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ARTICLE

Factors associated with photoprotection by body clothing coverage, particularly in non-summer months, among a New Zealand community sample.

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Clothing coverage is important for reducing skin cancer risk, but may also influence vitamin D sufficiency, so associated plausible predictors require investigation. Volunteers (18 to 85 years), with approximately equal numbers by sex and four ethnicity groups, were recruited in cities from two latitude bands: Auckland (36.9°S) and Dunedin (45.9°S). Baseline questionnaire, anthropometric and spectrophotometer skin colour data were collected and weather data obtained. Percent body coverage was calculated from eight week diary records. Potential independent predictors (unadjusted $p<0.25$) were included in adjusted models. Participants (n=506: Auckland n=334, Dunedin n=172; mean age 48.4 years) were 62.7% female and had a median body clothing coverage of 81.6% (IQR 9.3%). Dunedin was cooler, less windy and had lower UVI levels than Auckland. From the fully adjusted model, increased coverage occurred in non-summer months (despite adjusting for weather), among Dunedin residents and Asians (compared to Europeans), during the middle of the day, with a dose response effect observed for greater age. Reduced coverage was associated with Pacific ethnicity and greater time spent outdoors. Additionally, higher temperatures were associated with reduced coverage, whereas increased cloud cover and wind speed were associated with increased coverage. Although the only potentially modifiable factors associated with clothing coverage were the time period and time spent outdoors, knowledge of these and other associated factors is useful for the framing and targeting of health promotion messages to potentially influence clothing coverage, facilitate erythema avoidance and maintain vitamin D sufficiency.

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Introduction

The study of human behaviour related to solar ultraviolet radiation (UVR) exposure is important because of its potential health consequences. Exposure of the skin to sunlight initiates the endogenous production of vitamin D. This is the main source of vitamin D for most people.[1, 2] Vitamin D sufficiency is related to positive health outcomes, in particular, skeletal health.[3] Serum 25(OH)D_3 levels are strongly influenced by potentially modifiable behavioural factors, with the surface area of skin exposed being the single strongest contributor (27%) to the explained variance in serum 25(OH)D_3 among Australian adults.[4] Since time spent outdoors contributed far less (2%) to the explained variance in that study, the authors concluded that reducing clothing cover would be a more effective way to increase vitamin D levels than increasing the sun exposure time of habitually exposed areas of skin. However, this touches on health promotion recommendations about covering up with clothing – a practice that is promoted to help protect against the short term risk of erythema and longer term negative health outcome of skin cancer. Given this situation, it is informative to investigate body clothing coverage practices. Although summer weekend sun exposure, clothing practices and sunburn experiences among the NZ urban population are well documented,[5,6] we lack comparable information about clothing practices across all seasons. In particular, the summer 'shoulder months' of spring and autumn are potentially important periods, both for avoiding erythema and maintaining healthy vitamin D levels.[7]

In this paper, as part of a broader study of sun exposure and serum 25(OH)D_3 levels among 512 community volunteers,[8] aggregated personal diary records of body clothing coverage, including headwear, are reported for 8 weeks of follow up which, collectively, include all seasons. The main aims of this study were to: (1) describe variation in the percentage of total body clothing coverage by time period and interview centre, and 2) investigate which factors, from a range of plausible statistical predictors (demographic, personal and weather-related) are associated with the percentage of coverage reported. This information is potentially useful for the targeting of health education and health promotion interventions aimed at helping to maintain vitamin D sufficiency while avoiding harmful sun exposure, in particular, that which results in erythema and an increased risk of skin cancer – i.e. a balanced approach which follows existing NZ guidelines.[9]

Methods

Study sample

In 2008 and 2009, spanning mainly the southern hemisphere autumn, winter and spring seasons, community volunteers were recruited in the cities of Auckland (36.9°S) and Dunedin (45.9°S) for a study of sun exposure and serum 25(OH)D_3 levels, as fully described elsewhere.(8) Exclusion criteria included planning to take an overseas holiday during the 8 week follow up period. The aim was to recruit a wide age range (18 to >65 years) and approximately equal numbers from each of the four major NZ ethnic groups (European, Māori, Pacific, Asian).

Instruments

Questionnaire and anthropometric measures

At baseline interview, participants self-completed a questionnaire which provided demographic information on age, sex and self-defined ethnicity (ten Census options along with descriptions of other ethnicities recoded into four major population categories: European, Māori, Pacific and Asian). Three options for current employment status (unemployed, student, retired, house duties and 'other') were provided. Participation in outdoor work was recorded in response to the general question "In your job have you worked outdoors in the last 4 weeks?" with the respective number of hours per day and days per week categorised. Estimates of time spent outdoors in the past four weeks, overall, were also obtained. Attitudes to sun tanning were assessed using five Likert-like categories for six questions derived from the Triennial Sun Survey series and combined into an unweighted total Pro-Tan score with a maximum potential score of 30 (with higher values indicating more favourable attitudes towards tanning).[10] The Fitzpatrick classification [11] was modified to obtain information on skin reaction to sun exposure.[5] Height and weight were combined into Body Mass Index (BMI), where weight (kilograms) was divided by height (metres) squared. Skin colour was measured by reflectance using a Datacolor CHECK™ spectrophotometer and a calibration reference value. As an estimate of constitutive skin colour, measurements were carried out on the upper inner arm, midway between the axilla and medial epicondyle.

Clothing coverage diary

The clothing coverage diary was developed by refining instruments used for two earlier studies, one of young children[12] and another of outdoor workers.[13] In summary, it consisted of a seven day booklet with one page for each day of the week and each page subdivided into three time periods: before 1100, 1100-1600 (corresponding to the period during which UVR levels were most likely to reach the UVI value of ≥3 when protection is advised)(14) and after 1600. For each time period, the same range of clothing items was illustrated in diary columns for the head and face (3 columns), hands (1), upper and lower body (7) and feet (1 column), respectively. A body clothing coverage percentage for the three study time periods was calculated for each participant, based on the Lund and Browder adult chart which divides the body into units of surface area.[15] Although layering has the potential to reinforce a UVR barrier, only the total area of skin covered by any clothing was calculated and, where items overlapped, the score for that item which provided the greatest coverage area was used. Precise information on fabric type was not sought in order to avoid overburdening respondents for information of unknown validity.

Climatic and geographic data

Weather data, recorded on each hour at the measurement site nearest to the region where clothing diary information was reported, were sourced from the National Institute of Water and Atmospheric Research (NIWA) climate database (CliFlo). These data included the Ultraviolet Index (UVI),[16] mean air temperature (degrees Centigrade), cloud cover (octa), wind speed (kilometres per hour) and relative humidity (percentage). To facilitate linkage with study diary records, each measure was collapsed into three time periods, namely 0700-1059, 1100–1559 and 1600-1900 hours. Seasons were categorised by the blocks of calendar months officially used in NZ, and linked to the dissemination of sun exposure messages, namely spring (September to November, inclusive), summer (December to February), autumn (March to May) and winter (June to August).

Procedures

Participants were invited to attend an initial face to face interview during which baseline demographic and personal information was collected. The clothing diary for the first study week was issued during this interview, to be returned, completed, at the next scheduled weekly interview. This procedure with the clothing diary was continued each subsequent week for the 8 weeks' follow up of each participant. Ethical approval was granted by the Multi-Region Ethics Committee, Wellington (MEC/07/10/142).

Statistical analyses

For descriptive purposes only, mean total body coverage was calculated for each respondent over all of their study days for each of the three time periods. Linear mixed models using the coverage for each of the three periods for each day's data for each participant were used to identify associations with demographic, skin type, behaviour and weather variables (using the mean value for each weather variable for that period on that day). These models included random effects for participants and participant-days to accommodate these two levels of clustering. Potentially significant predictor variables with unadjusted $p<0.25$ were candidates for carrying forward into adjusted models of clothing coverage without ("partially adjusted") and with ("fully adjusted") weather variables. Standard regression diagnostics were checked including normality and homoscedasticity of residuals. Variance inflation factors were checked to detect any excessive correlations between independent variables using simplified models incorporating clustered (by person) Huber-White sandwich estimator-based standard errors. Stata 13.1 was used for all analyses with two-sided p<0.05 considered statistically significant in all cases.[17]

From the skin spectrophotometer output, two variables were recorded (ΔL* and Δa*), based on the mean of three measurements, representing the mean along the lightness-darkness and the yellow-blue axes, respectively. These values were used to calculate the Individual Typology Angle (ITA), which is indicative of skin colour (the higher the ITA value, the lighter the colour), according to the following formula:

$$°ITA = \tan^{-1}\left(\frac{L^{*}-50}{b^{*}}\right) \times \frac{180}{\pi}$$

ITA values were then classified into six skin colour categories.[18]

Results and Discussion

Of the 512 participants recruited, full demographic data were available for the 506 who constituted the present study (Table 1). Ethnicity and age group distributions were close to quota targets, but in each centre, and particularly Auckland, substantially more females than males were recruited. The mean age (standard deviation) was 48.4 (17.1) years at baseline and slightly older in Auckland (48.7) than Dunedin (47.9).

With respect to non-quota personal characteristics (Table 2), there was a statistically significant difference between the two interview centres in the Del Bino skin colour ITA category distributions. These differences were found using both the categorical and continuous variables, with Auckland participants being lighter than Dunedin participants. The only other statistically significant difference observed was that intentional sun bathing, undertaken at any time (i.e. whether on holiday or not), was more frequently reported by Auckland than Dunedin residents. There was no statistically significant difference between reporting sites in either non-work or total hours per week spent outdoors, with medians (IQRs) of 9.0 (14.0) and 10.0 (18) hours, respectively. Of the six Pro-Tan Attitude Score items, agreement (the strongly agree and agree categories were combined) was highest with respect to the perception that friends viewed a suntan positively (48%) and lowest for the intention to sunbathe regularly to get a tan (16%). When a total score was calculated from these six components, there was no statistically significant difference between the two interview centres. Pro-tan scores were mean imputed for respondents who provided at least five responses.

The distributions of the five weather variables for the 11am to 4pm period, by season and interview centre, are presented in Table 3. In each season, Dunedin was cooler, less windy and had a lower UVI than Auckland. The main outcome variable, the median of the individual mean percent body clothing coverage, overall, was 81.6% (IQR 9.3) and lower by between 4 and 5% in Auckland than Dunedin, depending on the time of day. Using values derived from the Lund and Browder chart, (15) the individual coverage data which contributed to the calculation of the overall median body clothing coverage (Table 4), typically, involved combinations of the following areas remaining exposed: the head (contributing up to 7% of total body area exposed, depending on head wear), neck (2%), hands (5%) and lower leg (14%). As an example, assuming maximum coverage for all other body areas in the chart, 86% total body coverage was recorded if only the head, neck and hands remained exposed. As a further example, if, in addition, the legs below the knee were exposed, total body coverage reduced to 72%.Of the non-weather related potential predictors of clothing coverage that reached the $p<0.25$ unadjusted statistical criterion for entry into the partially adjusted model, sex, Del Bino skin colour category and employment status failed to meet that criterion when adjusted for all of the other variables in the partially adjusted model (Table 5, column 3) and were, therefore, not carried forward to the fully adjusted model (column 4). The BMI per point variable and the Del Bino skin colour category variable were carried forward to the partially adjusted model in preference to the BMI categories and ITA per degree variables which had non-significant p-values. Only the BMI per point variable reached the criterion for entry into the fully adjusted model. The use of this variable also avoided the potential issues around ethnicity-specific BMI cut-points with the categorical version. The age category variable was chosen instead of age for the partially adjusted model as both had the same p-value ($p<0.001$), but the categories were more flexible in terms of the shape of the association. The variable 'total weekly hours outside' was chosen over the 'outside work' and 'daily hours outside excluding work' variables as it both demonstrated a lower p-value and is a more general indicator of time spent outdoors.

With the entry of the weather related potential predictors into the fully adjusted model, there was little or no alteration in the level of statistical significance demonstrated by any of the other variables brought forward. However, in addition, increasing temperature was associated with significantly reduced clothing coverage, whereas increasing cloud cover and wind speed were each associated with significantly increased clothing coverage. Relative humidity, which was significant in the unadjusted model, was no longer significant in the fully adjusted model and UVI level was not associated with clothing coverage in any of the analyses.

With respect to the demographic and personal factors remaining in the fully adjusted model, statistically significant greater percentage body clothing coverage was reported by Dunedin than Auckland residents; for all other seasons (winter, in particular) compared with summer; during the middle (i.e. high UVR) period of the day; by respondents of Asian ethnicity compared to European; and by older as compared with younger age groups (with a dose-response effect evident). Reduced body coverage was found among Pacific respondents; after 4pm; and by those who spent relatively less time per week outdoors.

Sensitivity analyses of the variable selection decisions described above found that neither weekly hours spent working outside nor weekly hours outside excluding work would have reached statistical significance in the fully adjusted model, respectively p=0.071 and p=0.339. As a further sensitivity analysis, when BMI was replaced with the BMI category in the fully adjusted model the conclusion already reached was not affected (BMI category p=0.350).

The findings in the present study supplement clothing coverage data reported from southern hemisphere summer weekend population surveys.[5,19] Our findings provide health relevant information because, in addition to summer months, at least during the NZ autumn and spring, solar UVR reaches levels that are capable of initiating endogenous vitamin D production as well as erythema in exposed skin.[7]

Plausible findings of the present study include that residents of the generally cooler, more southern interview centre (Dunedin) reported significantly greater clothing coverage than their counterparts interviewed in the generally warmer, northern centre (Auckland); that winter coverage was greatest, followed by autumn and spring; and that compared to younger participants those in the older age groups reported greater clothing coverage. With respect to these age differences, a similar pattern was reported for summer weekends in Victoria, Australia, where greater leg coverage was reported by the oldest age group,[19] In addition, we found that respondents of Pacific ethnicities wore less clothing coverage than Europeans, whereas those of Asian ethnicity wore the most, even when adjusted for climatic factors. While slightly lower coverage was observed amongst those of Māori ethnicity, this failed to differ significantly compared to those of European ethnicity. These results highlight some cultural differences in clothing practices.

Unlike three of the other identified weather factors (temperature, cloud cover and wind speed), the effect of UVR exposure is not immediately experienced, so it is hardly surprising that the ambient UVI level was unrelated to clothing coverage in this study, whereas the other weather factors (except for relative humidity in the adjusted model) were strongly associated with it. With respect to the association of increasing temperature with reduced clothing coverage, this is not only plausible but also consistent with the findings of studies undertaken during summer months. In Australia, reduced use of long sleeves and long leg coverage, among both adolescents and adults, were associated with higher temperatures.[19]

The only potentially readily modifiable variable to remain statistically significant in the fully adjusted model was total weekly hours spent outdoors. Time of day was also statistically significant and may allow an opportunity to reduce UVR exposure through scheduling events to a time with both lower UVR and greater clothing coverage. These present potential opportunities with respect to the modification of activities and clothing coverage practices, especially during peak UVR hours in the shoulder seasons. The other variables remaining significant in this final model were either non-modifiable demographic or climatic factors. However, these study results provide clear indications regarding the targeting of health related messages, and largely reinforce the conclusions of studies which have focused exclusively on summer months, in particular, that there is less clothing coverage among younger age groups - even controlling for all other factors. The apparently limited opportunities for behaviour modification reinforce the likely importance of focusing on settings where there is evidence for intervention success, for example, with skin cancer prevention programmes in workplaces,[20] and in multicomponent community-wide settings.[21]

In a related paper, based on the same study sample, it was concluded that serum vitamin D levels could be increased by regular, small exposures of less than 2 full body equivalent SEDs per week and that "greater exposures result in only small additional increases."[22] This finding is consistent with the practice of maintaining vigilance against erythema, and suggests that such vigilance is compatible with maintaining serum vitamin D levels through endogenous production during the southern hemisphere shoulder seasons. However, the challenge remains that, without some reliable external guidance, for example that provided by a dosimeter or feedback from reputable cellular telephone software, it is not simple to anticipate when erythema or vitamin D insufficiency may be a likely result.

Conclusions

This study reported clothing coverage, including in the NZ spring and autumn when the mean UVI between 11am – 4pm sometimes approached or exceeded 3 (the current trigger point for implementing sun protection recommendations in NZ), thereby indicating peaks above that level. With respect to maximising vitamin D production while minimising erythemal risk, a recommended strategy is to increase the area of skin exposed, but to reduce exposure time. In NZ during the shoulder months, given the relatively modest temperatures experienced and the already relatively small area of skin exposed (mean coverage being approximately 80% in Auckland and 85% in Dunedin), typically, this means that only the head and hands are exposed. Given the temperature range, the already high coverage and low likelihood of exposure of larger areas of skin and relative lack of opportunities, modest vitamin D supplementation is a strategy worthy of consideration, at least in the south of NZ, particularly between May and August.[9]

One potentially promising area for intervention is the possibility to compensate for the lack of physiological cues associated with increasing UVI, now that the technical ability exists to measure and communicate site specific UVI levels and personal risk levels, for example, via cellular telephone software applications and personal electronic dosimeters.[23-26]

Abbreviations

25(OH)D_3	25-Hydroxyvitamin D_3
BMI	Body Mass Index
IQR	Interquartile range
ITA	Individual Typology Angle
NZ	New Zealand
SED	Standard erythema dose
UVR	Ultraviolet radiation
UVI	Ultraviolet Index

Conflict of interest

The authors declare no conflicts of interest.

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Table 1 Interview year, baseline interview season and quota sample demographic characteristics [a] by interview centre.

Response category	All participants *n=506* Frequency	%	Auckland *n=334* Frequency	%	Dunedin *n=172* Frequency	%
Interview year						
2008	239	47.2	162	48.5	77	44.8
2009	267	52.8	172	51.5	95	55.2
Interview season [b]						
Autumn	173	34.2	105	31.4	68	39.5
Winter	180	35.6	128	38.3	52	30.2
Spring	113	22.3	70	21.0	43	25.0
Summer	40	7.9	31	9.3	9	5.2
Sex						
Male	189	37.4	118	35.3	71	41.3
Female	317	62.7	216	64.7	101	58.7
Age group (years, baseline)						
18 to 34	133	26.3	85	25.5	48	27.9
35 to 49	122	24.1	80	24.0	42	24.4
50 to 64	131	25.9	91	27.3	40	23.3
65 to 85	120	23.7	78	23.4	42	24.4
Ethnicity (prioritised)						
European	126	24.9	77	23.1	49	28.5
Māori	128	25.3	89	26.7	39	22.7
Pacific	123	24.3	84	25.2	39	22.7
Asian	129	25.5	84	25.2	45	26.2

[a] Demographic variables (sex, age group and ethnicity) by which participants were selected to address project quotas. [b] Using southern hemisphere calendar seasons autumn: March to May; winter: June to August; spring: September to November; and summer: December to February.

Table 2. Distribution of non-quota sample characteristics at baseline, by interview centre.

Variables assessed at baseline	All residents n = 506		Auckland n = 334		Dunedin n=172		
A. Categorical variables	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**p-value**
Weight status (BMI category)							0.606
Underweight (<18.5)	5	1.0	4	1.2	1	0.6	
Normal (18.5><25)	147	29.1	95	28.4	52	30.2	
Overweight (25><30)	142	28.1	89	26.7	53	30.8	
Obese (30+)	212	41.9	146	43.7	66	38.4	
Paid employment status							0.483
In paid employment	263	52.0	174	52.1	89	51.7	
Retired	110	21.7	68	20.4	42	24.4	
Not in paid employment	133	26.3	92	27.5	41	23.8	
Outdoor work							0.686
None (including unemployed)	438	86.6	286	85.6	152	88.4	
<20 hours/week	49	9.7	33	9.9	16	9.3	
20+ hours/week	16	3.2	12	3.6	4	2.3	
Some, but of unknown duration	3	0.6	3	0.9	0	0.0	
Self-reported skin reaction to sun exposure							0.159
Always burn, never tan	36	7.1	25	7.5	11	6.4	
Usually burn, tan with difficulty	49	9.7	32	9.6	17	9.9	
Sometimes burn, tan about average	177	35.1	127	38.1	50	29.1	
Rarely burn, tan with ease	243	48.1	149	44.7	94	54.7	
Missing data	*1*		*1*				
Del Bino ITA derived skin colour categories							0.024
Very light (≥55° to <90°)	88	17.4	68	20.4	20	11.6	
Light (≥41° to <55°)	216	42.7	131	39.2	85	49.4	
Intermediate (≥28° to <41°)	134	26.5	93	27.8	41	23.8	
Tanned (≥10° to <28°)	51	10.1	34	10.2	17	9.9	
Brown (≥-30° to <-10°)	16	3.2	8	2.4	8	4.7	
Dark (-90° to <-30°)	1	0.2	0	0.0	1	0.6	
Pro-tan Attitude Score items (agreement) [a]							
I feel more healthy with a suntan	455	47.0	302	46.4	153	48.4	
A suntan makes me feel more attractive	453	41.7	303	41.6	150	42.0	
I intend to sunbathe regularly to get a suntan	476	15.8	317	17.4	159	12.6	
Most of my friends think that a suntan is good	447	48.3	300	51.0	147	42.9	
A suntan makes me feel better about myself	471	42.5	314	43.0	157	41.4	
Most of my family think that a suntan is good	453	37.3	303	38.3	150	35.3	
Intentional sun bathing history last summer*							
Any	246	49.3	329	53.5	170	41.2	0.009
B. Continuous variables							
BMI							
Median (IQR)	506	28.3 (8.5)	334	28.7 (8.8)	172	27.6 (8.5)	0.364
Hours per week spent outdoors							
Non-work hours, median (IQR)	423	9.0 (14.0)	314	9.0 (14.0)	109	9.0 (21.0)	0.906
Total hours, median (IQR)	421	10.0 (18.0)	312	10.5 (15.0)	109	9.0 (21.0)	0.993
ITA upper inner arm							
Mean (SD)	506	43.1 (15.0)	334	44.1 (14.6)	172	41.3 (15.5)	0.046
Pro-tan attitude score (range 6-30)							
Mean (SD)	436	16.9 (6.5)	289	17.0 (6.6)	147	16.8 (6.3)	0.790

[a] For these binary measures, the frequency represents the total number of valid responses rather than the number expressing agreement. The difference between these values and the column totals reflects missing data.

Table 3. Weather variables 11am – 4pm with mean (SD) over all study days, by season and interview centre

	Auckland			Dunedin		
Variables by season	**Frequency**	**Mean**	**SD**	**Frequency**	**Mean**	**SD**
Autumn (March to May)	184 [a]			184 [a]		
Temperature (degrees centigrade)		18.5	3.2		13.3	4.0
Cloud (Octa)		4.5	2.0		5.5	2.2
Wind speed (km/hour)		19.2	8.1		13.8	7.3
Relative humidity (%)		67.0	11.0		68.7	11.4
UVI		2.8	1.6		1.8	1.3
Winter (June to August)	184 [a]			184 [a]		
Temperature (degrees centigrade)		13.6	1.8		9.2	2.5
Cloud (Octa)		4.8	2.2		5.0	1.9
Wind speed (km/hour)		21.4	9.9		13.2	7.0
Relative humidity (%)		75.2	9.4		69.7	13.2
UVI		1.2	0.5		0.7	0.4
Spring (September to November)	182 [a]			182 [a]		
Temperature (centigrade)		16.6	1.9		13.1	3.6
Cloud (Octa)		4.8	2.1		4.8	1.7
Wind speed (km/hour)		24.4	7.4		16.5	7.0
Relative humidity (%)		71.2	10.6		61.5	14.3
UVI		3.7	1.7		2.9	1.6
Summer (December to February):	50			53		
Temperature (centigrade)		21.4	2.0		14.3	2.4
Cloud (Octa)		4.6	1.8		5.5	2.1
Wind speed (km/hour)		22.3	6.4		14.9	4.2
Relative humidity (%)		67.1	12.1		76.2	11.7
UVI		5.8	2.2		4.1	2.0

[a] All possible dates over the two year period were included for these seasons.

Table 4. Median of individual mean clothing coverage, by time period and interview centre.

	All			Auckland			Dunedin		
	Frequency	**Median [a]**	**IQR**	**Frequency**	**Median [a]**	**IQR**	**Frequency**	**Median [a]**	**IQR**
Time period									
Before 11am	506	81.9	9.7	334	79.6	9.9	172	85.0	4.7
11am to 4pm	506	81.6	8.6	334	79.6	9.4	172	84.6	5.1
After 4pm	506	81.5	9.5	334	79.4	11.0	172	84.6	5.7
Total	506	81.6	9.3	334	79.6	10.2	172	84.8	4.8

[a] The mean coverage from all their study days was used for each participant to estimate their personal coverage and values shown are the median of these across all participants

Table 5 Variables associated with percentage total body clothing coverage (dependent variable): in unadjusted, partially adjusted and fully adjusted models.

	Unadjusted			Partially Adjusted [a]			Fully Adjusted [b]		
Variable	**Effect**	**95% CI**	***p***	**Effect**	**95% CI**	***p***	**Effect**	**95% CI**	***p***
City of residence			<0.001			<0.001			<0.001
Auckland	0.00			0.00			0.00		
Dunedin	4.93	3.80, 6.05		5.10	3.92, 6.27		3.49	2.40, 4.58	
Season			<0.001			<0.001			<0.001
Summer	0.00			0.00			0.00		
Autumn	3.05	2.48, 3.62		3.42	2.78, 4.08		2.72	2.08, 3.36	
Winter	5.17	4.59, 5.74		5.81	5.17, 6.44		4.32	3.68, 4.95	
Spring	3.04	2.49, 3.60		3.52	2.92, 4.12		2.59	1.99, 3.19	
Time of day			<0.001			<0.001			<0.001
Before 11am	0.00			0.00			0.00		
11am to 4pm	0.21	0.12, 0.30		0.29	0.19, 0.39		0.98	0.85, 1.10	
After 4pm	-0.25	-0.34, -0.16		-0.18	-0.28, -0.08		-0.13	-0.24, -0.03	
Ethnicity:			<0.001			<0.001			<0.001
European	0.00			0.00			0.00		
Māori	-0.36	-1.94, 1.21		-0.45	-2.07, 1.18		-0.30	-1.72, 1.13	
Pacific	-2.24	-3.84, -0.65		-2.14	-3.92, -0.36		-1.81	-3.23, -0.38	
Asian	1.39	-0.18, 2.97		1.57	-0.10, 3.23		1.80	0.45, 3.15	
Gender			0.200			0.307			
Male	0.00			0.00			—		
Female	-0.77	-1.95, 0.41		-0.55	-1.62, 0.51		—	—	—
Age (per 5 years)	0.48	0.32, 0.65	<0.001	—	—	—			
Age category (years)			<0.001			<0.001			<0.001
18 to 34	0.00			0.00			0.00		
35 to 49	0.71	-0.85, 2.27		1.33	-0.13, 2.79		1.14	-0.25, 2.53	
50 to 59	1.98	0.45, 3.51		2.03	0.63, 3.44		2.08	0.76, 3.41	
65 to 85	4.31	2.75, 5.88		3.77	2.27, 5.27		4.09	2.77, 5.40	
BMI (per point)	-0.10	-0.19, -0.01	0.026	-0.05	-0.14, 0.03	0.227	-0.06	-0.14, 0.02	0.133
BMI category:			0.066			—			
<18.5	0.12	-5.67, 5.91		—	—				
18.5 to <25	0.00			—					
25 to <30	-0.89	-2.39, 0.60		—	—				
≥30	-1.84	-3.20, -0.47		—	—				
Burns			0.314			—			
Always	-0.83	-3.11, 1.45		—	—				
Usually	-0.80	-2.80, 1.20		—	—				
Sometimes	-1.19	-2.45, 0.08		—	—				
Rarely (reference)	0.00			—					
ITA (per degree)	-0.04	-0.08, 0.00	0.056	—	—	—			
Del Bino categories:			0.015			0.521			—
Very light (≥55° to <90°)	-2.86	-4.46, 1.26		-1.25	-2.79, 0.29		—	—	
Light (≥41° to <55°)	0.00			0.00			—		
Intermediate (≥28° to <41°)	-1.04	-2.43, 0.36		-0.41	-1.67, 0.86		—	—	
Tanned (≥10° to <28°)	-0.63	-2.61, 1.34		-0.25	-2.03, 1.54		—	—	
Brown/Dark (≥-90° to <10°)	-1.04	-4.23, 2.15		-1.43	-4.31, 1.46		—	—	
Employment:			0.001						
Employed	0.00			0.00					
Not employed	1.84	0.71, 2.97		0.07	-1.16, 1.30	0.912	—	—	—
Outside work:			0.034			—			
No [c]	0.00			—					
Yes <20 hours	-1.71	-3.63, 0.21		—	—				
Yes 20+ hours	-3.36	-6.60, -0.11		—	—				
Weekly hrs outside/per hour [d]	-0.34	-0.74, 0.06	0.100	—	—	—			
Total weekly hrs outside per hr	-0.39	-0.72, -0.06	0.019	-0.34	-0.64, -0.03	0.032	-0.28	-0.54, -0.02	0.038
Pro-tan (per 6 points)	-0.32	-0.90, 0.26	0.276	—	—	—			
Weather variables									
UVI (per point)	0.00	-0.03, 0.03	0.990				—	—	—
Temperature (per 5°C)	-1.32	-1.43, -1.21	<0.001				-2.02	-2.18, -1.87	<0.001
Cloud (per okta)	0.13	0.10, 0.15	<0.001				0.14	0.11, 0.17	<0.001
Wind (per 5 kmh-1)	0.11	0.08, 0.15	<0.001				0.09	0.05, 0.13	<0.001
Relative humidity (per 10%)	0.14	0.09, 0.19	<0.001				-0.03	-0.10, 0.04	0.393

[a] Adjusted for all non-climate variables in this table.

[b] Adjusted for all variables in this table.

[c] Including the unemployed.

[d] Excluding work hours.

— in a cell indicates that a variable from the previous model or set of models was not included in that model either because of its *p*-value ($p>0.250$) or for the reason(s) described in the text when a variable needed to be chosen from among similar or related variables.

Short statement for Contents list

Clothing coverage was associated with season, latitude of residence, air temperature, cloud cover, wind speed, age, Pacific ethnicity and time spent outdoors, but not the Ultraviolet Index.