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Joseph J. Scott
University of Sunshine Coast

Robyn S. Johnston
Telethon Kids Institute

Natasha Bear
Natasha Bear Statistics

Sonia Gregory
Natasha Bear Statistics

Sally Blane
Cancer Council Western Australia

Mark Strickland
Cancer Council Western Australia

See next page for additional authors

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Joseph J. Scott, Robyn S. Johnston, Natasha Bear, Sonia Gregory, Sally Blane, Mark Strickland, Jill Darby, and Elin S. Gray

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Joseph J. Scott
University of Sunshine Coast
Robyn S. Johnston
Telethon Kids Institute
Edith Cowan University
Natasha Bear
Sonia Gregory
Natasha Bear Statistics
Sally Blane
Mark Strickland
Cancer Council Western Australia
Jill Darby
Elin Gray
Edith Cowan University

Abstract: Teachers are responsible for children at school during peak ultraviolet (UV) times of the day. It is paramount that teachers have knowledge and understanding of UV to effectively protect themselves and their students. The aim of this pilot study was to investigate the effect of a short intervention on preservice teachers' sun protective behaviours, knowledge and perceived skill to teach sun safety. Participants (n =161; median age=20 years) attended a 45-minute preservice teacher sun safety intervention and completed pre- and post-test surveys. Post-intervention, most participants indicated they felt: i) more informed about the dangers of UV and risks of developing skin cancer (93.3%); ii) more knowledgeable about the importance of sun protection (92%); and iii) more skilled to teach sun safety (87.4%). Our findings indicate that the targeted preservice teacher sun safety education intervention improved understandings of UV, effective sun-protective practices, and their perceived skills to teach sun safety.

Introduction

The prevention of skin cancer is a public health priority globally due to its high economic and social cost. In the United States (U.S.) alone the associated annual heath care costs are estimated at over 7 billion (USD) (Guy et al., 2015). In 2019, the American Institute for Cancer Research noted Australia as having the highest rate of skin cancer in the world (American Institute of Cancer Research [AICR], 2019) with the associated health burden costing over $900 million (AUD) per annum (Elliott et al., 2017). Melanoma skin cancer was responsible for over 2000 deaths in Australia in 2019 (AIHW, 2019). Research suggests that 95% of melanomas are caused by excessive sun exposure (Armstrong, 2004), and there is

general consensus in the literature that childhood ultraviolet radiation (UV) exposure is key in the development of melanoma and non-melanoma skin cancers in later life (Didona et al., 2018; Holman & Watson, 2013; Oliveria et al., 2006). Research suggests that 50% of total UV exposure up to age 60 occurs before the age of 20 (Green, Wallingford, et al., 2011). Moreover, primary school-aged children tend to spend more time outside than adolescents and are hence at particular risk of harmful UV exposure (Godar, 2005). Therefore, approaches that reduce childhood sun exposure can contribute significantly to reducing future rates of skin cancer in the Australian population.

Primary schools remain a particularly important location for sun safety education programs globally (Hart & DeMarco, 2008; United States Department of Health Human Services [USDHHS], 2014). Educating children on effective sun-protective behaviours and the dangers of UV radiation can positively influence their future sun-related behaviours and reduce their risk of developing skin cancers later in life (Cancer Council, 2015; Watts et al., 2018). Furthermore, establishing health behaviours during childhood increases the likelihood of them being maintained habitually long term (Hill & Dixon, 1999). School-based sun safety approaches can also be cost effective. For example, evaluation of the SunWise program in U.S. schools found that every dollar spent on the program produced two to four dollars' worth of societal benefits (Kyle et al., 2008).

Primary school teachers can play an important and influential role in child sun protection and other health behaviours (Speller et al., 2010). They are responsible for children during the part of the day when UV is at its highest, and, as part of a whole-school approach to sun safety, can potentially influence children's sun exposure at school through education, modelling and reinforcement (Nicholson, Hill, et al., 2019; Storey et al., 2016). Despite widespread sun safety education, individual levels of ultraviolet (UV) radiation exposure, the UV index, and the effect of UV on the skin are still poorly understood across the Australian population (Cancer Council, 2019). For example, many people believe they are at low risk from UV during overcast days or when the temperature is lower (Carter & Donovan, 2007; Heckman et al., 2019). In schools, ultraviolet radiation awareness and the sun protection practices used remain inconsistent (Dono et al., 2014; Dudley et al., 2017; Winslade et al., 2017). School policies that support staff to teach and model effective sun safety practices can influence student behaviours and also meet occupational health and safety requirements (Dadlani & Orlow, 2008), however, the number of schools who include classroom sun safety education in their written policies has declined between 2005 and 2016 as has the amount of sun protection taught in the curriculum of Australian schools (Hunkin et al., 2019).

Initial teacher education must provide preservice teachers with deep content knowledge and address skills gaps across all learning areas (Stephenson, 2018), including health education, to improve existing school-based health programs. Research has indicated that preservice training facilitates the development of positive attitudes to teaching health education (Byrne et al., 2012; Speller et al., 2010) and may facilitate PSTs becoming more involved in teaching health, particularly in the early years of their teaching career (Byrne et al., 2016; Byrne et al., 2018). Furthermore, trained teachers are likely to be more motivated to implement health programs more comprehensively (Barwood et al., 2016; Jourdan et al., 2008). School sun protection policies have been identified as more likely to be effective when supported by input from, and professional development for, teachers or other school staff who enforce the policy and deliver sun safety curriculum (USDHHS, 2014). Educating PSTs whilst at university prior to entering schools could be a potential opportunity to improve schools' approaches to sun protection, by facilitating classroom teaching on the UV Index and modelling of positive sun safe behaviours to students (Nicholson, Hill, et al., 2019; Storey et al., 2016).

Despite the important role school sun safety measures play in protecting Australian students, there is little evidence to suggest that all undergraduate primary preservice teachers (PSTs) are routinely trained to effectively teach sun safety. Studies of Australian PSTs level of understanding of UV and effective sun safety measures to protect themselves and young children are limited. One small study (n =30) provided anecdotal evidence to suggest that secondary PSTs knowledge about the UV Index is poor (Barwood & Jones, 2019). To the authors' knowledge, no other study has investigated primary PSTs knowledge or perceptions of UV and how this could potentially affect their sun protective practices for themselves and their students when teaching in primary schools. In addition, while sun safety education is potentially addressed within tertiary level teaching degrees across universities, the authors found no research evaluating targeted interventions for primary PSTs to increase understanding of UV radiation and effective sun protective measures for young children. Therefore, this exploratory pilot study aims to investigate the effect of a short intervention on PSTs sun protective behaviours, attitudes, perceived knowledge and understanding of UV and also their confidence and skills to be able to teach sun safety in primary school settings. The intention of exploratory pilot intervention was to test the feasibility of this approach prior to conducting a larger, multi-centre trial with control groups.

Methods

Participants

A convenience sample of 2nd and 4th year undergraduate PSTs enrolled in the Bachelor of Primary Education in 2019 at an Australian university were invited to participate in the study. A total of 275 provided written consent. Participants included in the analysis attended the intervention and provided pre- and post-test survey data (n =161). Table one provides demographic data of the sample.

	n	%
Preservice Teacher Participant Demographics		
Student year group		
2nd year student	130	80.7
4th year student	29	18.0
missing	2	1.3
Age (Mean: 23.21 years; Median:20 years)		
<24years	124	77.0
25-29years	19	11.8
30+years	18	11.2
Gender		
Males	30	18.6
Females	131	81.4
Country of Birth		
Australia	125	77.6
Other	36	22.4
Language spoken at home most frequently		
English	155	96.3
Other	6	3.7
Schooling in Australia		
Primary only	2	1.2
Secondary only	11	6.8
Both primary and secondary	138	85.7
Neither, I attended outside Australia	10	6.2

Table. 1: Demographic of sample (n= 161)

Intervention

The intervention comprised a 45-minute interactive educational workshop which focused on sun safety education, effective sun protection measures for primary aged children, school sun protection policies, availability of resources for teachers and the UV Index. The Social Cognitive Theory (SCT) (Bandura, 1986) and the Social Ecological Model (SEM) (Bronfenbrenner, 1977) were used to inform the design of the intervention. Specifically, the SCT was used to provide a framework to explore the interaction between PSTs tanning and sun behaviours, personal attitudes and environmental influences and the effect this may have on self-efficacy to teach sun safety. The SEM was used to assist in exploring social determinants that may influence the adoption of UV protective practices at individual (teachers and children) and organisational (schools), community levels.

Key content and strategies for inclusion in the intervention were identified in conjunction with staff from Cancer Council Western Australia (CCWA) and reinforced information in CCWA public education and health promotion campaigns for adults (18+ years) and primary aged children (5-12 years). CCWA is a part of a federation with Cancer Council organisations across Australia which aims to promote cancer control at a national level. The intervention was an interactive workshop where PSTs had the opportunity to observe, experiment with and evaluate different types of: sun protection measures/tools (different hat types, sunglasses, ways to seek shade when teaching outside, school uniforms and clothing), online UV indexes, weather forecasts and apps. Participants were also shown how to properly apply sunscreen and provided with strategies to teach children how to apply sunscreen in a school setting (also how much sunscreen should be applied and how often). Participants were involved in practical and theory-based activities to increase their knowledge and skills in interpreting UV and weather forecasts. Participants were also provided with skills-based health education strategies and teaching resources that are aligned to developmental sequences of learning (i.e. early years, lower and upper primary) to develop lifelong sun protective skills.

Content within the intervention focused on the impact teachers can have on children's sun protection behaviours; sun protection guidelines; effective sun protective measures for primary teachers and children (particularly clothing, hat, sunscreen and shade usage); dangers of skin tanning; misconceptions about UV, links between UV exposure and skin cancer, and school-based prevention of harmful UV exposure; goal setting to reduce future risks; UV index education in primary schools; strategies to effectively teach sun safety in primary schools; use of existing teacher resources; community support for primary school teachers and school sun safety policies. The intervention was delivered by staff from CCWA and incorporated practical demonstrations and participation by PSTs. The workshop was delivered six times across three different campuses of one university to accommodate all participants. The same CCWA staff members delivered all intervention sessions to ensure uniformity.

Assessment Tool

This study used the Preservice Teacher Sun Safety Survey (PSTSSS) which included previously validated questions from state and national surveys (Dobbinson & Tabbakh, 2016; Hollier & Pettigrew, 2015), plus questions added for this study that were specific to the attitudes, behaviours and experiences of preservice primary school teachers. The survey contained questions that explored participants' sun behaviours and perceived efficacy to teach sun safety in relation to the three components of the SCT: i) cognitive/personal factors

(knowledge/attitudes); ii) behavioural factors (skills/efficacy); and iii) environmental factors (influence on others) (Bandura, 1986). The PSTSSS took approximately 15 minutes to complete and included questions on: participants' demographics; frequency of sun-protective behaviour use; awareness and perceptions of UV; and self-perceived confidence and competence to teach sun safety. The PSTSSS was administered a second time (approximately 6 weeks after completion of the intervention) and also included additional questions about usefulness of the intervention. Responses were provided on a five-point Likert scale and ranged from "never (1)" to "everyday (5)" for behavioural frequency variables and from "1 = strongly disagree (1)" to "strongly agree (5)" for attitudinal variables. Question stems and responses are included in Tab. 2-6. Qualtrics (Utah, UT) software was used to create and administer the PSTSSS via QR code and website links.

Procedures

Approval to conduct this research was granted by the relevant University Human Research Ethics Committee (HREC22500). In March 2019, all 2nd and 4th Year undergraduate Bachelor of Primary Education PSTs were invited to attend an information session that provided a study overview and explained consent processes. Consenting PSTs were emailed a QR code and link to the PSTSSS (Qualtrics survey) which was completed immediately prior to the 45minute intervention. Six weeks after the intervention workshop, participants were emailed the post-test PSTSSS for completion. Six weeks was selected as the timeframe for post-test as this allowed time for PSTs to complete practicums and reflect on their personal experiences in primary schools and perceptions of the school's approach to sun safety. At post-test, non-respondents were followed up twice with emails that included the QR code and links to the relevant online survey.

Analysis

Survey data were downloaded from Qualtrics and analysed using IBM SPSS Statistics 25 (SPSS Inc. Chicago, IL) and Stata 14.1 (StataCorp, College Station, TX) software. Subjects with both pre- and post- scores were included in the analyses.. Data were described using frequencies and percentages, medians and interquartile ranges. Wilcoxon signed rank test are frequently used as a nonparametric test for paired data (e.g., consisting of pre- and post-data) (Rosner et al., 2006). Therefore, Wilcoxon signed-rank tests were used to assess differences from pre- to post-intervention, with alpha set at 0.05.

Results

Sample

Overall, 275 of the 555 eligible 2nd and 4th year education undergraduate students (49.5%) completed the pre-test survey and 161 (29%) completed both pre and post-test surveys. The final sample (n = 161) was relatively homogenous, most participants were: second year undergraduates (80.7%), aged 18-24yrs (77%), female (81.4%), born in Australia (77.6%) and attended both primary and secondary school in Australia (85.7%) (See Tab. 1).

Sun-Related Behaviours

There were no significant differences in participants' pre- and post-intervention perceptions on tanning in relation to feeling healthier with a tan (p >0.05), feeling better about themselves with a tan (p >0.05) or feeling more attractive with a tan (p >0.05). Following intervention, there was a significant reduction in agreement with the statement "I like attempting to get a tan" (p <0.01) and 20.2% of those who previously "agreed" with this statement, or were "neutral", changed to "disagree" (See Tab. 2). Participants reported no change in their behaviours regarding general sun protection (p >0.05) the utilisation of shade (p >0.05) or hat usage (p >0.05), however, participants reported they significantly increased their frequency of sunscreen usage following intervention (p <0.01) with 36.8% of those who reported wearing sunscreen "never", "rarely" or "sometimes" at pre-test changing to "often" or "everyday" at post-test (See Tab. 3).Following the intervention, participants reported they increased the frequency with which they checked the UV index (p <0.01) and used the index as a tool for sun protection. (p <0.01). Post-intervention, 54.5% of participants reported that they used the UV index as a tool to protect themselves from the sun "sometimes", "often" or "everyday" compared to 36.9% pre intervention (See Tab. 3). Similarly, participants reported there was a significant increase post-intervention in agreement that understanding the UV index is important (p <0.01) and that it is useful to assist in sun protection (p <0.01). Furthermore, there was also a significant improvement in self-reported understanding of the UV index post intervention (p <0.01) with 65.7% of those who previously did not agree that they understood the UV index subsequently reporting that they did (See Tab. 4).

Question	Time	Strongly disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly agree n (%)	Median (IQR)	Decreased	Same	Increased	change to agree[1]	change to disagree[2]	*p*
I like attempting to get a tan.	Pre	23 (14.7%)	29 (18.6%)	51 (32.7%)	39 (25.0%)	14 (9.0%)	3 (2 to 4)	43 (27.6%)	91 (58.3%)	22 (14.1%)	16 (15.5%)	21 (20.2%)	0.007
	Post	28 (17.9%)	39 (25.0%)	38 (24.4%)	43 (27.6%)	8 (5.1%)	3 (2 to 4)						
I feel healthier with a suntan.	Pre	23 (14.7%)	46 (29.5%)	41 (26.3%)	39 (25.0%)	7 (4.5%)	3 (2 to 4)	39 (25.0%)	80 (51.3%)	37 (23.7%)	20 (18.2%)	14 (16.1%)	0.949
	Post	26 (16.7%)	43 (27.6%)	36 (23.1%)	42 (26.9%)	9 (5.8%)	3 (2 to 4)						
I feel better about myself when I have a suntan	Pre	14 (9.0%)	27 (17.3%)	35 (22.4%)	53 (34.0%)	27 (17.3%)	4 (2 to 4)	41 (26.3%)	81 (51.9%)	34 (21.8%)	20 (26.3%)	16 (13.9%)	0.443
	Post	19 (12.2%)	24 (15.4%)	28 (17.9%)	63 (40.4%)	22 (14.1%)	4 (2 to 4)						
I feel more attractive to others when I have a suntan	Pre	13 (8.3%)	28 (17.9%)	41 (26.3%)	51 (32.7%)	23 (14.7%)	3 (2 to 4)	36 (23.1%)	80 (51.3%)	40 (25.6%)	23 (28.0%)	14 (12.2%)	0.685
	Post	17 (10.9%)	26 (16.7%)	28 (17.9%)	62 (39.7%)	23 (14.7%)	4 (2 to 4)						

[1] Change to agree = pre-recorded strongly disagree, disagree or neutral and changed post to agree or strongly agree

[2] Change to disagree = pre-recorded neutral, agree or strongly agree and changed post to disagree or strongly disagree

* Missing data (n =5)

Table. 2. Perceptions of Tanning Among Preservice Teachers (n= 156)*

Question	Time	Never n (%)	Rarely n (%)	Some times n (%)	Often n (%)	Everyday n (%)	Median (IQR)	Decreased	Same	Increased	Change to often/ everyday[1]	Change to rarely/ never[2]	*p*
I attempt to stay in the shade between 10am and 2pm	Pre	13 (8.4%)	22 (24.2%)	56 (36.1%)	52 (33.5%)	12 (7.7%)	3 (3 to 4)	39 (25.2%)	74 (47.7%)	42 (27.1%)	16 (17.6%)	18 (15.0%)	0.966
	Post	6 (3.9%)	36 (23.2%)	56 (36.1%)	45 (29.0%)	12 (7.7%)	3 (2 to 4)						
I use sun protection if outside for > 10 minutes	Pre	16 (10.3%)	42 (27.1%)	65 (41.9%)	26 (16.8%)	6 (3.9%)	3 (2 to 3)	38 (24.5%)	80 (51.6%)	37 (23.9%)	20 (16.3%)	20 (20.6%)	0.995
	Post	17 (11.0%)	48 (31.0%)	51 (32.9%)	29 (18.7%)	10 (6.5%)	3 (2 to 4)						
I wear sunscreen to protect myself from the sun	Pre	3 (1.9%)	17 (11.0%)	67 (43.2%)	56 (36.1%)	12 (7.7%)	3 (3 to 4)	23 (14.8%)	89 (57.4%)	43 (27.7%)	32 (36.8%)	10 (7.4%)	0.020
	Post	3 (1.9%)	19 (12.3%)	48 (31.0%)	70 (45.2%)	15 (9.7%)	4 (3 to 4)						
I wear a hat to protect myself from the sun	Pre	8 (5.2%)	35 (22.6%)	66 (42.6%)	40 (25.8%)	6 (3.9%)	3 (2 to 4)	38 (24.5%)	76 (49.0%)	41 (26.5%)	25 (22.9%)	18 (16.1%)	0.608
	Post	9 (5.8%)	37 (23.9%)	52 (33.5%)	49 (31.6%)	8 (5.2%)	3 (2 to 4)						
I check the UV index	Pre	44 (28.6%)	43 (27.9%)	43 (27.9%)	21 (13.6%)	3 (1.9%)	2 (1 to 3)	32 (20.8%)	70 (45.5%)	52 (33.8%)	17 (13.1%)	13 (19.4%)	0.014
	Post	36 (23.4%)	32 (20.8%)	56 (36.4%)	22 (14.3%)	8 (5.2%)	3 (2 to 3)						
I use the UV index as a tool to protect myself from the sun	Pre	50 (32.5%)	47 (30.5%)	41 (26.6%)	13 (8.4%)	3 (1.9%)	2 (1 to 3)	18 (11.7%)	75 (48.7%)	61 (39.6%)	27 (19.6%)	11 (19.3%)	< 0.001
	Post	34 (22.1%)	36 (23.4%)	45 (29.2%)	33 (21.4%)	6 (3.9%)	3 (2 to 4)						

[1] Change to often/everyday = pre-recorded never, rarely or sometimes and changed post to often or everyday
[2] Change to disagree = pre-recorded sometimes, often or everyday and changed post to never or rarely
*Missing data (n =6)

Table. 3: Sun Protection Behaviours Among Preservice Teachers (n =155)*

Question	Time	Strongly disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly agree n (%)	Median (IQR)	Decreased	Same	Increased	change to agree[1]	change to disagree[2]	*p*
I understand the UV index	Pre	1 (0.6%)	21 (13.6%)	45 (29.2%)	76 (49.4%)	11 (7.1%)	4 (3 to 4)	12 (7.8%)	77 (50.0%)	65 (42.2%)	44 (65.7%)	4 (3.0%)	<0.001
	Post	0 (0.0%)	10 (6.5%)	18 (11.7%)	94 (61.0%)	32 (20.8%)	4 (4 to 4)						
I feel that understanding UV index is important to properly protect myself from the sun	Pre	1 (0.6%)	4 (2.6%)	39 (25.3%)	84 (54.5%)	26 (16.9%)	4 (3 to 4)	18 (11.7%)	73 (47.4%)	63 (40.9%)	35 (79.5%)	1 (0.7%)	<0.001
	Post	0 (0.0%)	2 (1.3%)	11 (7.1%)	86 (55.8%)	55 (35.7%)	4 (4 to 5)						
I feel the UV index is useful to assist me to protect myself from the sun	Pre	2 (1.3%)	4 (2.6%)	29 (18.8%)	96 (62.3%)	23 (14.9%)	4 (4 to 4)	16 (10.4%)	74 (48.1%)	64 (41.6%)	28 (80.0%)	1 (0.7%)	<0.001
	Post	0 (0.0%)	2 (1.3%)	10 (6.5%)	86 (55.8%)	56 (36.4%)	4 (4 to 5)						

[1] Change to agree = pre-recorded strongly disagree, disagree or neutral and changed post to agree or strongly agree

[2] Change to disagree = pre-recorded neutral, agree or strongly agree and changed post to disagree or strongly disagree

*Missing data (n =7)

Table. 4: Perceptions of the UV Index Among Preservice Teachers (n = 154)*

Sun-related Perceived Knowledge and Skills

Post-intervention, there was a significant improvement in participants' perceptions of possessing both the knowledge (p <0.01) and skills (p <0.01) required to teach sun safety. Following the intervention, 77% of participants reported that they felt they had the knowledge to effectively teach sun safety in a primary school, compared to only 38.8% at baseline. Over two thirds (68.8%) of those who did not agree pre-intervention that they had the knowledge to teach sun safety, changed to "agree" or "strongly agree" post-intervention. Similarly, after completing the intervention 75.6% of participants reported that they felt they had the skills to competently teach sun safety in primary school, compared to only 42.7% at baseline. Nearly two thirds (65.5%) of participants who did not agree that they had the skills to teach sun safety at baseline changed to reporting they "agreed" or "strongly agreed" that they had the required skill after completing the intervention (See Tab. 5).

Perceptions of Sun-Protection in Schools

There was no significant change in participants' attitudes towards mandatory hat wearing by students in primary schools with the vast majority (over 90%) maintaining that it was warranted at both pre-and post-test (p >0.05). There was a significant increase in the proportion of participants who agreed, post-intervention, that staff should be required to wear hats when outside at school (p <0.05). A large proportion of participants maintained at both pre-intervention (80.3%) and post-intervention (82.3%; p >0.05) that it was the teachers' responsibility to make sure that students are properly protected from UV while at school. Similarly, there was almost unanimous agreement pre-test (96.7%) that it is important for teachers to understand sun safety well so that they can educate their students effectively, which increased to 100% (n=152; p >0.05) post intervention (See Tab. 5).

Participant Perceptions of the Intervention and Intentions to Change Sun Behaviours

Descriptive analyses revealed that after completing the preservice teacher sun safety intervention, the majority of participants indicated they: i) felt more informed about the risks of developing skin cancer (93.3%); ii) had more knowledge about the importance of sun protective behaviours (92%); iii) were now more confident (92%) and more skilled (87.4%) to teach sun safety (See Tab. 6). Post intervention, 82.2% of participants reported that after attending the sun safety education intervention they intended to change their sun protective behaviours to improve their level of personal sun protection.

Question	Time	Strongly disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly agree n (%)	Median (IQR)	Decreased	Same	Increased	change to agree[1]	change to disagree[2]	*p*
Staff should be required to wear hats while outside at school	Pre	2 (1.3%)	0 (0.0%)	7 (4.6%)	68 (44.7%)	75 (49.3%)	4 (4 to 5)	18 (11.8%)	100 (65.8%)	34 (22.4%)	8 (88.9%)	0 (0.0%)	0.023
	Post	0 (0.0%)	0 (0.0%)	5 (3.3%)	58 (38.2%)	89 (58.6%)	5 (4 to 5)						
I believe teachers are responsible for ensuring students are protected from UV	Pre	1 (0.7%)	2 (1.3%)	27 (17.8%)	86 (56.6%)	36 (23.7%)	4 (4 to 4)	35 (23.0%)	78 (51.3%)	39 (25.7%)	19 (63.3%)	1 (0.7%)	0.678
	Post	0 (0.0%)	1 (0.7%)	26 (17.1%)	91 (59.9%)	34 (22.4%)	4 (4 to 4)						
It's important that teachers understand sun safety well so that they can properly educate their students	Pre	2 (1.3%)	0 (0.0%)	3 (2.0%)	62 (40.8%)	85 (55.9%)	5 (5 to 5)	24 (15.8%)	100 (65.8%)	28 (18.4%)	5 (100.0%)	0 (0.0%)	0.544
	Post	0 (0.0%)	0 (0.0%)	0 (0.0%)	67 (44.1%)	85 (55.9%)	5 (5 to 5)						
I have the knowledge to teach sun safety in primary schools	Pre	2 (1.3%)	22 (14.5%)	69 (45.4%)	45 (29.6%)	14 (9.2%)	3 (3 to 4)	12 (7.9%)	61 (40.1%)	79 (52.0%)	64 (68.8%)	4 (3.1%)	<0.001
	Post	0 (0.0%)	7 (4.6%)	28 (18.4%)	88 (57.9%)	29 (19.1%)	4 (4 to 4)						
I have the skills to teach sun safety in primary schools	Pre	2 (1.3%)	21 (13.8%)	64 (42.1%)	54 (35.5%)	11 (7.2%)	3 (3 to 4)	9 (5.9%)	29 (19.1%)	114 (75.0%)	57 (65.5%)	4 (3.1%)	<0.001
	Post	0 (0.0%)	8 (5.3%)	29 (19.1%)	92 (60.5%)	23 (15.1%)	5 (5 to 5)						

[1] Change to agree = pre-recorded strongly disagree, disagree or neutral and changed post to agree or strongly agree
[2] Change to disagree = pre-recorded neutral, agree or strongly agree and changed post to disagree or strongly disagree
*Missing data (n=9)

Table. 5. Preservice Teachers' Perceptions of School-based Sun Safety (n =152)*

Question	Strongly disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly agree n (%)	Median (IQR)
I feel more informed about the risks of skin cancer after attending the intervention	0 (0.0%)	1 (0.7%)	9 (6.0%)	81 (53.6%)	60 (39.7%)	4 (4 to 5)
After attending the intervention, I have more knowledge about the importance of sun protective behaviour	0 (0.0%)	0 (0.0%)	12 (7.9%)	82 (54.3%)	57 (37.7%)	4 (4 to 5)
After attending the workshop, I feel that I am more confident to teach sun safety	0 (0.0%)	0 (0.0%)	12 (7.9%)	92 (60.9%)	47 (31.1%)	4 (4 to 5)
After attending the workshop, I feel that I am more skilled to be able to teach sun safety	0 (0.0%)	1 (0.7%)	18 (11.9%)	87 (57.6%)	45 (29.8%)	4 (4 to 5)
After attending the workshop, I feel I will start to change my behaviour to protect myself more from the sun	0 (0.0%)	4 (2.6%)	23 (15.2%)	86 (57.0%)	38 (25.2%)	4 (4 to 5)

*Missing data (n=10)

Table. 6: Participants Evaluation of the Preservice Teacher Sun Safety Intervention (n =151)*

Discussion

This study addresses a gap in the literature and aimed to investigate the effect of a brief intervention on primary PSTs sun protection behaviours, awareness of the dangers related to UV exposure, and perceived confidence and perceived competence to teach sun safety to primary-aged children. This exploratory pilot trialled the feasibility of this approach prior to conducting a larger, multi-centre trial with control groups. Participation in the intervention was associated with some reported positive changes in some sun related behaviours (tanning and sun protection) and increased perceived importance of teachers' understanding of UV. Furthermore, post-intervention, most participants felt more knowledgeable, skilled and confident to teach sun safety. Key findings are discussed below in relation to the literature.

Internationally, schools have been noted as a crucial location for skin cancer prevention (Guy et al., 2016). Demographic data of the sample indicates that most preservice teachers were in their second year of study, Australian born, spoke English at home and attended both primary and secondary schools in Australia. As SunSmart Schools commenced in WA in 1998 (Cancer Council, 2015), most participants were likely to have been exposed to similar sun safety and skin cancer prevention campaigns throughout their schooling years, however, this may not be the case at all universities. As preservice teachers may have attended primary and/or secondary school in a different country or at different times, and therefore had different exposure to skin cancer campaigns, it is important that tertiary programs cater for this and embed sun education into initial teacher education courses so that all graduates have the required knowledge and skills to properly protect themselves and their students when they enter schools on graduation.

In addition to PST training and education while at university, factors such as school ethos, senior leadership attitudes, mentoring support and ongoing training will influence PSTs attitudes and approaches to sun safety education once they begin teaching (Byrne et al., 2018). Further longitudinal research may provide insight into the relative effects of PST training and other factors influencing teachers' approaches to sun safety in the longer term. For example, prior research has indicated that students' and teachers' positive experiences with SunSmart programs in schools increase their motivations to implement sun safe practices (Wright, 2018). The majority of participants in this study felt it was important that teachers understand UV, model sun protective behaviours in schools and educate students on effective sun protection measures indicating an understanding that approaches that improve sun protection during childhood are likely to reduce future adult future skin cancer rates (Watts et al., 2018). Given this did not change between pre- and post-test, it could be a result of PSTs prior exposure to sun safety programs during their own schooling, as most participants attended primary and secondary school in Australia. PSTs from jurisdictions without Australia's long history of public sun safety education (Cancer Council, 2015) may have differing attitudes to sun safety education.

A previous study of 165 university students who frequently tanned, identified that participants' desire to tan was strongly influenced by feeling more 'attractive' or 'healthier' with a tan (Dennis et al., 2009). Many participants in the current study "agreed" or "strongly agreed" that they felt more attractive and healthier with a tan and the intervention did not statistically change this opinion. Addressing misconceptions about tanning remain an important focus for ongoing skin cancer prevention campaigns in Australia and elsewhere (Falzone et al., 2017; Perez et al., 2015). Clarifying PSTs misconceptions surrounding the dangers of tanning could potentially impact their personal behaviours and their future students.

Sunscreen was the most common form of sun protection among PSTs and its reported frequency of use increased post-intervention. This is an important finding as regular sunscreen use has been shown to significantly reduce the risk of developing cutaneous melanoma and non-melanoma skin cancers (Green, Williams, et al., 2011; Watts et al., 2018). Post intervention changes in shade and hat usage were however not significant. The most common response to sun protection questions relating to shade and hat and sunscreen use was that they are "sometimes" used, which supports existing research that although Australian adults are more vigilant with sun protection than children and adolescents, they remain complacent about daily use (Volkov & Dobbinson, 2011). Research has suggested that changes to school environments and mandatory hat use policies are likely needed if sun safety education programs are to facilitate changes in children's sun behaviours (Gage et al., 2018). Our findings indicate similar requirements and UV education for staff working to schools may also be warranted.

The 2016-2017 National Sun Protection Survey of 3,614 adults found that over 90% had a poor understanding of UV and the times during which sun protection was required. Approximately 40% of participants were confused about which weather factors cause sunburn (Dobbinson & Tabbakh, 2016). Our findings suggest that awareness and understanding of the UV index remain inconsistent among primary PSTs, however, post-intervention there were significant increases in understanding of the UV index, and in the use and perceived importance of the UV index as a sun protective tool. This suggests that education about UV radiation and effective use of the UV Index may facilitate behaviour change in PSTs, at least in the short term. This is important as intentions to change behaviours may potentially lead to improved personal sun protection approaches (Ajzen, 1991).

Existing research suggests that public education to improve understanding of the UV Index may be required before it can be a useful tool for sun protection, and that simply being aware of the UV Index is not sufficient to encourage its use (Italia & Rehfuess, 2011; Nicholson, Murphy, et al., 2019). Furthermore, individuals with limited understanding of the UV index are unlikely to use it effectively (Carter & Donovan, 2007). Increasing knowledge of UV and sun protection among students and other school community members has been a focus of many large scale studies (Bellamy, 2005; Jones et al., 2008; Littlewood & Greenfield, 2018), however, research focusing on increasing PSTs knowledge and awareness of UV remains sparse. Our findings suggest that a short intervention increased PSTs knowledge and understanding of UV and the UV index. This is an important contribution to the literature as primary teachers are remain crucial community members to deliver sun safety health promotion to children.

According to the SCT (Bandura, 1977) self-efficacy refers to a person's confidence to perform a behaviour. As self-efficacy is influenced by a person's social capabilities (learned experiences) and environmental factors, this intervention was designed to provide PST with the essential skills and knowledge to successfully protect themselves and their future students from harmful UV radiation. Our findings indicated that the short intervention had a positive effect on the three central interacting components of the SCT (Bandura, 1986): knowledge and attitudes (personal factors), skills and self-efficacy (behavioural factors) and influence on others (environmental factors). Increases in participants' self-efficacy were evidenced by increases in their perceived knowledge, skills and confidence to teach sun safety after the intervention in this study. Furthermore, over 80% reported that they intended changing their sun protective behaviours in the future after attending the intervention, however, it is important to note that brief interventions such as the current one, while useful in changing knowledge and eliciting short term behaviour change, may be insufficient to generate long term change in behaviour (Williams et al., 2013).

This study presents an initial exploratory evaluation of a novel approach to strengthening preservice teachers' approaches to sun safety education in schools. Strengths of the study include the evaluation of a sustainable intervention approach developed in partnership with Australia's leading national cancer-focussed organisation (Cancer Council). Secondly, this is the first study to attempt to impact sun-protective practices in Australian primary schools using a specialised sun safety education intervention with primary PSTs. Thirdly, survey questions were drawn from previously validated state and national surveys. While this study had noted strengths, there are some limitations that should be noted. Due to feasibility limitations, a convenience sample from one university was used and as this study was exploratory there was no control group. Therefore, we cannot be sure that changes in outcomes were due solely to the intervention. Furthermore, due to the distribution of our data, non-parametric techniques for data analysis were used. Findings from this exploratory pilot study will inform a larger planned study that uses samples from multiple universities and will involve a control group to determine the effectiveness of the intervention. The sample in this study was relatively homogeneous with regards to age and gender which may limit the generalisability of findings. A six week follow up timeframe was selected as this allowed time for PSTs to complete practicums and reflect on sun protection practices in primary schools. Findings may have differed slightly if the survey was administered immediately after the intervention. While n =275 participants provided written consent to be involved in the study, only n =161 completed the post intervention survey and were included in the analysis, therefore, findings may not be generalisable to the larger sample. Finally, there was the potential for reporting bias as self-report measures were used and participants may have provided responses, they felt to be more socially desirable.

Implications for Future Research and Practice

Internationally, school based sun safety programs have been shown to significantly reduce health care burden in relation to skin cancer (Kyle et al., 2008). The World Health Organization's Global School Health initiative seeks to mobilise and strengthen school health promotion and advises that school leaders and teachers play a crucial role in increasing awareness and changing behaviour among children (WHO, 2009) School settings remain an important location to disseminate sun safety programs and develop children's sun safe habits (Gritz et al., 2007). Therefore, interventions that increase teachers' knowledge, skills and confidence to teach sun safety in primary schools could potentially be a strategy to improve existing school-based programs and have important community-wide public health impacts. Research indicates that community-wide programs including education for all adults (including parent and teachers) are likely to be the most cost-effective method to achieve wide-spread change in sun protection behaviours in children (Buller & Borland, 1999).

Given primary teachers' critical role within the community to model effective sun protective behaviours and educate children about the dangers of harmful UV (Speller et al., 2010; Turner et al., 2014), PSTs may be a feasible and important group among which to focus future research and education to improve school-based approaches to sun protection. Specialised sun safety interventions for primary PSTs at tertiary level may provide an opportunity to increase knowledge of UV and effective sun protective measures before they enter schools to practice as a primary teacher, and in addition, encourage positive personal behaviour change in a group who are potential role models for of children.

Our findings indicate there is a need for further research to explore both pre- and in-service primary school teachers' ability to effectively teach sun safety. It is currently unknown what effect teachers' existing personal sun behaviours have on their ability to

effectively teach sun safe practices and hence this should be a focus of future research. Increasing teachers' knowledge of UV and effective sun protective measures for primary aged children is a potential strategy to create a more consistent school-based approach to sun safety. Further studies conducted with PSTs at a number of tertiary institutions, using a pre-post-test, control group design would allow more precise intervention effect analysis. Longitudinal approaches that assess whether the intervention influences sun safety teaching once PSTs enter the teaching workforce are also warranted to determine the effectiveness of such interventions in influencing teaching outcomes.

Conclusion

This exploratory pilot study revealed that a specially designed sun safety intervention for primary PSTs implemented at tertiary level raised awareness of UV, increased participants' knowledge of sun safety and perceived skill to be able to teach this in primary schools. Findings suggest that the short intervention had a positive effect on participants perceived knowledge, attitudes, skills and self-efficacy (personal and behavioural factors that influence health behaviour change according to the SCT). It is also important to note that findings also indicate that primary PSTs understandings of UV remain inconsistent and further UV and sun protection education may have the potential to increase knowledge, skills and understandings among primary PSTs. Addressing sun safety and UV education with PSTs while at university, before they enter schools to practice as primary school teachers could provide a feasible and sustainable strategy to improve future teachers' knowledge and understandings of the danger of harmful UV radiation and effective measures to protect and teach their future students.

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