure against sun exposure to mitigate health hazards posed by the sun radiation. Additionally, for those parents who were aware, they considered clothing made from cotton, light-coloured fabrics and full body covering clothing as the best form of sun protection. A few parents were aware of clothing items in shops that are specifically made with sun-protective finishes to protect children from sun radiation. Only one retail outlet sold clothing with sun-protective finishes applied on the fabric, and the garments were highly-priced. The study may be improved by disaggregating the data according to responses from urban and rural areas and including more questions in the questionnaire. Face to face interviews with parents may have improved the completeness of the questionnaire by clarifying terminology used.

RECOMMENDATIONS

There is need for awareness campaigns for parents to take the necessary precautions to mitigate the adverse effects of sun exposure for their children in pre-schools. The education sector needs to incorporate topics on sun protection in the curricula for teacher training and for learners in schools in order to improve the awareness. Inclusion of sun protection against UVR in the school curriculum is a necessity. Other sectors, like the health sector, need to have educational campaigns on the detrimental effects of the sun in order to caution the public about the effects of sun exposure. Retail outlets also need to cater for consumers who may want to purchase clothing with sun protective finishes, particularly with climate change patterns experienced these days. For further studies, replication of the study on awareness assessment of teachers at pre-school and primary school levels could be done and to investigate their sun-protective practices.

REFERENCES

- Al Robaee, A.A., 2010, Awareness to sun exposure and use of sunscreen by the general population, *Bosnian Journal of Basic Medical Sciences* 10(4), 314–318.
- Bajaj, P., Kothari, V.K., & Ghosh, S.B., 2000,

- Some innovations in UV protective clothing, *Indian Journal of Fibre & Textile Research* 25, 315-329.
- Baruch, Y., & Holtom, B.C., 2008, Survey response rate levels and trends in organisational research, *Human Relations* 61(8), 1139-1160.
- Black, C., Grise, K., Heitmeyer, J., & Readdick, C.A., 2001, Sun protection: Knowledge, attitude, and perceived behaviour of parents and observed dress of pre-school children, *Family and Consumer Sciences Research Journal* 30, 93-109.
- Creswell, J.W., 2014, *Research Design: Qualitative, Quantitative and Mixed Methods Approach*, Sage Publications, Washing DC.
- Das, B.R., 2010, UV radiation protective clothing, *The Open Textile Journal* 3, 14-21.
- Dobbinson, S., Wakefield, M., Hill, D, Girgis, A., Aitken, J.F., Beckmann, K., Reeder, A.I., Herd, N., Spittal, M.J., Fairthorne, A., & Bowles, K., 2011, Children's sun exposure and sun protection: Prevalence in Australia and related parental factors, *Journal of American Academy of Dermatology* 66(6), 938-947.
- Dubrovski, P.D., 2010, Woven fabrics and ultraviolet protection, in P.D. Dubrovski (ed.), *Woven Fabric Engineering*, pp. 273-296, InTech, Croatia.
- Glenn, B.A., Lin, T., Chang, C.L., Okada, A., Wong, W.K., Glanz, K., & Bastani, R., 2015, Sun protection practices and sun exposure among children with a parental history of melanoma, *Cancer Epidemiology, Biomarkers & Prevention* 24(1), 169-177.
- Green, A.C., Wallingford, S.C., & McBride, P., 2011, Childhood exposure to ultraviolet radiation and harmful skin effects: Epidemiological evidence, *Progress in Biophysics & Molecular Biology* 107(3), 349-355.
- Jindal, A.K., Gupta, A., Vinay, K., & Bishnoi, A., 2020, Sun exposure in children: Balancing the benefits and harms, *Indian Dermatology Online Journal* 11(1), 94-98.
- LAWTON, S., 2019, Skin 1: The structure and functions of the skin, viewed 27 August 2020, from [Nursingtimes.com.net/clinical-archives/dermatology](https://www.nursingtimes.com.net/clinical-archives/dermatology).
- Lingham, G., Milne, E., Cross, D., English, D.R., Johnston, R.S., Lucas, R.M., Yazar, S., & Mackey, D.A., 2018, Investigating the long-term impact of a childhood sun-exposure intervention, with a focus on eye health: protocol for the Kidskin-Young Adult Myopia Study, *British Medical Journal* 8, 1-5.
- Littlewood, Z., & Greenfield, S., 2018, Parents' knowledge, attitudes and beliefs regarding sun protection in children: A qualitative study, *Bio-Medical Central Public Health* 18, 207-218.
- Rahman, M., & Ramachandran, M., 2015, Emerging trends in textile industry-exploring ultraviolet radiation protection clothing, *International Journal on Textile Engineering and Processes* 1(4), 14-17.
- Ray, A., Singha, K., Pandit, P., & Maity, S., 2020, Advanced ultraviolet protective agents for textiles and clothing, in *Advances in Functional and Protective Textiles*, viewed 24 August 2020, from <https://doi.org/10.1016/B978-0-12-820257-9.00011-4>.
- Robinson, J.K., Rademaker, A.W., & Sylvester, J.H., 2007, Summer sun exposure: Knowledge, attitudes, and behaviour of Midwest adolescents, *Preventive Medicine* 86(4), 634-640.
- Shiel, W.C., 2020, Medical definition of SPF. WebMD LLC, viewed 14 April 2020, from [www//medicinenet.com/sun_damaged_skin_pictures_article.htm](http://www.medicinenet.com/sun_damaged_skin_pictures_article.htm).
- STATA version 15, 2017, *Statistical computer software*, Stata Corporation LLC, College Station, TX.
- Sümen, A., & Öncel, S., 2018, Development of sun protection behaviours in pre-schoolers: A systematic review, *Turkderm-Turk Arch Dermatology Venereology* 52, 56-63.
- The Skin Cancer Foundation, 2020, Sun protective clothing, viewed 20 February 2020, from [www//skincancer.org/skin_cancerprevention/sun_protection/sun-protective-clothing/](http://www.skincancer.org/skin_cancerprevention/sun_protection/sun-protective-clothing/).
- Thompson, C.F., 2019, *Eswatini business year book*, Christina Forsyth Thompson, Mbabane, Eswatini.
- Thoonen, K., Schneider, F., Candel, M., De Vries, H., & Van Osch, L., 2019, Childhood sun safety at different ages: Relations between parental sun, protection behaviour towards their child and children's own sun protection behaviour, *Biomed-Central Public Health* 19, 1044, viewed 6 May 2020, from doi:10.1186/S12889-019-7382-0.
- Vladimir, B., & Bajie, C., 2002, Contribution to skin cancer prevention in South Africa, *Australian Journal of Statistics* 31, 169-175.
- Welch, M., Chang, P., & Taylor, M.F., 2016, Photo-aging photography: Mothers' attitudes toward adopting skin-protective measures pre- and post-viewing photoaged images of their

child's facial sun damage, Sage Open 1-11 viewed 4 September 2020, from doi:10.1177/2158244016672906.

Wright, C.Y., Mundackal, A.J., Oosthuizen, M.A., & Albers, P.N., 2014, Towards sun-smart school policies in South Africa, South African Journal of

Science 110(9), 1-4.

Zuo, D., Liang, N., Xu, J., Chen, D., & Zhang, H., 2019, UV protection from cotton fabrics finished with boron and nitrogen co-doped carbon dots, Cellulose 26(6), 4205-4212.
