

INTRODUCTION

Evidence-based sexual health education (SHE) programs aim to reduce risks related to sexual behavior in adolescent populations. Youth who engage in sexual behaviors at younger ages are more likely to have poorer health outcomes, including being exposed to STDs and unintended pregnancies¹. SHE programs aim to reduce potential health risks in middle school aged youth by educating them before they become sexually active.



Often the measure of efficacy of SHE programs is a reduction in initiation of sexual activity among participating youth. However, since the prevalence of sexual activity is already low in middle school aged youth, detecting changes in initiation of sexual activity due to these programs can be difficult. Differences in pre-sexual behaviors, such as dating, kissing, and touching, might allow for better detection of program effects due to their higher prevalence². This study aims to explore how pre-sexual behaviors may be useful as alternate measures of program outcomes in younger populations by examining the relationships between pre-sexual behaviors and sexual behavior.

METHODS

Cross-sectional survey data were collected from 9th grade students attending 10 high schools located in large urban school districts that were participating in the Keeping It Real (KIR) SHE program during 2012 to 2015³.

Table 1 <i>Participant Characteristics (N=6,007)</i>		
Measure	<i>n</i>	%
Demographics		
Female	2,951	49.0
Hispanic/Latino	5,103	89.9
African American	600	10.1
Age (mean, SD)	15.1	0.38
Sex Behavior		
Ever had sex (oral, vaginal or anal)	1,196	20.0
Pre-sexual behaviors		
Ever been on a date alone	3,376	56.6
Ever kissed someone	4,860	81.5
Ever had a boyfriend/girlfriend	4,918	82.5
Ever touched someone else's privates or had privates touched (consensual)	2,169	36.9

Note: Frequencies may not add up to 6,007 due to missing values.

ANALYSIS APPROACH

Association of pre-sexual behaviors with sexual behaviors

- 2 x 2 cross-tables are used to examine the co-occurrence of pre-sexual behaviors with sexual behavior.
 - Pre-sexual behaviors include: dating, kissing, having a boyfriend/girlfriend, and sexual touching (defined as consensual touching of 'private parts').
 - Sexual behavior includes oral, vaginal or anal sex.

Predicting sexual behavior using pre-sexual outcome measures

- Multivariable logistic regression models were fit on each of the four pre-sexual behaviors and the reported sexual behavior response variables.
 - Six demographics and 17 psychosocial covariates were chosen via best subsets. Sufficient overlap in subsets resulted in the same model being used for all outcomes.
 - Certain psychosocial variables are associated with the likelihood of initiating sexual behavior among adolescents^{4,5}.
 - The KIR program also measured these constructs in order to determine how they affected behavior relating to sexual activity.
 - The baseline accuracy for predicting the modeled response for each response variable was generated.
- Model predicted probabilities of the pre-sexual behavior were then used in a logistic regression to predict the reported sexual behavior.
 - Model accuracy was calculated for each response variable.

RESULTS

Table 2a

Ever been on a date	Ever had sex	
	No	Yes
No	2,454 95.0%	130 5.0%
Yes	2,307 68.4%	1,066 31.6%

p < 0.0001, Phi Coefficient = 0.33

Table 2b

Ever had boyfriend/girlfriend	Ever had sex	
	No	Yes
No	1,033 99.0%	11 1.1%
Yes	3,728 75.9%	1,185 24.1%

p < 0.0001, Phi Coefficient = 0.22

Table 2c

Ever kissed	Ever had sex	
	No	Yes
No	1,092 99.2%	9 0.8%
Yes	3,669 75.6%	1,187 24.4%

p < 0.0001, Phi Coefficient = 0.23

Table 2d

Sexual touching	Ever had sex	
	No	Yes
No	3,708 100%	0 0%
Yes	969 44.8%	1,196 55.2%

p < 0.0001, Phi Coefficient = 0.66

Tables 2a-2d show the frequency and row percent for the cross-table of pre-sexual behavior by sexual behavior. P-values were generated using Chi-squared or Fishers Exact tests. Phi Coefficient Correlations, a measure of degree of association between binary outcomes, are included.

RESULTS

- Participants who reported having sex were much more likely to have also engaged in a pre-sexual behavior.
- At least 95% of participants reporting sexual behavior also reported engaging in a pre-sexual behavior.
- Phi Coefficient Correlations ranged from 0.22 (ever had a boyfriend/girlfriend) to a high of 0.66 (sexual touching).

Table 3

Baseline model accuracy for pre-sexual and sexual behaviors

Response	Accuracy (%)	Sensitivity (%)	Specificity (%)
Ever been on a date (alone)	74.0	80.0	65.7
Ever kissed someone	86.0	95.8	39.6
Ever had a boyfriend/girlfriend	97.3	99.1	73.4
Ever touched someone else's privates or had privates touched (sexual touching)	78.7	66.8	85.9
Ever had sex (any)	85.2	49.4	94.6

- Table 3 shows the baseline accuracy (how well the model predicts the response), sensitivity (% of correctly identified positives), and specificity (% of correctly identified negatives) for each model.
- The baseline accuracy to predict sexual behavior (using sexual behavior as the reported outcome) had an accuracy of 85.2%.
 - Baseline accuracy of predicting pre-sexual behaviors ranges from 74.0% (dating) to 97.3% (ever had a boyfriend/girlfriend).

Table 4

Model accuracy, pre-sexual behaviors predicting sexual behaviors

Outcome	Accuracy (%)	Sensitivity (%)	Specificity (%)
Ever been on a date (alone)	75.8	76.3	75.7
Ever kissed someone	72.0	75.6	71.0
Ever had a boyfriend/girlfriend	74.9	75.8	74.7
Ever touched someone else's privates or had privates touched (sexual touching)	79.4	78.8	79.6

Table 4 shows how well each model, using the probabilities of a 'positive' pre-sexual behavior outcome, predicts sexual behavior.

- Accuracy ranged from 72.0% to 79.4%, slightly lower than the accuracy of the baseline sexual behavior model.
- Sensitivity ranged from 75.6% to 78.8%, higher in all cases than the base model, and specificity ranged from 71.0% to 79.6%, lower than the base model.

DISCUSSION

Association of pre-sexual behaviors with sexual behaviors

- The finding that at least 95% of students who reported having sex also reported engaging in pre-sexual behaviors strongly suggest that these behaviors co-occur, either simultaneously or in succession.
- While the correlations for three of the four pre-sexual behaviors weren't large, sexual touching had a sizeable correlation of 0.66.

Pre-sexual behaviors predicting sexual behaviors

- The accuracies of models using pre-sexual behavior probabilities' to predict sexual behavior were 13.2% to 5.8% lower than the accuracy of the baseline model to predict sexual behavior using reported sexual behavior.
- While some accuracy is lost when using pre-sexual behaviors, there still remains reasonable accuracy to predict sexual behavior.
- Each pre-sexual predictive model had higher sensitivity than the base model. This means they did better at correctly identifying students who have had sex, than they did correctly identifying students who reported the modeled pre-sexual behavior.
- However, specificity is lower by 24.6% to 15.0%. These models are less able to correctly identify a student who has not had sex.
- Sexual touching showed the highest accuracy, sensitivity, and specificity.

Implications

- These findings support the premise that pre-sexual behaviors can be used as alternative measures of program efficacy, serving as more proximal outcomes in younger adolescents than sexual behavior.
- Sexual touching performed the best in each test, although each of the other pre-sexual behaviors could be a reasonable surrogate as well.
- These models may over-estimate the true proportion of sexually active students, further refinements to the model using advanced tools such as machine learning for variable selection could be warranted.
- This research may also inform evaluators on the type of data to collect. A 'no' response to one or more pre-sexual behavior would most likely mean that the student has also not engaged in sexual behavior, which could avoid discomfort in asking sensitive questions in younger populations.
- Longitudinal studies are needed to investigate how pre-sexual behaviors relate to sexual behaviors through time, and possible causal pathways.

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