



Present choices, future outcomes: Anticipated regret and HPV vaccination

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ABSTRACT

Objective. The study examined the role of anticipated regret in human papillomavirus (HPV) vaccination decisions as well as potential antecedents of anticipated regret.

Method. In 2007, we interviewed 889 caregivers for girls aged 10–18 in areas of North Carolina with high rates of cervical cancer. The survey assessed vaccination regret (anticipated regret if daughter became more sexually active after vaccination) and inaction regret (anticipated regret if an unvaccinated daughter developed an HPV infection that could lead to cervical cancer). Main outcomes were self-reported vaccination behavior and intentions to vaccinate. Analyses controlled for perceived risk and caregiver and child characteristics.

Results. Caregivers who reported higher vaccination regret were less likely to have gotten their adolescent daughters the HPV vaccine ($OR = .60, p < .001$). Among those who had not yet vaccinated their daughters, higher intentions to vaccinate were associated with higher anticipated inaction regret ($\beta = .45, p < .001$) and lower vaccination regret ($\beta = -.22, p < .001$). Decision urgency was a significant correlate of both types of regret.

Conclusion. Anticipated regret appears to play an important role in caregivers' decisions to vaccinate adolescent girls against HPV, above and beyond the role played by perceived risk.

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Introduction

A new vaccine, administered in a series of three doses over 6 months, protects against common HPV infections that can lead to genital warts, cervical neoplasia, and invasive cervical cancer (Koshiol et al., 2008). If widely adopted, HPV vaccine could prevent up to 70% of cervical cancers. Understanding factors that can foster widespread HPV vaccine uptake is particularly important in the United States where the vaccine is provided only during doctor visits and is paid for through a patchwork system of private insurance, public programs and private payments (Keating et al., 2008).

Anticipated regret

Regret can be defined as an aversive combination of thoughts and feelings elicited when comparing an event that occurred to another (perhaps more favorable) event that did not (Connolly and Reb, 2005). Because anticipated regret influences sexual behavior (van der Pligt and Richard, 1994), exercise (Abraham and Sheeran, 2003), and cancer-related decisions (Connolly and Reb, 2005), it may also provide

insight into how to encourage HPV vaccine uptake. In a recent study, adults who believed that they would regret getting the flu because they were not vaccinated were more likely to get vaccinated (Weinstein et al., 2007); furthermore, anticipated regret more strongly predicted their vaccine uptake than other risk constructs including perceived likelihood (belief that a hazard is likely to happen) and perceived severity (belief that a hazard will have negative consequences) (Brewer et al., 2007a). However, anticipated regret has yet to be examined in the context of HPV vaccination (Brewer and Fazekas, 2007).

Regret can come from action or inaction. Some believe that vaccination (action) causes sexual disinhibition (Lo, 2006; Olshen et al., 2005). Therefore, parents who anticipate regretting *vaccinating* should be less interested in getting their daughters HPV vaccine. On the other hand, without the vaccine (inaction), chances of getting an HPV infection and later, cervical cancer, are higher. Thus, parents who anticipate regretting *not vaccinating* should be more interested in getting their adolescent daughters HPV vaccine. Previous research on other vaccines has shown that people may be reluctant to endorse vaccination, even if harm done by not vaccinating is worse than harm done by vaccinating (Asch et al., 1994; Ritov and Baron, 1990). This previous research does not suggest whether anticipated regret of action or inaction will play a larger role in HPV vaccination decisions; however, one reasonable assertion is that concerns about cervical cancer (which is known to exist and is deadly) might outweigh concerns about sexual

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disinhibition (the existence of which is a matter of speculation) (Brewer et al., 2007b).

We also consider four potential antecedents of anticipated regret, relying heavily on Anderson's (2003) model of contributors to anticipated regret. First, believing the opportunity to vaccinate is time-limited may increase anticipated regret of not vaccinating and decrease regret of vaccinating. This is especially relevant in light of recommendations for HPV vaccination prior to adolescent girls' sexual debut (Centers for Disease Control and Prevention, 2007). Second, feeling more responsible for vaccination decisions should prompt more anticipated regret of both vaccination and inaction. Increased responsibility for the decision may focus parents on the possible negative outcomes associated with either HPV vaccination or inaction.

Third, as an extension of Anderson's (2003) concept of outcome permanence, we hypothesized that believing the vaccine's protection lasts for a lifetime should be associated with greater anticipated regret of inaction, potentially because beliefs in enduring benefits might provide ready rationalizations for the shot's initial cost and inconvenience. Although the duration of protection offered by HPV vaccine is unknown (Saslow et al., 2007), some expect that it may last a lifetime. Such beliefs about the durability of benefits should not affect anticipated vaccination regret, which concerns potential harms of action.

Finally, we also included perceived risk in our analyses of antecedents because believing that HPV infection is likely and severe should also elicit higher levels of anticipated regret from not vaccinating (Nordgren et al., 2007) but should not affect vaccination regret. Because not all previously studied antecedents of anticipated regret apply to HPV vaccination, we did not examine mutability, abnormal causes, outcome valences, or orientations (Anderson, 2003) as potential antecedents.

Our study examined the role of anticipated regret in caregivers' HPV vaccination decisions. We hypothesized that anticipating regretting not vaccinating an adolescent daughter, because she later contracted HPV, should make a caregiver more likely to vaccinate. Conversely, anticipating regretting vaccinating her, due to vaccine-induced sexual disinhibition, should discourage vaccination. We also hypothesized that vaccination regret would be associated with believing the opportunity to vaccinate is time-limited and feeling responsible for the vaccination decision, while inaction regret would be associated with both of these antecedents, the belief the vaccine will last a lifetime, and perceived likelihood and severity of cervical cancer.

Methods

Participants

Between July and October 2007, we interviewed 889 female and male caregivers of adolescent girls aged 10 to 18 years living in counties in southeastern North Carolina with high rates of cervical cancer (i.e., incidence >10 cases/100,000 women annually 1993–2003 and mortality >4 cases/100,000 annually 1994–2004) (North Carolina State Center for Health Statistics, 2006). The sample came from a random digit-dialing telephone frame (5%) and a non-overlapping targeted-list frame of directory-listed residential telephone numbers with available recent household demographic information (95%). We over-sampled households likely to include a female child aged 10 to 18, African Americans, and rural telephone exchanges to further focus on higher risk populations.

Procedures

We interviewed the primary female caregiver; if she was unavailable, we interviewed the first available caregiver. Respondents

received a ten dollar payment for participating. The institutional review board at the University of North Carolina approved the study protocol.

Measures

The item assessing vaccination behavior read, "Has [daughter's name] had any shots of the HPV vaccine?" Caregivers answering yes were asked how many shots. We coded responses of 1, 2 or 3 shots as having vaccinated. Participants not answering yes were asked four questions about their vaccination intentions (e.g., "How likely are you to get [daughter's name] the HPV vaccine in the next year?"), which we averaged to create a scale ($\alpha = .97$). Response options were "definitely won't," "probably won't," "probably will," and "definitely will."

An item assessing vaccination regret asked caregivers to "Imagine that [daughter's name] became more sexually active earlier than she would have otherwise because she got the HPV vaccine. How much would you regret that she did get the vaccine?" An item assessing inaction regret asked caregivers who had yet to vaccinate to "Imagine that [daughter's name] got an HPV infection that could lead to cervical cancer, but the HPV vaccine might have prevented it. How much would you regret that she did not get the HPV vaccine?" Response options were "not at all," "a little," "a moderate amount," and "a great deal." These anticipated regret measures reflect Connolly and Reb's (2005) conceptualization of anticipated regret.

The survey also assessed hypothesized antecedents of anticipated regret. We assessed vaccination decision urgency ("[Daughter's name] will get the most benefit from the HPV vaccine if she gets it sooner rather than later") and the durability of the vaccine ("The HPV vaccine lasts a person's entire life"). Response options were "strongly disagree," "somewhat disagree," "somewhat agree," and "strongly agree." We assessed perceived responsibility for the vaccination decision by asking caregivers who in their household decided or would decide whether or not the daughter got vaccinated. Responses were coded into three categories: others would decide without involving the respondent, the decision was shared, or the respondent alone would decide. Caregivers rated perceived likelihood of the daughter developing cervical cancer using a 4-point scale that ranged from "no chance" to "high chance." They rated perceived severity ("How serious would it be if [daughter's name] got cervical cancer") using a 4-point scale ranging from "slightly" to "extremely."

Demographic information collected included caregiver's age, sex, race, income, and level of education, and daughter's age. Data were dropped from analyses of behavior for three caregivers who did not know whether their daughters had received HPV vaccine. Responses of don't know or refused for other variables were replaced by the mean, median or scale midpoint, except for income and race where we treated missing data as a separate category.

Statistical analyses

We examined correlates of vaccination behavior using simultaneous multiple logistic regression and correlates of vaccination intentions and anticipated regret using simultaneous multiple linear regressions. Analyses of intentions and anticipated regret included only caregivers who had not yet vaccinated, as intentions and some antecedents questions were asked only of those individuals. Because the regression predicting disinhibition regret did not fully meet regression assumptions, we reran the analyses as a logistic regression using a dichotomized disinhibition regret variable as the outcome, which yielded the identical pattern of results. In addition to respondent age, child age, sex, race, income, education, and rural or urban residence, regressions controlled for perceived likelihood and

Table 1
Bivariate correlations among main study variables; North Carolina, 2007

	Mean (SD)	1	2	3	4	5	6	7	8	9
1. Daughter had any shots of HPV vaccine	.12 (.32)	1.00								
2. Intentions to vaccinate daughter	2.91 (.92)	–	1.00							
3. Inaction regret	3.59 (.81)	–	.50**	1.00						
4. Vaccination regret	2.65 (1.24)	–.18**	–.24**	.00	1.00					
5. Perceived likelihood of cervical cancer	2.41 (.67)	–.21**	.34**	.30**	–.06	1.00				
6. Perceived severity of cervical cancer	3.70 (.59)	–.01	.02	.16**	.01	.06	1.00			
7. HPV vaccine lasts lifetime	2.70 (.68)	.12**	.25**	.16**	–.07*	.04	.02	1.00		
8. Increased benefit of vaccinating sooner	3.06 (.94)	–	.62**	.39**	–.19**	.31**	.05	.27**	1.00	
9. Responsibility for vaccinating	2.44 (.58)	.05	.07	.05	.04	.05	–.04	.01	.03	1.00

Note. N = 886 for correlations involving vaccine uptake (variable 1). N = 783 for correlations involving variables not assessed among caregivers who had already vaccinated their daughters (variables 2, 3 and 8). N = 889 for remaining correlations.

* p < .05.
** p < .001.

perceived severity to demonstrate that these constructs offered value beyond these other risk constructs.

Results

We interviewed 889 caregivers (response rate 73%; see Hughes et al., in press). Most caregivers were parents or legal guardians (97%), were female (94%), and identified themselves as white (70%) or African American (23%). Mean caregiver age was 43 years (SD = 6.5 years), and 49% lived in a rural area. Most caregivers (79%) had greater than a high school education, but 32% reported an annual household income of less than \$50,000.

Anticipated inaction regret assuming a bad outcome resulted (assessed only among caregivers who had gotten their daughter one or more doses of the vaccine) was high (M = 3.59, SD = .81) (Table 1). Anticipated vaccination regret assuming a bad outcome resulted (assessed among all caregivers) was moderate (M = 2.65, SD = 1.24). Caregivers who answered both regret measures reported higher anticipated regret from inaction than vaccination (t = 16.33, p < .001). The two regret measures were uncorrelated (r = .00), largely due to two patterns of responding: anticipating regretting both vaccination and inaction as much as possible if a bad outcome resulted (30%, 233/783 of caregivers) and anticipating regretting inaction as much as possible but vaccination not at all (21%, 162/783). Over a third (36%, 324/889) of caregivers perceived a moderate or high chance their daughters would eventually get cervical cancer, and 76% (671/889) perceived cervical cancer to be an extremely severe disease.

Behavior

Overall, 106 caregivers daughters had received at least one dose of the vaccine, 780 had not vaccinated, and 3 did not answer. Caregivers who reported greater vaccination regret were less likely to have vaccinated their daughters against HPV (OR = .60, p < .001) (Table 2).

Table 2
Correlates of HPV vaccination behavior and intentions; North Carolina, 2007

	Behavior (N = 886)	Intentions (N = 783)
	OR (95% CI)	β (95% CI)
Inaction regret (assuming no vaccination)	–†	.45 (.39, .51)**
Vaccination regret (assuming vaccination)	.60 (.50, .72)**	–.22 (–.28, –.16)**
Perceived likelihood of cervical cancer	.27 (.18, .42)**	.19 (.13, .25)**
Perceived severity of cervical cancer	1.04 (.71, 1.50)	–.04 (–.10, .02)

Note. Analyses controlled for respondent age, child age, sex, race, income, education, and rural or urban residence. Data for three caregivers who did not know whether their daughter had received any shots of the HPV vaccine were dropped from the behavior analyses.

OR = odds ratio; β = standardized regression coefficient.

** p < .001.

† Not assessed among parents who had already vaccinated their daughters.

Caregivers who had vaccinated their daughters believed them to be less likely to get cervical cancer (OR = .27, p < .001).

Intentions

Among the 783 caregivers who had not yet vaccinated their daughters, higher anticipated inaction regret was associated with higher vaccination intentions (β = .45, p < .001), even after statistically controlling for perceived likelihood and severity of cervical cancer. Higher anticipated vaccination regret showed the opposite relationship (β = –.22, p < .001), with those who would regret vaccinating if their daughters becoming sexually disinhibited reporting lower intentions to vaccinate. Although anticipated vaccination regret could be a proxy for perceived likelihood of sexual disinhibition, vaccination regret remained a significant correlate of intentions when controlling for these likelihood beliefs (data not shown). Intentions to vaccinate were higher among caregivers who reported higher perceived likelihood of cervical cancer (β = .19, p < .001).

Antecedents of anticipated regret

In addition to assessing the role of anticipated regret in decisions to vaccinate, we also examined several hypothesized antecedents to regret (Table 3). Decision urgency, the belief that vaccination offered increased benefit when received sooner rather than later, was correlated with both types of anticipated regret (inaction regret, β = .31, p < .001; action regret, β = –.19, p < .001). For inaction regret, perceived likelihood of cervical cancer (β = .19, p < .001) and perceived severity (β = .13, p < .001) were both correlates. Perceived durability and responsibility for making the decision to vaccinate were unrelated to either type of anticipated regret.

Table 3
Correlates of anticipated regret; North Carolina, 2007

	Vaccination regret (if vaccinate) (N = 783)	Inaction regret (if do not vaccinate) (N = 783)
	β (95% CI)	β (95% CI)
Increased benefit of vaccinating sooner	–.19 (–.26, –.11)**	.31 (.24, .38)**
HPV vaccine lasts a lifetime	.02 (–.05, .09)	.06 (.00, .13)
Responsibility for deciding to vaccinate daughter	.07 (–.01, .14)	.02 (–.05, .08)
Perceived likelihood of cervical cancer	–.07 (–.14, .01)	.19 (.12, .26)**
Perceived severity of cervical cancer	.06 (–.01, .13)	.13 (.07, .20)**

Note. Analyses controlled for respondent age, child age, sex, race, income, education, and rural or urban residence.

β = standardized regression coefficient.

** p < .001.

Discussion

Anticipated regret was associated with caregivers' HPV vaccination behaviors and intentions, an important finding because a recent systematic review of HPV vaccine acceptability literature found that no studies had examined the role of anticipated regret (Brewer and Fazekas, 2007). Anticipated inaction regret was both more strongly endorsed than vaccination regret (consistent with believing oncogenic HPV infection is more dangerous) and more correlated with vaccination intentions. Caregivers reporting lower anticipated vaccination regret were more likely to have vaccinated their adolescent daughters against HPV; furthermore, among caregivers whose daughters were not vaccinated, higher inaction regret and lower disinhibition regret correlated with higher intentions to vaccinate.

Caregivers who had already vaccinated their daughters believed they were less likely to get cervical cancer. Among caregivers who had yet to vaccinate, those who said their daughters had higher chances of getting cervical cancer were more likely to want to get them the vaccine. The findings are consistent with our previous conceptual and empirical work suggesting that perceiving risk prompts intentions to vaccinate but that having been vaccinated (i.e., behavior) lowers risk perceptions (Brewer et al., 2004). The findings also suggest that while vaccination lowers perceived risk, it might not reduce anticipated regret.

In terms of antecedents of regret, higher perceived benefit if vaccination happens sooner correlated with both types of regret, as we hypothesized. Perceived likelihood and severity of cervical cancer were significant correlates only of inaction regret, which is not surprising given the natural development of cervical cancer following HPV infection. However, vaccine durability and responsibility were unrelated to regret, possibly due to particular measures we used or to the constructs truly being unrelated.

Our study's cross-sectional design did not allow us to examine whether vaccination intentions translate into behavior (Montaño and Kasprzyk, 2002) and precludes making inferences about the causal relationships among study variables. Low reliability of some single-item measures may explain small correlations with some antecedents to anticipated regret, a problem that could be addressed by using multi-item measures. That regression analyses yielded the same results whether or not individuals not responsible for vaccination were included (analyses not shown) suggests that we may have assessed outcome regret instead of decision regret. The relatively small number of parents who had vaccinated their daughters prevented us from examining whether vaccinators who were on schedule in completing the shot series differed from those who were not. We also interviewed primarily female caregivers, and findings may have differed had we interviewed more men. Lastly, the study was conducted in rural and urban areas of a Southern state, but establishing the generalizability of the findings to other regions of the US or to countries with different healthcare systems requires further research.

Conclusions

The present study is, to our knowledge, the first to examine anticipated regret in the context of HPV vaccination. Study findings suggest that anticipated regret is likely to be an important factor in HPV vaccination decisions, perhaps more so than commonly studied risk constructs. While substantial association of anticipated regret and HPV vaccination suggest that uptake can be affected by anticipated regret, additional research will help us to understand the practical implications of these findings for public health, including the

relevance of modifying anticipated regret as a way to increase HPV vaccination rates.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

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References

- Abraham, C., Sheeran, P., 2003. Acting on intentions: the role of anticipated regret. *Brit. J. Soc. Psychol.* 42, 495–511.
- Anderson, C.J., 2003. The psychology of doing nothing: forms of decision avoidance result from reason and emotion. *Psychol. Bull.* 129, 139–166.
- Asch, D.A., Baron, J., Hershey, J.C., et al., 1994. Omission bias and pertussis vaccination. *Med. Decis. Making* 14, 118–123.
- Brewer, N.T., Chapman, G.B., Gibbons, F.X., Gerrard, M., McCaul, K.D., Weinstein, N.D., 2007a. Meta-analysis of the relationship between risk perception and health behavior: the example of vaccination. *Health Psychol.* 26, 136–145.
- Brewer, N.T., Cuite, C.L., Herrington, J.E., Weinstein, N.D., 2007b. Risk compensation and vaccination: can getting vaccinated cause people to engage in risky behaviors? *Ann. Behav. Med.* 34, 95–99.
- Brewer, N.T., Fazekas, K.L., 2007. Predictors of HPV vaccine acceptability: a theory-informed, systematic review. *Prev. Med.* 45, 107–114.
- Brewer, N.T., Weinstein, N.D., Cuite, C.L., Herrington, J.E., 2004. Risk perceptions and their relation to risk behavior. *Ann. Behav. Med.* 27, 125–130.
- Centers for Disease Control and Prevention, 2007. Quadrivalent Human Papillomavirus Vaccine: Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR* 56, 1–24.
- Connolly, T., Reb, J., 2005. Regret in cancer-related decisions. *Health Psychol.* 24 (Suppl.), S29–S34.
- Hughes, J., Cates, J., Liddon, N., Smith, J.S., Gottlieb, S.L., Brewer, N.T., in press. How are caregivers of adolescent girls learning about the HPV vaccine? *Cancer Epid. Biomarkers Prev.*
- Keating, K.M., Brewer, N.T., Gottlieb, S., Liddon, N., Ludema, C., Smith, J.S., 2008. Potential barriers to HPV vaccine provision among medical practices in an area with high rates of cervical cancer. *J. Adolesc. Health* 43, S61–S67.
- Koshiol, J.E., Lindsay, L., Pimenta, J.M., Poole, C.L., Jenkins, D., Smith, J.S., 2008. A systematic review of human papillomavirus persistence and cervical neoplasia. *Am. J. Epidemiol.* 168, 123–137.
- Lo, B., 2006. HPV vaccine and adolescents' sexual activity. *Brit. Med. J.* 332, 1106–1107.
- Montaño, D.E., Kasprzyk, D., 2002. The theory of reasoned action and the theory of planned behavior. In: Glanz, K., Rimer, B.K., Lewis, F.M. (Eds.), *Health Behavior and Health Education*, 3rd ed. Jossey-Bass, San Francisco, pp. 67–98.
- Nordgren, L.F., van der Pligt, J., van Harreveld, F., 2007. Unpacking perceived control in risk perception: the mediating role of anticipated regret. *J. Behav. Decis. Making* 20, 533–544.
- North Carolina Center for State Health Statistics, 2006. North Carolina State Center for Health Statistics. Ten year cervical cancer incidence and mortality for the state of North Carolina by county.
- Olshen, E., Woods, E.R., Austin, S.B., Luskin, M., Bauchner, H., 2005. Parental acceptance of the human papillomavirus vaccine. *J. Adolescent Health* 37, 248–251.
- Ritov, I., Baron, J., 1990. Reluctance to vaccinate: omission bias and ambiguity. *J. Behav. Decis. Making* 3, 263–277.
- Saslow, D., Castle, P.E., Cox, J.T., Gynecologic Cancer Advisory Group, 2007. American Cancer Society Guideline for human papillomavirus (HPV) vaccine use to prevent cervical cancer and its precursors. *CA—Cancer J. Clin.* 57, 7–28.
- van der Pligt, J., Richard, R., 1994. Changing adolescents' sexual behaviour: perceived risk, self-efficacy and anticipated regret. *Patient Educ. Couns.* 23, 187–196.
- Weinstein, N.D., Kwitel, A., McCaul, K.D., Magnan, R.E., Gerrard, M., Gibbons, F.X., 2007. Risk perceptions: assessment and relationship to influenza vaccination. *Health Psychol.* 26, 146–151.