

Correcting Injunctive Norm Misperceptions Motivates Behavior Change: A Randomized Controlled Sun Protection Intervention

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Objective: Despite long-standing social psychological research supporting the influence of injunctive norms (i.e., what is commonly approved or disapproved) on behavior, support for this influence on health behaviors is limited. We examined the utility of correcting misperceptions of injunctive norms for improving sun protection and whether changes in attitudes mediated the injunctive norm-intention relationship. **Method:** At baseline 263 community residing primarily White women, aged 37 to 77 years, reported their beliefs about sun protection and tanning and their perceptions of “typical women’s” approval of sun protection versus tanning. Women underestimated approval of sun protection and overestimated approval of tanning. In a randomized trial, 189 of these women received either information about sun protection or information plus personalized normative feedback (PNF). PNF compared each woman’s own perceptions of typical women’s approval of tanning and sun protection with actual normative values, both measured at baseline. PNF communicated that most women approve of others who sun protect. **Results:** PNF led to more positive sun protection injunctive norms, attitudes, and intentions at immediate posttest and more positive intentions and self-reported behavior at 4-week follow-up. Baseline discrepancy between a woman’s beliefs and actual normative values related negatively to changes in sun protection in the control condition but positively in the PNF condition. As hypothesized, changes in attitudes partially mediated the influence of PNF on changes in intentions. **Conclusions:** The present research demonstrates the utility of correcting injunctive norm misperceptions for promoting healthy behaviors. That attitudes changed in response to PNF and mediated the norm-intention relationship suggests a method for influencing attitudes that may limit reactance.

Keywords: injunctive norms, personalized normative feedback, intervention, attitudes, sun protection

Research supporting the influence of social norms on attitudes and behaviors has a long-standing history in social psychology (Sherif, 1936). Cialdini (Cialdini, Reno, & Kallgren, 1990; Cialdini & Trost, 1998) distinguished between two types of norms—descriptive norms, capturing how most others behave in a given situation, and injunctive norms, reflecting what is approved or disapproved by society. Descriptive norms powerfully influence behavior, potentially leading individuals to increase health risk behaviors to comply with descriptive norms (Wechsler et al., 2003). Possibly due to the weak relationship of injunctive norms to intentions in models of health behavior (Armitage & Conner, 2001), research has focused heavily on descriptive, rather than

injunctive, norms for influencing health behaviors. That descriptive norms can have deleterious effects on health behavior has led to calls for increased utilization of injunctive norms for behavior change (Blanton, Köblitz, & McCaul, 2008; Prentice, 2008). Further, work by Reno, Cialdini, and Kallgren (1993) suggests that the influence of injunctive norms reaches beyond the environment in which the norm is activated, whereas descriptive norms are context dependent.

Social norms theory forms the basis for much research applying norms to health behavior change (Reid, Cialdini, & Aiken, 2010). According to the theory, prevalence and approval are typically overestimated for risky behaviors, but underestimated for protective behaviors; these misperceptions stimulate engagement in unhealthy behaviors (Perkins & Berkowitz, 1986). Behavior change is achieved by correcting misperceptions. Personalized normative feedback (PNF) juxtaposes individuals’ own reported normative perceptions (e.g., perceptions of peers’ alcohol use) and personal behaviors (own alcohol use) against their peers’ true normative values (actual average alcohol use among peers). PNF has successfully reduced college students’ alcohol consumption (Carey, Scott-Sheldon, Carey, & DeMartini, 2007). As PNF has not been widely applied and has seldom incorporated injunctive norms, the full potential of norms for influencing health behaviors has not been realized.

The present research investigated the utility of PNF communicating misperceptions of the true injunctive norms for promoting sun protective behaviors. Lack of sun protection (i.e., tanned skin)

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This article is based on Allecia E. Reid’s doctoral dissertation and was funded in part by the ASU Graduate and Professional Student Association, the Society for Multivariate Experimental Psychology, and National Institute of Mental Health training Grant T32 MH20031. We thank Robert Cialdini, Adam Cohen, and Anthony Roberto for their insights throughout this research and Jack Dovidio and Stephanie Moser for their comments on this article.

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is an observable health-risk behavior that offers the possibility of social disapproval should one fail to comply with the norm, making sun protection an ideal context for examining injunctive norms. Sun protection includes limiting sun exposure, using broad spectrum sunscreen, and wearing protective clothing (American Cancer Society, 2011). We expected PNF to increase the impact of the normative message because misperceptions are made explicit, and perceived self-relevance of the message is enhanced, thereby increasing depth of message processing (Petty & Briñol, 2010). Tailored health messages activate the neural mechanisms associated with viewing self-relevant information (Chua et al., 2011), which is associated with greater maintenance of behavior change.

Interventions have improved sun protection by targeting appearance-based motivations for tanning (Jackson & Aiken, 2006; Mahler, Kulik, Butler, Gerrard, & Gibbons, 2008) and utilizing tailored risk information (Glanz, Schoenfeld, & Steffen, 2010; Manne et al., 2010). Peer injunctive norms are associated with sun protection (Hillhouse, Adler, Drinnon, & Turrisi, 1997) but have not been the primary focus of previous interventions. The role of peer approval of sun protection and disapproval of tanning in motivating sun protection remains unclear.

Social norms theory argues that correcting normative misperceptions drives behavior change. PNF research has deviated from theory by comparing individuals' behaviors with peers' behaviors (e.g., own alcohol use with peer use; see Walters & Neighbors, 2005, for a review). Employing PNF as a strict reflection of social norms theory would compare only individuals' normative perceptions with true normative values. Understanding whether it is correcting misperceptions or highlighting behavioral discrepancy that drives behavior change is important for the design of future interventions.

Our research makes four distinct novel contributions. First, we examined injunctive norms as the sole mechanism for altering intentions and behavior, demonstrating the unique influence of injunctive norms on a health behavior. Second, we targeted only

normative misperceptions, rather than behavioral discrepancy, to test the utility of PNF as a behavior change technique from the perspective of social norms theory. Third, in a randomized trial, we examined the impact of correcting injunctive norm misperceptions on sun protection attitudes and showed the role of attitudes in mediating the influence of PNF on intentions. This suggests a causal relationship between injunctive norms and attitudes not captured in the theories of reasoned action (TRA, Fishbein & Ajzen, 1975) and planned behavior (Ajzen, 1991), which have driven much health related research. Fourth, we conducted the first known application of PNF to sun protection.

Identifying mechanisms through which interventions influence behavior contributes to refining health behavior models and designing future interventions (Aiken, 2011). The possibility that changing perceived injunctive norms in favor of health protection could lead to more positive attitudes toward a health protective behavior is important for persuasive health communication. Targeting health related attitudes directly has led to reactance and resistance to persuasive messages (Dillard & Shen, 2005); modifying attitudes indirectly might mitigate this problem. A role for attitudes in mediating the injunctive norm-intention relationship is suggested by both theoretical (Cialdini, 2003) and empirical literature documenting strong correlations between injunctive norms and attitudes (Trafimow, 2000). We therefore examined the mediational role of attitudes in the influence of clarified injunctive norms on changes in intentions.

A modified TRA served as the basis for this research (see Figure 1). The TRA proposes direct relationships of attitudes and injunctive norms to intentions, but specifies no causal relationship between attitudes and norms. Reflecting our mediational hypothesis, we considered the influence of injunctive norms on both attitudes and intentions. Intentions were expected to influence future behavior and future intentions.

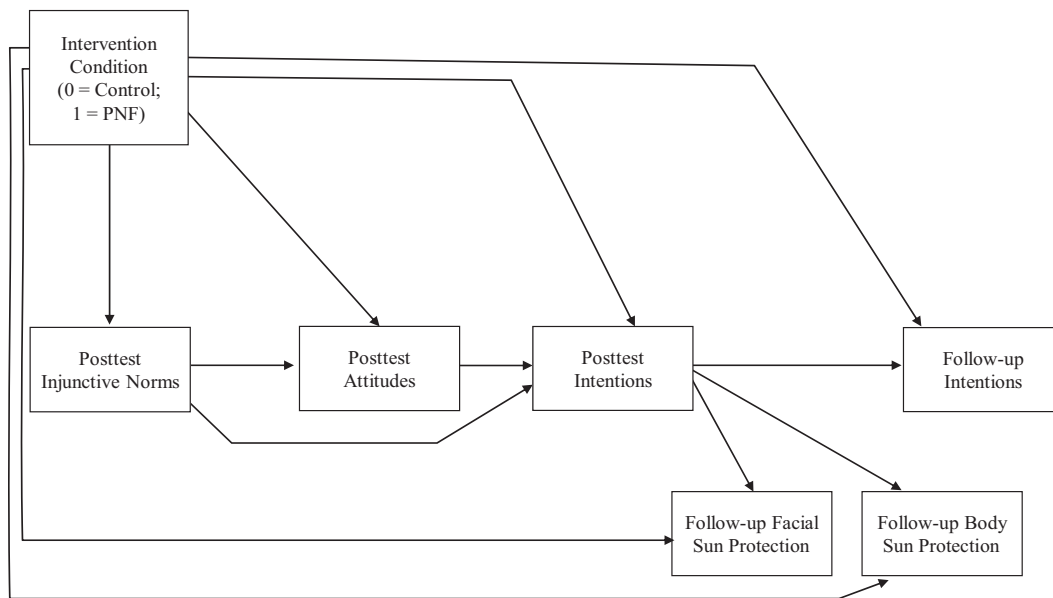


Figure 1. Hypothesized longitudinal model of the effect of the intervention on sun protection intentions and sun protective behaviors.

Overview and Hypotheses

We investigated the utility of PNF communicating the true injunctive norms for promoting sun protection. Women (aged 37–77 years) residing in the Phoenix, Arizona metropolitan area participated. Phoenix receives over 300 days of sunshine annually. Sun exposure is evenly spread out across the life span; 25% occurs after age 60 (Godar, Urbach, Gasparro, & van der Leun, 2003). Sunburns in adulthood contribute to melanoma development (Pfahlberg, Kolmel, & Gefeller, 2001; Whiteman, Whiteman, & Green, 2001), warranting sun protection interventions among older populations.

Participants were assigned to either an information only (standard of care) control condition or information plus PNF. We expected PNF to increase sun protection perceived injunctive norms, attitudes, intentions, and behavior. Two possible mechanisms of the PNF intervention impact were (1) providing true community injunctive norms for tanning and sun protection, and (2) highlighting each individual's discrepancy between the true norm and her perception thereof. We explored whether the magnitude of normative misperceptions moderated the influence of PNF on behavior. Our proposed model specified putative mechanisms by which injunctive norms influence intentions and subsequently behavior. Changes in attitudes were predicted to partially mediate the influence of PNF on changes in intentions. We expected that strengthening sun protection intentions likely precedes enhanced sun protective behavior.

Method

Participants

Figure 2 depicts the flow of participants through the three-part study. In all, 316 community residing women, aged 77 years or younger, were invited by letter to participate in our study exam-

ining how sun protection beliefs “shift over time, with the coming of warmer weather.” Women had previously been recruited from local women's groups to participate in various studies, primarily examining psychosocial predictors of health behaviors other than sun protection (e.g., exercise, mammography screening). In all, 263 completed an initial baseline questionnaire; of these, 189 agreed to participate in the intervention phase of the study. The age range of the 189 participants was 37 to 77 years ($M = 64$; $SD = 9.0$); 94% identified as non-Hispanic White; 25% had had skin cancer.

Procedures

The study consisted of three phases—(1) baseline assessment, (2) intervention plus immediate posttest, and (3) 4-week follow-up. Baseline assessment began in February with high temperatures in the low 70s; follow-up concluded in June with highs up to 109 °F. Self-reported sun protection injunctive norms, attitudes, intentions, and behavior were assessed at baseline. Seven weeks later, intervention materials were delivered simultaneously with the immediate posttest; injunctive norms, attitudes, and intentions were reassessed. At 4-week follow-up, intentions and self-reported behavior were assessed. Participants were not made aware in advance of the 4-week follow-up. All materials were mailed. Although tanning was included in PNF and was assessed throughout, deliberate tanning was almost nonexistent across the study (3% at baseline). Thus, we present only sun protection outcomes.

Baseline assessment of misperceptions. As we sought to employ PNF, we confirmed that participants misestimated injunctive norms for tanning and sun protection at baseline. Injunctive norms have been assessed with evaluations of whether performing a behavior is “good” (Perkins & Berkowitz, 1986; White, Smith, Terry, Greenslade, & McKimmie, 2009). Social norms research treats the mean frequency of a behavior across a sample as the true

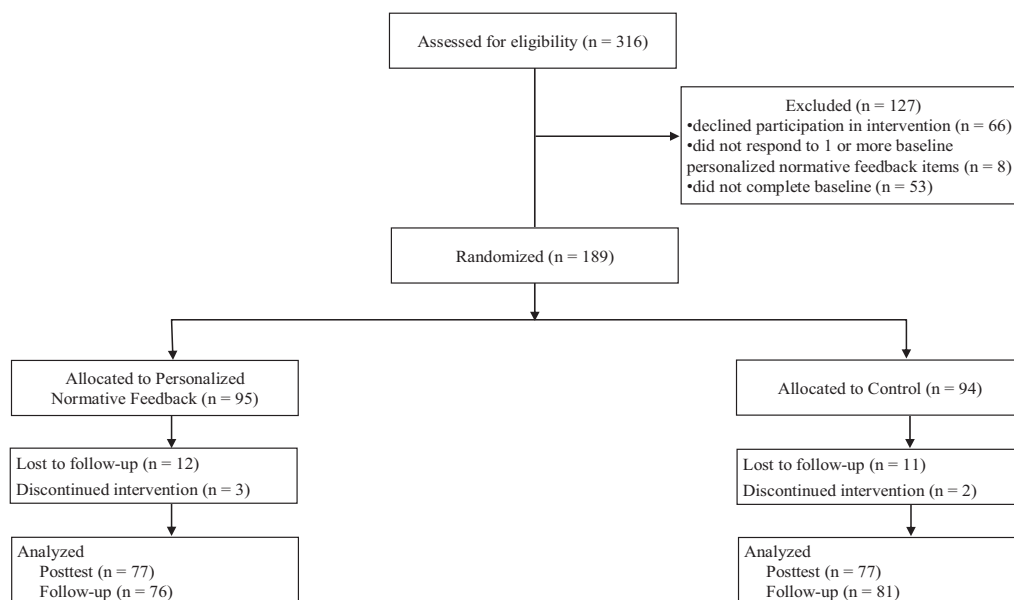


Figure 2. Diagram of flow of participants through data collection.

descriptive norm to be juxtaposed against corresponding personal frequency of behavior (e.g., Lewis, Neighbors, Lee, & Oster-Aaland, 2008). Perceptions of peers' frequency of behavior represent the perceived descriptive norm. Extrapolating from this literature, we considered the mean personal evaluations of tanning and sun protection of all 263 participants at baseline as the true injunctive norms. We compared women's perceptions to the actual average evaluation. Drawing on Phoenix's moniker, "Valley of the Sun," perceived injunctive norm items referenced "typical women in the Valley." For example, women's perceptions of whether typical women in the Valley view tanned skin as bad versus good (perceived injunctive norm) was compared to the mean rating across all women of their own personal views of whether having tanned skin is bad versus good (the true injunctive norm).

Consistent with social norms theory, the true injunctive norms for tanned skin as good, healthy, and more attractive were overestimated by 73%, 82%, and 80% of participants, respectively; support for protection as good was underestimated by 87% (all $ps < .01$; Cohen's corrected d , .71 to 1.0). Fully 55% of intervention participants misperceived all four items in the expected direction (i.e., overestimated risky norms; underestimated protective norms); 25% misperceived three items. Only three of the 189 participants misestimated no items in the expected direction.

Experimental manipulation. A randomized block design was employed to assign participants to either the information only control ($n = 94$) or the information plus personalized normative feedback conditions (PNF, $n = 95$). Block randomization was employed to ensure equal distribution of non-White, skin cancer history, and age. We used a binary (1, 0) random number generator to equally distribute participants within each stratum between conditions. Control participants received a freely available American Academy of Dermatology (AAD, 2008) information sheet recommending sunscreen, protective clothing, and avoidance of sun exposure.¹ Such information sheets or pamphlets represent the standard of care received by clients at a health practitioner's or dermatologist's office.

PNF participants received the information sheet plus a personally tailored normative feedback sheet, a portion of which is illustrated in Figure 3. Every participant received feedback on all four injunctive norm items significantly misestimated at baseline, whether or not she misperceived a particular item at baseline. The true injunctive norm for each item was the baseline sample mean, rounded to the nearest integer. A participant's own baseline perceptions of the community norms were handwritten, juxtaposed against the true injunctive norms. For example, as shown in Figure 3, a participant's baseline response to whether typical women would rate tanned skin as bad versus good was handwritten. This was juxtaposed against the true injunctive norm, the average across all participants of their own evaluations of tanned skin as bad versus good. Women were encouraged to compare their perceptions with the true normative values.

Measures

For all scales, higher numbers represented more positive views. Means served as scale scores. Unidimensionality of scales consisting of four or more items was examined with single factor confirmatory factor analyses (CFAs).

Injunctive norms. A six-item injunctive norms scale, distinct from the four normative feedback items, was developed for this study, assessing "typical women's" views of protection as good and approval for taking specific protective precautions ($\alpha = .83$; e.g., "Typical women in the Valley think that others should wear a hat when they are in the sun"). CFA supported a one-dimensional structure, $\chi^2(7, N = 189) = 32.38, p < .01$; comparative fit index (CFI) = .94; standardized root mean square residual (SRMR) = .05.

Attitudes. Attitudes were assessed by a single semantic differential item that characterized sun protection as ranging from 1 (*extremely bad*) to 7 (*extremely good*; Hillhouse et al., 1997). Attitudes and injunctive norms both include evaluations of sun protection as good. We considered attitudes to reflect an internal, personal evaluation, while injunctive norms reflected perceptions of external evaluations of sun protection.

Intentions. Four items, expanded from Jackson and Aiken (2006), encompassed intentions for using sunscreen, wearing protective clothing, staying in the shade, and general protection ($\alpha = .82$; e.g., "I plan to stay in the shade as much as possible when I am outside"). Response options ranged from 1 (*strongly disagree*) to 6 (*strongly agree*). CFA supported a one-dimensional structure, $\chi^2(1, N = 189) = 11.12, p < .01$; CFI = .96; SRMR = .03.

Self-reported sun protective behavior. Facial ($\alpha = .41$) and body sun protection ($\alpha = .44$), were each comprised of three 7-point items assessing use of sunscreen, protective clothing, and shade to avoid sun exposure in the previous week (Jackson & Aiken, 2006). For example, "In the past week, how often did you wear a hat when you were in the sun?" Response options ranged from 1 (*never*) to 7 (*always*). Coefficient alphas were low because engaging in one protective behavior is sufficient for sun protection. Individuals need not utilize all three protective options.

Baseline Support for the Conceptual Model

We examined correlations among variables at baseline to provide initial support for our model and additional justification for a norms-based intervention. Consistent with our model, injunctive norms were correlated with attitudes ($r = .19, p = .01$) and intentions ($r = .22, p < .01$). In turn, intentions were correlated with facial ($r = .46, p < .01$) and body sun protection ($r = .52, p < .01$). Injunctive norms were not correlated with facial ($r = -.01$) or body sun protection ($r = .00$). However, TRA-based interventions select beliefs to target for behavior change based on correlations with intentions, rather than behavior (von Haefen, Fishbein, Kasprzyk, & Montaño, 2001).

Results

Baseline Equivalence of Conditions

Baseline equivalence was examined with analysis of variance (ANOVA) or chi-square models in SPSS 18. The PNF and control

¹ We obtained permission from the AAD to distribute the information sheet as part of our research.

Is Your Impression of Women in the Valley Accurate?

You thought that typical women in the Valley would rate protecting their skin from the sun to be:

quite good (you)

extremely bad	quite bad	slightly bad	neither good nor bad	slightly good	quite good	extremely good
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On average, women actually rated protection as **extremely good**

You thought that typical women in the Valley would rate having tanned skin to be:

slightly good (you)

extremely bad	quite bad	slightly bad	neither good nor bad	slightly good	quite good	extremely good
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On average, women actually rated tanned skin as **neither good nor bad**

Figure 3. Sample of a portion of the personalized normative feedback sheet. Hypothetical perceptions for a fictional participant are hand-written. The circled statement represents the mean response of all 263 participants at baseline.

groups were equivalent in age, skin tone (Fitzpatrick, 1988), skin cancer history, and non-White participants (all p s > .48). Groups did not differ on any sun protection constructs (see Table 1).

Attrition

Rates of attrition did not differ between groups at posttest or follow-up (see Figure 2; p s > .41). Participants who were retained versus lost were compared in age, personal and family skin cancer history, skin tone, and baseline levels on all constructs, including behavior. Participants who attrited reported lower baseline intentions to engage in sun protective behaviors than those retained, posttest: $F(1, 187) = 5.35, p = .02, \eta^2 = .03$; follow-up: $F(1, 182) = 4.41, p = .04, \eta^2 = .02$.

Differential attrition across conditions was examined with the Jurs and Glass (1971) procedure. There was no interaction between condition (1 = PNF, 0 = control) and attrition status (1 = attrited, 0 = retained) on any baseline measure, indicating the absence of differential attrition.

Intervention Impact

The impact of PNF on measured constructs was assessed with analyses of covariances (ANCOVAs); baseline scores on the same construct served as the covariate. Table 1 provides adjusted posttest and follow-up means, significance tests, and Cohen's corrected d (Hedges & Olkin, 1985).

There was a moderate to large influence of PNF on changes in injunctive norms. PNF participants believed the injunctive norms favoring sun protection to be stronger than did controls and reported more favorable sun protection attitudes and intentions at posttest than controls. At 4-week follow-up, PNF participants reported greater intentions to sun protect and greater facial sun protection. In particular, PNF participants reported greater use of

hats, $F(1, 154) = 5.25, p = .02$, and marginally greater use of sunscreen on their faces, $F(1, 153) = 3.36, p = .07$. There was no main effect of PNF on body sun protection.

The role of normative misperceptions. We employed two indexes to examine whether discrepancy between the perceived and true injunctive norms moderated the effect of condition on behavior: (a) inaccuracy count, number of items misestimated out of four in the expected direction ($M = 3.23, SD = 1.02$); (b) average discrepancy, average discrepancy (perceived–true norm) across items. Protection items were reverse scored. Higher positive values indicated greater perceived tanning, lower protection norms ($M = 1.29, SD = .73$). Both indexes exhibited a single pattern—positive slope of misperceptions to behavior change in PNF, negative slope in control.

Inaccuracy count interacted with condition for facial and body sun protection, $B = -.38, t(152) = -2.35, p = .02$; $B = -.43, t(151) = -2.76, p = .01$, respectively. In PNF, the inaccuracy count positively predicted change in facial protection, $B = .25, t(152) = 2.12, p = .04$; body ($B = .16, ns$). In control, inaccuracy count negatively predicted change in body protection, $B = -.28, t(151) = -2.58, p = .01$; face ($B = -.13, ns$).

Average discrepancy decreased significantly from baseline to posttest in PNF, $F(1, 134) = 20.27, p < .01$ but not control, $F(1, 134) = 0.05, p = .82$. Discrepancy interacted with condition in predicting body sun protection, $B = .56, t(151) = 2.43, p = .02$; for facial protection, $B = .39, t(152) = 1.64, p = .10$. Among controls, greater discrepancy predicted less change in body protection, $B = -.31, t(151) = -1.95, p = .05$; face ($B = -.10, ns$). PNF mitigated this effect for body protection, $B = .25, t(151) = 1.50, p = .14$; face ($B = .29, t(152) = 1.70, p = .09$). For those three individuals who received PNF, responded at follow-up, and whose small negative discrepancies indicated, on average, overes-

Table 1

Construct Means, Tests for Baseline Equivalence, and Tests of the Effect of the Intervention on Posttest and Follow-Up Constructs

Scale	PNF	Control	Baseline equivalence (full sample; <i>df, F</i>)	Baseline equivalence (retained; <i>df, F</i>)	Significance test (<i>df, F</i>)	Effect size (<i>d</i>)
Posttest outcomes						
Injunctive norms			(1, 185)	(1, 150)	(1, 144)	
Baseline (full sample)	4.00	3.97	0.09			
Baseline (retained)	4.02	3.95		0.33		
Adjusted posttest	4.64	4.21			16.29**	.66
Attitudes			(1, 187)	(1, 152)	(1, 150)	
Baseline (full sample)	6.40	6.48	0.51			
Baseline (retained)	6.39	6.49		0.66		
Adjusted posttest	6.53	6.36			4.30*	.33
Intentions			(1, 187)	(1, 152)	(1, 151)	
Baseline (full sample)	4.43	4.54	0.63			
Baseline (retained)	4.52	4.60		0.32		
Adjusted posttest	4.71	4.54			4.56*	.34
Follow-up outcomes						
Intentions			(1, 187)	(1, 155)	(1, 154)	
Baseline (full sample)	4.43	4.54	0.63			
Baseline (retained)	4.54	4.55		0.00		
Adjusted follow-up	4.65	4.38			4.87*	.35
Facial sun protection			(1, 187)	(1, 154)	(1, 154)	
Baseline (full sample)	3.52	3.44	0.14			
Baseline (retained)	3.63	3.44		0.71		
Adjusted follow-up	4.31	3.95			4.82*	.35
Body sun protection			(1, 187)	(1, 155)	(1, 153)	
Baseline (full sample)	3.33	3.35	0.01			
Baseline (retained)	3.32	3.35		0.02		
Adjusted follow-up	3.52	3.56			0.16	.06

Note. PNF: baseline $n = 95$; posttest $n = 77$; follow-up $n = 76$. Control: baseline $n = 94$; posttest $n = 77$; follow-up $n = 81$.

* $p < .05$. ** $p < .01$.

timating protection and underestimating tanning norms, there was no evidence of change to less sun protection.

Longitudinal Model of Sun Protection

Residualized change scores, formed by partialing baseline scores out of corresponding posttest or follow-up measures, were employed to model changes in constructs. Participants who responded at posttest or follow-up were included. Missing data (maximum 14% for any pair of constructs) were addressed in Mplus 5.0 (Muthén & Muthén, 2007) with full information maximum likelihood estimation, which performs well with up to 25% missing data (Enders & Bandalos, 2001).

Table 2 provides correlations among residualized scores above and zero-order correlations below the main diagonal. Correlations of condition with residualized scores were consistent with main effects of PNF (see Table 1). All residualized scores, except body sun protection, suggested significantly more positive scores among PNF participants.

Model fit was good (see Figure 4). The influence of PNF was primarily transmitted through changes in injunctive norms. After accounting for changes in injunctive norms, the influence of condition on all other constructs became marginal or nonsignificant. Supporting our mediational hypothesis, changes in injunctive norms related to changes in attitudes, which related to changes in

Table 2

Zero-Order Correlations (Lower Triangle) and Correlations Based on Residualized Change Scores (Upper Triangle, in Italics) for Condition, Posttest Constructs, and Behavior at Follow-Up

Scale	1	2	3	4	5	6	7
1. Condition (0 = control, 1 = PNF)	—	.28**	.16*	.17*	.18*	.17*	.03
2. Posttest injunctive norms	.28**	—	.29**	.28**	.27**	.03	.16†
3. Posttest attitudes	.05	.23**	—	.35**	.26**	.19*	.15†
4. Posttest intentions	.09	.27**	.56**	—	.47**	.22**	.18*
5. Follow-up intentions	.12	.27**	.51**	.75**	—	.38**	.33**
6. Follow-up facial sun protection	.18*	-.00	.31**	.47**	.58**	—	.55**
7. Follow-up body sun protection	.02	.07	.27**	.50**	.60**	.63**	—

Note. $N = 140$ to 157.

† $p < .10$. * $p < .05$. ** $p < .01$.

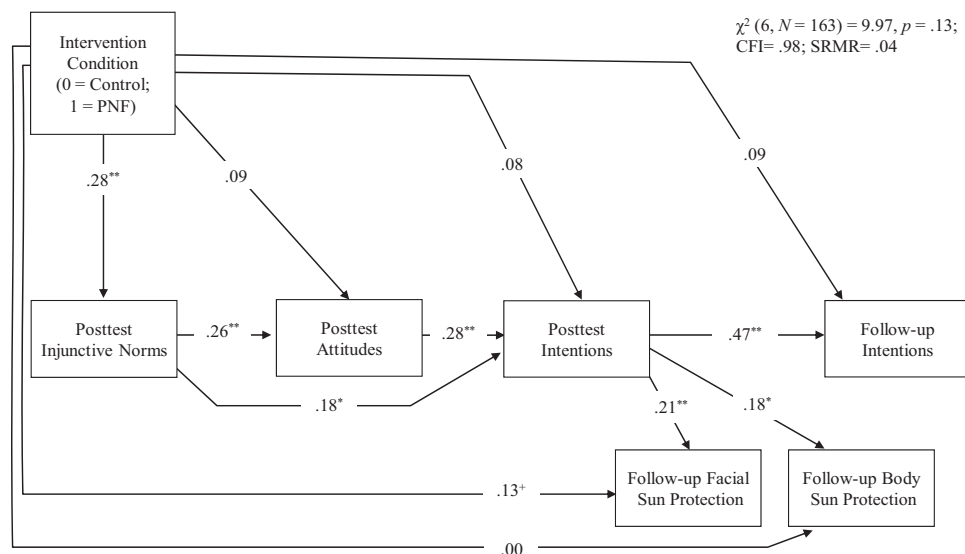


Figure 4. Longitudinal model of the effect of the intervention on sun protection intentions and sun protective behaviors. All parameter estimates are standardized. CFI = comparative fit index; SRMR = standardized root mean square residual. + $p < .10$. * $p < .05$. ** $p < .01$.

posttest intentions. The intention-behavior link over time was demonstrated in the relationships of changes in posttest intentions to changes in facial and body sun protection 4 weeks later.

Residualized injunctive norms and attitudes were related to follow-up intentions and body sun protection, while residualized attitudes were correlated with facial sun protection (see Table 2). Following the TRA, we examined whether changes in posttest intentions fully mediated the relationships of injunctive norms and attitudes to follow-up intentions, facial sun protection, and body sun protection. There were no significant direct effects of attitudes or injunctive norms on follow-up behavior or intentions, indicating full mediation by changes in posttest intentions.

Mediation of the Effect of PNF by Attitudes

We examined whether changes in posttest attitudes mediated the influence of PNF on follow-up intentions, testing a longitudinal mediational chain. Bias-corrected bootstrapped standard errors were employed (MacKinnon, 2008). Mediation was examined in Mplus 5.0; residualized change scores served as the input.

We examined a sequential mediation model; intervention condition predicted posttest injunctive norms, which predicted posttest attitudes. In turn, posttest attitudes predicted follow-up intentions. Reflecting our expectation that changes in attitudes resulted from changes in perceptions of the injunctive norms, the effect of the intervention on changes in attitudes was fully mediated by changes in injunctive norms (mediated effect = .08; 95% CI [.03, .16]), accounting for 47% of the effect of the intervention on attitudes. This is also shown in the near zero path from condition to attitudes in Figure 4. Injunctive norms mediated the relationship of condition to follow-up intentions (mediated effect = .09; 95% CI [.02, .19]). Supporting our hypothesis, the sequential path through injunctive norms and attitudes to follow-up intentions was supported (mediated effect = .03; 95% CI [.01, .06]). These two mediational paths accounted for 32% and 9%, respectively, or 41% overall, of

the total effect of PNF on follow-up intentions. The direct effect of PNF on follow-up intentions was reduced from $c = .27, p = .03$, to $c' = .13, p = .31$, after accounting for these paths.

Discussion

Consistent with experimental social psychological research, there was an influence of PNF on perceived injunctive norms, attitudes, intentions, and self-reported behavior. Though norms-based research has primarily focused on descriptive norms, targeting young adults on college campuses (Reid et al., 2010), we demonstrated the utility of injunctive norms for encouraging healthy behaviors in an older population in a large community. Utilization of injunctive norms to influence health behaviors is particularly desirable. Descriptive norms can lead individuals who initially have more prohealth behavior than the norm to adopt riskier behaviors to be closer to the norm (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Reno et al. (1993) suggested that injunctive, but not descriptive, norms, exert cross-situational influence. Further investigation of whether these findings hold for health related injunctive versus descriptive norms is warranted.

The role of attitudes in mediating the effect of PNF on follow-up intentions suggests a relationship of injunctive norms to attitudes not captured in the TRA. Terry and Hogg (1996) examined the moderating role of norms in attitude-behavior consistency. However, we present the first known research to demonstrate the influence of a purely injunctive norm manipulation on attitude change, which in turn was linked to changes in intentions. Health psychology has relied heavily on the TRA and its extensions for designing psychosocial and intervention research. Greater understanding of the link between injunctive norms and attitudes supports more informed application of the TRA to the study of health behavior.

Intervention Effects

Changes in intentions and facial sun protection associated with PNF plus information exceeded those of information alone. Information included sun protection instructions from an authoritative source, constituting an active, relevant control group, an intervention in its own right. When employed in comparison with treatment groups, such control groups yield smaller treatment effect sizes than would a no-treatment or irrelevant-content control (Johnson, Carey, Marsh, Levin, & Scott-Sheldon, 2003). Our control group lessens the plausibility of alternative explanations for behavior change including the information sheet, seasonal changes as we moved from spring to summer, and assessment effects (Clifford, Maisto, & Davis, 2007). Nonetheless, our effect size for change in facial sun protection ($d = .35$) is consistent with effect sizes for other health behaviors ($d = .36$; Webb & Sheeran, 2006). Effect sizes may be improved by extending message exposure over time or by linking PNF to a mnemonic cue that will spur later recall (Cialdini et al., 2011).

The influence of PNF over and above alternative influences on behavior change is remarkable given its brevity and the vagueness of the reference group—women in the Valley. The Valley is geographically larger than Los Angeles, encompassing 2 million women. Arizona is a highly transient state, including seasonal residents and retirees. Strongly identifying with a group is an important determinant of responsiveness to group norms (Terry & Hogg, 1996). Results may be even more pronounced in smaller, more stable communities.

Supporting social norms theory, we changed behavior by targeting only misperceptions of the injunctive norms rather than also highlighting behavioral discrepancies. Misperceptions were profound; 55% of participants inaccurately perceived all four of the targeted community injunctive norms at baseline in the expected direction. This is expected, as instances of individuals engaged in risky behaviors are often more cognitively available than are instances of protective behaviors (Reid et al., 2010). Moderation of intervention effectiveness by the count of inaccuracies and average discrepancy suggests the importance of utilizing PNF, rather than only the true norm, to change behavior. Presenting only the true norm may allow individuals to falsely construe their perceptions as having been accurate (Fischhoff, 1975), dampening effects on behavior. Body and facial sun protection were both influenced by inaccuracy count; only body sun protection was significantly influenced by average discrepancy. Inaccuracy count is a more pure indicator of the strength of the message individuals received about their misperceptions, as discrepancy aggregates across over-, accurate-, and underestimation. Results suggest the potential of individually tailored normative messages. Providing feedback only on the items misperceived by an individual and selecting those items that provide maximum discrepancy between the perceived and true norms may prove most effective.

Targeting what is approved by a broad peer group differs from interventions targeting the TRA's subjective norms, approval from specific powerful others for performing a behavior. Powerful others may exert a strong influence that does not support, but rather undermines, behavior (e.g., an overweight friend who undermines weight loss). A broad injunctive norms intervention, such as employed here, avoids this issue of significant others who may undermine behavior change.

Mediation by Attitudes

Changes in attitudes partially mediated the effect of PNF on follow-up intentions. Most underestimate the influence of normative information on their own behaviors, yet norms can produce greater changes in behavior than attitudinal appeals (Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008). External pressure to change one's attitudes can produce reactance (Worchel & Brehm, 1970). The subtle and potentially undetected influence of injunctive norms on attitude change may reduce reactance.

Program Dissemination

A strength of norms-based interventions is the ease of dissemination. Though proximal reference groups exhibit stronger influence on behavior (Borsari & Carey, 2003), national data have been employed to achieve behavior change (Doumas & Hannah, 2008). Web- or computer-based interventions and mailed pamphlets can be configured so participants provide their normative perceptions, then review their own perceptions juxtaposed against the true norms (e.g., Lewis et al., 2008).

Limitations

We primarily targeted older non-Hispanic White women. PNF increased use of hats. Young women may also select hat use for protection; 14% of women (M age 19 years) who received a sunscreen focused intervention reported wearing hats (Jackson, 1997). PNF has been utilized successfully in younger populations (Carey et al., 2007) and injunctive norms are largely misestimated (Borsari & Carey, 2003), suggesting the utility of our methodology for altering behavior among younger populations. Given varying norms across ethnicities for sun protection (Coups, Manne, & Heckman, 2008), non-White individuals may require ethnically tailored normative information. Men are less likely to engage in sun protection (Geller et al., 2002) and may require improvements in self-efficacy to alter their behaviors.

Though we relied on self-report data, adults' reports of use of sunscreen and protective clothing are generally accurate (O'Riordan, Lunde, Steffen, & Maddock, 2006). Nonetheless, common method variance associated with self-report measures may have contributed to inflating somewhat observed associations with behavior, and self-report data may reflect demand characteristics. Our single item measure of attitudes is subject to low reliability, potentially attenuating observed relationships. Only 60% of the 316 eligible women participated in the intervention, potentially decreasing sample heterogeneity. Though the issue of skin cancer was likely salient, we found no evidence that salience (personal or family skin cancer history, perceived susceptibility) influenced results.

Conclusions

Injunctive norms are a powerful motivator of behavior that can and should be brought to bear in health promotion research. As injunctive norms may produce less reactance than more direct appeals, they are ideal for altering not only health behaviors but also health protective attitudes and intentions.

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Received May 31, 2011

Revision received November 7, 2011

Accepted January 13, 2012 ■