Use of the Carolina HPV Immunization Attitudes and Beliefs Scale (CHIAS) in Young Adult Women

Running Title: CHIAS use in Young Women

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Short Title:
CHIAS performance in young adult women

Abstract

Background: Validated measures that can accurate describe young adults' HPV vaccination attitudes and how these relate to vaccination intention and receipt are needed for developing interventions to improve low HPV vaccination levels. The Carolina HPV Immunization Attitudes Scale (CHIAS) is a validated measure of these outcomes that was originally designed for parents.

Objective: To assess the performance of the CHIAS among young adult women.

Methods: A convenience sample of 139 young adult women (age 18-26 years) were given the CHIAS measure at baseline. Factor analysis was used to determine attitudinal factor groupings and the association of these factors with HPV vaccination intention. A 6-month follow up assessment examined the stability of the CHIAS over time and the association of baseline vaccine factors with vaccine receipt.

Results: Five factors loaded on to the CHIAS in young adults - "Access," "Harms," "Effectiveness," "Risk Denial" and "Uncertainty," - which was similar to the factor loadings of CHIAS for parents. "Harms" was the factor most consistently associated with vaccination intention at all time points assessed. Only 5 women had received or made an appointment to receive the vaccine at the 6-month follow-up.

Conclusions: In terms of categorizing HPV vaccination attitudes, the CHIAS appears to have similar performance among young adults as in parents. However, additional studies are needed to assess the utility of the CHIAS for predicting HPV vaccine receipt among the young adult population.

Key Words: Human papillomavirus; vaccine; young adult

Introduction

Vaccines against human papillomavirus (HPV) represent a remarkable opportunity for the primary prevention of cervical cancer and other HPV-related diseases. Despite these health benefits, HPV vaccination among young adults in the U.S. is significantly lower than national goals.[1] Compared to adolescents,[2] young adult women have substantially lower HPV vaccine utilization, with national estimates indicating that as of 2011, only 29.5% of women ages 19-28 years had received at least one dose in the 3-dose HPV vaccine series.[3]

Interventions to improve HPV vaccine utilization among young women have been hindered by limited understanding of the factors that influence vaccine acceptability, intention, and ultimately vaccine utilization among this population.[4] Though there have been several studies on young women's attitudes about HPV vaccination,[5-7] a validated measure that can accurately categorize attitudes about the vaccine and predict vaccination intention and receipt is not yet available. However, such a measure has been developed for parents making decisions about HPV vaccination for their adolescents and is called the Carolina HPV Immunization Attitudes Scale (CHIAS).[8-10]

The CHIAS , developed by McRee et al, was originally evaluated among a regional sample of parents in North Carolina.[8] Analysis of this 16-item scale resulted in the identification of 4 factors (Harms, Effectiveness, Barriers, Uncertainty) that categorized parental attitudes about HPV vaccines. Subsequent longitudinal analyses demonstrated the stability of these factors to describe HPV vaccination attitudes over time.[4] Of the four factors found to be associated with parent HPV vaccination intention, only Barriers (which related primarily to parents' ability to access the vaccine) predicted actual HPV vaccine utilization by these parents' adolescents. When the CHIAS was examined among a nationally-representative sample of parents, a very similar factor structure resulted, suggesting that the CHIAS is a robust measure of parental

attitudes about the vaccine.[6] Unfortunately, this national study did not assess the association between the CHIAS factors and vaccine utilization.

Having a similarly robust, standardized measure of HPV vaccination attitudes for young women would be useful for developing and examining interventions to improve HPV vaccine uptake among this population. Therefore, the goal of this study was to examine the factor structure of the CHIAS when applied to a sample of young adult women. The specific objectives were: 1) to compare the factor structure that results from young women's' use of the CHIAS to that reported previously for parents, 2) to examine the stability of the CHIAS factors among young women over time, and 3) to evaluate the association between the CHIAS factors and young women's HPV vaccination intention and utilization.

Materials and Methods:

Study Design

We conducted a cross sectional survey of 139 college-aged women that was implemented from October 11, 2011 to November 1, 2012. This survey was part of a larger study aimed at evaluating the longitudinal impact of different educational materials on HPV vaccination intention and receipt, and on hormonal stress responses to those materials (manuscript in preparation). The focus of this manuscript is on responses to CHIAS items specifically, which were administered at baseline (i.e. immediately prior to the educational intervention), immediately after the educational intervention, and in a follow-up survey implemented 6 months later. In this manuscript the longitudinal component of our analysis compares the factor groupings of CHIAS items provided at baseline and at the 6-month follow-up assessment.

Ethics Statement

This study was approved by the Institutional Review Board at the University of Michigan.

Participants

Participants were recruited via Psychology participant pool and flyers posted on campus and in the local town advertising a study about HPV vaccines. Eligibility criteria for participation included being a female aged 18-26 years and not yet having received any doses in the HPV vaccine series. Upon arriving at the study lab and providing informed consent, participants received a paper version of the baseline survey to complete in a private cubicle in the lab. Follow-up surveys were emailed to participants and administered via Qualtrics with up to 2 prompts for non-respondents.

CHIAS items

We used all 16 items described in the original CHIAS[2] and also included one additional item from a modified version of the CHIAS that had been validated previously among a national sample of parents ("*HPV vaccination is not really necessary because Pap smears can be done to make sure cervical cancer doesn't develop").*[6] For each item derived from previous versions of the CHIAS, wording was changed to reflect a young adult, rather than parent, perspective (i.e. "*Other parents in my community are getting their daughters vaccinated*" becomes *"My friends are getting the HPV vaccine*"). One additional item ("*I would regret not getting the HPV vaccine if I later got an HPV infection")* was also included in our study because previous data suggested that anticipated regret may be an important longitudinal predictor of HPV vaccination intention and receipt.[9] All responses were assessed using an 11-point Likert scale (with anchors at 0, 5, 7 and 10 of "strongly disagree," "somewhat disagree," "somewhat agree" and "strongly agree"; or anchored at "extremely ineffective, "somewhat ineffective," "somewhat effective" and "extremely effective") and were coded such that higher values corresponded to stronger agreement with the statement and less agreement with or endorsement of HPV vaccination. Five items were reverse-coded.

Outcome Variables

HPV vaccination intention and receipt were assessed as outcome variables. HPV vaccination intention was measured with two items that asked participants about the likelihood of getting the vaccine *"today if it was available for you,"* or "*within the next 6 months*" using a previously-published 11-point vaccination intention scale.[11-13] This outcome was asked at baseline, and at the 6-month follow-up survey. Vaccination "receipt" was determined by self-report at the 6-month follow-up assessment and was defined as a positive response to at least one of two questions: "*Since you were in the lab for the first part of the study 6 months ago, have you received any doses (shots/injections) of the HPV vaccine?" (yes/no),* and "*Have you made an appointment to get the vaccine?" (yes/no).*

Statistical Analysis

An exploratory factor analysis of the baseline CHIAS items was conducted using principal components analysis with oblique rotation method (as factors were assumed to be correlated). Factors meeting the Kaiser criterion (Eigenvalues ≥ 1.0) were retained. Non-weighted factor scores (consistent with previous CHIAS assessments)[8, 9, 12] were created for each respondent by calculating the mean of the responses to all items loading onto each factor. Cronbach's α coefficient was used to evaluate the internal reliability of each factor grouping. Analyses of CHIAS factor groupings at the 6-month follow-up survey used a similar methodology.

Linear and logistic regression models were used to examine the association between the different factor groupings with vaccination intention and uptake, respectively. Each model included the factor groupings, but no other covariates were added given our relatively small sample size (n=139). Reliability of the factors loadings over time was assessed using a test-retest (i.e. repeated measures) analysis whereby correlations of the factor scores were

computed between baseline and the 6-month follow-up. For all analyses, *p*-values ≤0.05 were considered statistically significant. All analyses were performed using SPSS 20).

Results

Study Sample

Of the 139 participants who completed the baseline survey, 98 (70.5%) also completed the 6-month follow-up survey. As shown in Table 1, at baseline 41% of respondents were in a current sexual relationship, and nearly all had heard of HPV and knew a vaccine was available. Only a small proportion of respondents indicated they had ever experienced an HPV-related disease (2-5**%).**

Factor Structure Among Young Women

The exploratory factor analyses performed on baseline CHIAS measures among young women demonstrated 5 factor groupings (Table 2). Three of these factors, which we labeled "Access," "Harms," and "Effectiveness," showed good internal reliability (Cronbach's alpha 0.74-0.91, Table 3). The internal reliability of the other two factors, "Risk Denial" and "Uncertainty," was considerably lower (0.54 and 0.43, respectively).

Stability of Factor Groupings Over Time

Table 2 compares the factor loadings among young women between the baseline and follow-up survey assessments. There was good stability over time for Access and Effectiveness - all of the items loading on these factors at baseline also loaded on these factors at follow-up. The Harms factor was also reasonably stable in that all except one item loaded on this factor in both the baseline and follow-up assessments. Risk Denial and Uncertainty were the least stable factors over time. Two of the four items that loaded to the Risk Denial factor at baseline then loaded to Harms in the follow-up assessment, and one of the two factors that loaded to

Uncertainty at baseline then loaded to Access at follow-up. Stability of the factors between baseline and follow-up was also assessed quantitatively using paired correlations. Test-retest reliability was high for Access and Harms (Pearson's r=0.67 for both), moderate for Risk Denial (r=0.35) and low for Effectiveness and Uncertainty (r=0.07 and 0.03, respectively).

Association of Baseline Factors with Vaccination Intent Assessed at Baseline

As shown in Table 4, all the factors except Uncertainty were associated with vaccination intention when assessed at baseline for the outcome of willingness to receive the vaccine if it were available "today." Higher perceived difficulty in accessing the vaccine (Access) was associated with *increased* vaccination intention whereas increased concern about harms (Harms), lower perceived effectiveness (Effectiveness) and stronger risk denial attitudes (Risk Denial) were associated with lower vaccination intention. Interestingly, when assessing vaccination intention for the coming 6 months, Access was no longer associated with this outcome (Table 4).

Association of Baseline Factors with Vaccination Receipt at Follow-Up

Only 5 out of 98 women (5.1 %) completing the 6-month follow-up assessment indicated that they had either received the HPV vaccine or made an appointment to get it since the baseline assessment. Of the factors identified at baseline, Risk Denial was the only factor even marginally associated with this outcome. Those having the strongest Risk Denial attitudes were *less* likely to have received or made an appointment to receive the vaccine than those with lower levels of Risk Denial (Table 5).

Association of Baseline Factors With Vaccination Intent Assessed at Follow-up

Comparing Tables 4 and 5, there were notable differences in the relationship between the factors and vaccination intention when participants were assessed at baseline versus at the 6-

month follow-up. In contrast to the baseline assessment (Table 4), only Harms was associated with vaccination intention for "today," and only Harms and Effectiveness were associated with vaccination intention for the coming 6 months when assessed at the follow-up survey (Table 5).

Discussion

Measures that reliably predict HPV vaccination intention across populations and over time could help facilitate the development of effective interventions to improve HPV vaccine uptake. The original CHIAS[3] was tested among parents of adolescents and found to be a useful tool to categorize HPV vaccination attitudes, with each identified factor reliably predicting vaccination intention over time, and one factor ("Barriers" – called "Access" in our study) longitudinally predicting vaccination receipt. When we evaluated the factor loadings of the CHIAS among young adult women, we found the overall factor structure to be robust - there were significant similarities in the items loading to the factors Access, Harms, Effectiveness and Uncertainty between young women in our study and prior analyses of CHIAS in parents. However, in our study a new factor emerged from the CHIAS, which we termed Risk Denial. This new factor contained correlates of two statements that loaded to Harms in the original CHIAS ("I think that getting the HPV vaccine makes it more likely for someone to have sex" and "I think I am too young to get a vaccine for a sexually transmitted infection) in addition to the two new items added for assessment in our study ("HPV vaccination is not necessary because Pap smears can be done to make sure cervical cancer doesn't develop" and "I would regret not getting the HPV vaccine if I later got an HPV infection"). It was notable that 3 of the 4 items loading to the Risk Denial factor relate to low perceived risk of HPV infection or sequelae (vaccine non necessary because of Pap tests; too young to get a vaccine against an STI, and low anticipated regret). Given that "infallibility" is a developmental stage that many adolescents and young adults go through,[14] the appearance of the Risk Denial factor among young adults using the CHIAS is not surprising but has great clinical significance. Our results suggest that young

women may have subtle differences in attitudes about HPV vaccines from parents of adolescents that could be important to consider for intervention to improve vaccine uptake among this population. Furthermore, our findings may indicate a heightened need to "convince" young women about their individual risk for HPV infection and disease.

An important finding from our study was the variable stability in the CHIAS factor groupings over time. For some factors, the items loading on it were identical between baseline and follow-up assessments whereas for others, there was less continuity. This was particularly true for the Risk Denial and Uncertainty factors where 50% of the items loaded differently between the two assessments. In the original CHIAS study among parents,[8] 3 factors (Harms, Effectiveness and Uncertainty) were assessed at baseline and 1 year later and all had reasonably high test-retest reliability (r = 0.42-0.73). However, in our study among young women only the Access and Harms constructs had similarly high test-retest reliability over time (alpha=0.80 for both). The significance of this finding is unclear, but could suggest that certain attitudes about HPV vaccination are more volatile and subject to change over time for young adults than for parents. However, larger studies among a more diverse sample of young adults would be necessary to make any firm conclusions in this regard. The finding that items loading to the Harms construct appear to be consistent and reliable across populations, combined with the fact that in our study Harms is the most consistent predictor of vaccination intention both immediately and longer-term, suggests that interventions focusing on mitigating concerns about the vaccine's harms may be a particularly effective educational strategy for increasing HPV vaccination among young adults.

An interesting finding from our study was the association between the Access factor and vaccination intention. When assessed at baseline, young adults with higher perceived barriers to accessing the vaccine had an *increased* vaccination intention if the vaccine were available

"today." In contrast, at baseline there was no association between Access and vaccination intention when intentions for the "next 6 months" were assessed as the outcome, or when vaccination intention was assessed for either time frame in the follow-up survey. This finding could signify that the young women in the study had a very literal interpretation of having "the vaccine available for you today." Participants may have believed that they would have opportunity to get the vaccine in the study lab after taking the baseline assessment (which was not the case). If so, it is understandable that those with higher perceived barriers to accessing the vaccine would have a higher vaccination intention for a vaccine that might be immediately available, and that access would be unrelated to a vaccine dose theoretically available 6 months in the future, or when reassessed by email where "vaccinating today" by the study team was obviously not a realistic possibility. These findings suggest that coupling HPV vaccination education with immediate access to the vaccine may be an effective strategy to increase HPV utilization among young adults.

In the original CHIAS study in parents,[8] Harms, Effectiveness, Access (a.k.a. "Barriers") and Uncertainty were all associated with vaccination intention, but only Access was associated with actual vaccine receipt when vaccination status was assessed a year later.[9] In our study there were only 5 women who reported either getting the vaccine or making an appointment to get the vaccine between the baseline and follow-up assessments, making it difficult to draw conclusions about the interrelationship between CHIAS factors, vaccination intention and vaccine receipt in young adults. In our limited analyses, Risk Denial was the only factor associated with vaccine receipt - those who had stronger perceptions about their infallibility to HPV-related infection and disease had a lower likelihood of vaccine receipt and making an appointment for vaccination. However, further study is needed to determine whether Risk Denial is a factor that is uniquely influential among young adults, and the degree to which this factor is associated with vaccine

receipt. Risk Denial was one of the least stable factors over time in our study, and also included the two items that we added to the assessment that were not present in the original CHIAS.

Other limitations that are important to consider for this study are the relatively small sample size that was drawn from a limited geographic area, which impacts the generalizability of the results. In addition, participants involved in the study were exposed to one of four different educational materials immediately after their baseline assessment. While none of the interventions appeared to have impacted vaccination intention or receipt (manuscript in preparation) either when assessed immediately following the intervention or at the 6-month follow-up, it is possible that the variability of educational materials could have had subtle influences on the CHIAS factor loadings when assessed over time.

Conclusions

CHIAS items appear to group into very similar factors when comparing parents making decisions about HPV vaccination for their adolescents to young women making the HPV vaccination decision for themselves, suggesting that the CHIAS is robust measure for categorizing HPV vaccination attitudes. However, the association of these factors with vaccination intention, and also likely on vaccine receipt, appears to differ between parents and young adults. Harms was the only factor that performed similarly between these two populations and also consistently predicted vaccination intention over a variety of time frames. This suggests that educational strategies focusing on mitigating perceived harms from the vaccine may have the widest influence and appeal across populations of different ages.

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Table 1. Sample Characteristics of College-Aged Females in Study at Baseline	
Variable	Sample N=139
Mean age, yrs (range)	20 (19-25)
% Currently in sexual relationship*	41%
Lifetime number of sexual partners (range)*	1 (0-8)
Relationship status (%)	
Single and not dating	55%
Dating more than one person	1%
In a relationship with one person only (dating, engaged, married)	44%
% Ever heard of HPV	94%
% Knew there was an HPV vaccine available	98%
% Ever diagnosed with genital warts	2%
% Ever diagnosed with an abnormal Pap smear	5%
% Never diagnosed with a sexually transmitted infection	99%

*Sexual partner and sexual relationship were defined as having any intimate genital contact.

Table 2. Factor Profiles of the CHIAS Assessed at Baseline and at 6-month Follow-up

Factor Items	**Factor Loading at Baseline**	**Standardized Beta Coefficient**	**Factor Loading at Follow-up[¥]**	**Standardized Beta Coefficient**
It would be hard to find a provider or clinic that would be easy to get to for getting vaccinated against HPV.	Access	0.923	Access	0.862
It would be hard to find a provider or clinic where I could afford the HPV vaccine.	Access	0.912	Access	0.874
It would be hard to find a provider or clinic that has the HPV vaccine available.	Access	0.891	Access	0.856
I am concerned the HPV vaccine costs more than I can pay.	Access	0.873	Access	0.827
It would be hard find a provider or clinic where I don't have to wait a long time to get an appt. to be vaccinated.	Access	0.800	Access	0.777
I think the HPV vaccine may cause health problems in the future.	Harms	0.899	Harms	0.865
I think the HPV vaccine is unsafe.	Harms	0.836	Harms	0.814
I think the HPV vaccine might cause short term problems like fever or discomfort.	**Harms**	**0.715**	**Uncertainty**	**-0.745**
The HPV vaccine is so new that I want to wait a while before	Harms	0.696	Harms	0.749

deciding if I should get it.				
I think the HPV vaccine is being pushed to make money for drug companies and/or doctors.	Harms	0.555	Harms	0.793
How effective do you think the HPV vaccine is in preventing genital warts? If you don't know, make your best guess.*	Effectiveness	0.850	Effectiveness	0.869
How effective do you think the HPV vaccine is in preventing cervical cancer?*	Effectiveness	0.833	Effectiveness	0.805
I think that getting the HPV vaccine makes it more likely for someone to have sex.	Risk Denial	0.702	Risk Denial	0.824
HPV vaccination is not really necessary because Pap smears can be done to make sure cervical cancer doesn't develop.	**Risk Denial**	**0.682**	**Harms**	**0.523**
I think I am too young to get a vaccine for a sexually transmitted infection like HPV.	Risk Denial	0.538	Risk Denial	0.691
I would regret not getting the HPV vaccine if I later got an HPV infection.*	**Risk Denial**	**0.525**	**Harms**	**0.605**
I have enough information about the HPV vaccine to decide whether to get it.*	Uncertainty	0.873	Uncertainty	0.612

My friends are getting the HPV vaccine.*	**Uncertainty**	**0.626**	**Access**	**0.351**

Bolded items delineate items that loaded onto different factors at baseline versus follow-up.

*Items were reverse-coded to maintain consistency, with higher values corresponding to less support for HPV vaccines.

[¥]Follow-up survey occurred 6 months after baseline. N = 98

Table 3. Mean Factor Scores and Internal Reliability of Factors When Assessed at Baseline and Follow-up[¥]

Factor	Baseline		Follow Up	
	Mean (SD)	**Cronbach's Alpha**	**Mean (SD)**	**Cronbach's Alpha**
Access	1.60 (1.86)	0.92	2.51 (2.01)	0.85
Harms	4.87 (2.04)	0.81	3.95 (2.08)	0.83
Effectiveness	4.10 (1.36)	0.74	3.26 (1.69)	0.79
Risk Denial	2.70 (1.73)	0.54	2.22 (2.07)	0.63
Uncertainty	5.30 (2.32)	0.43	4.86 (1.99)	0.69

[¥] Follow-up survey occurred 6 months after baseline. N = 98

Table 4. Relationship Between Baseline Factors and Baseline Intentions for HPV Vaccine

	Baseline Vaccination Intention for "today"*		**Baseline Vaccination Intention for the "next 6 months****	
Baseline Factors	**Standardized Beta Coefficients**	***p*-value**	**Standardized Beta Coefficients**	***p*-value**
Access	**0.215**	**0.002**	0.080	0.318
Harms	**-0.359**	**<0.0001**	**-0.207**	**0.021**
Effectiveness	**-0.147**	**0.049**	**-0.170**	**0.046**
Risk Denial	**-0.244**	**0.001**	**-0.228**	**0.009**
Uncertainty	-0.057	0.416	-0.036	0.653

*Assessed at baseline by measuring response to the question *"If the HPV vaccine was available for you today, how likely would you be to get vaccinated?"*

**Assessed at baseline by measuring response to the question *"How likely are you to get the HPV vaccine within the next 6 months?"*

Bolded values highlight statistically significant relationship.

Table 5. Relationship Between Baseline Factors and 6-month *Follow-up* Intentions for HPV Vaccine[¥] or Vaccine Receipt[§]

	Follow-up Vaccination Intention for "today"*		**Follow-up Vaccination Intention for the "next 6 months****		**Vaccine Receipt[§] at 6 month Follow-up Assessment**	
Baseline Factors	**Standardized Beta Coefficients**	***p*-value**	**Standardized Beta Coefficients**	***p*-value**	**Standardized Beta Coefficients**	***p*-value**
Access	.038	.690	.067	.495	.594	.212
Harms	**-.409**	**.000**	**-.289**	**.010**	.047	.906
Effectiveness	-.123	.227	**-.287**	**.007**	-.019	.976
Risk Denial	-.190	.062	-.133	.197	**-6.581**	**.098**
Uncertainty	.125	.195	.076	.436	-.412	.342

*Assessed at follow-up by measuring response to the question *"If the HPV vaccine was available for you today, how likely would you be to get vaccinated?"*

**Assessed at follow-up by measuring response to the question *"How likely are you to get the HPV vaccine within the next 6 months?"*

[¥] Follow-up survey occurred 6 months after baseline. N = 98

[§] Vaccine receipt defined and reporting having received or made and appointment to receive an HPV vaccine dose.

Bolded values highlight statistically significant relationship.