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Correlation and Structural Equation Analysis on the Effects of Anti-Discrimination Policies and Resources on the Well Being of Lesbian, Gay, and Bisexual College Students

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ABSTRACT

Methods: Among a convenience sample of cisgender LGBQ college students (n=268), we examined the association between college- and state-level structural factors and students' experiences of campus hostility and microaggressions, psychological distress, and self-acceptance. Relationships between these outcomes were first examined with Spearman correlation coefficients. Structural Equation Modeling (SEM) was used to explore the meditating relationship of college-level structural factors on discrimination, distress, and self-acceptance.

SAS® Proc Corr was used for the correlation analysis and Proc CALIS was used for the SEM. The EffPart feature in Proc CALIS was used to test for a mediating effect from an inclusive non-discrimination policy to (hostility and microaggressions) to psychological distress.

Results: State-level factors were not correlated with students' experiences nor psychological well being. Both the correlation matrix and SEM results suggested positive benefits from select college policies and resources, particularly non-discrimination policies that include both gender identity and sexual orientation (versus only sexual orientation). Based on the SEM and correlation matrix, a non-discrimination policy that included both sexual orientation and gender identity was significantly associated with lower microaggressions and overt hostility, $p<.05$. Higher LGBTQ student organization to study body ratios were also significantly associated with reduced microaggressions and hostility, in addition to lower stress and anxiety.

The SEM model indices indicated good absolute fit, incremental fit, parsimony, and predictive ability with CFI>.95, along with RMSEA and SRMR<.05.

Conclusion: An inclusive non-discrimination policy, that includes transgender students, also provides a healthier college environment for cisgender students.

Outline

1)_Research Questions and Description of the Data.

The research questions for this data analysis project were:

- Among lesbian, gay, bisexual, queer, questioning (LGBQ) college students, which state-level and college-level policies are associated with greater psychological well-being (self-esteem, pride, self-acceptance)?
- Are any policies and resources associated with lower hostility or microaggressions?

The data for this study (n = 268) consisted of 268 cisgender LGBQ college students who were attending colleges in the United States. By using an anonymous web-based survey, the college student data was collected from January to February of 2013. The participants were recruited through electronic messages distributed via the Consortium of Higher Education LGBT Resource Professionals. To participate, participants had to be at least 18 years old and identify as a sexual or a gender minority, and be currently enrolled in college or have graduated within the past year. Transgender students were excluded because they received different micro-aggression questions.

The state-level policies in this analysis project were employment discrimination protection and relationship recognition. Employment discrimination protection was coded as 0 for none, 1 for sexual orientation only, and 2 for sexual orientation and gender identity. Relationship recognition was coded as 0 for none, 1 for civil unions, and 2 for legal marriage. For example, Michigan would be a zero for both employment non-discrimination and relationship recognition. Whereas, Wisconsin would a one for employment discrimination because the state law includes sexual orientation, but not gender identity. Illinois would be a 1 for relationship recognition, because same sex civil unions, but not marriage were recognized.

The college-level policies and resources, coded as 0 for present and 1 for not present are presented in Table 1 below, along with demographics. The only non-categorical resources variable was the ratio of lgbtq student organizations per student body, calculated as count of organizations per 1000 students.

Table 1. Demographics and College and State Policies and Resources (*n* = 268), Mean (std dev) or N (%)	
Age (years)	24.13 (6.44)
Atypical gender presentation (1 = typical to 5 = atypical)	2.21 (0.80)
Ratio of LGBTQ student organizations/student body	0.34 (0.27)
Institutional policies	
Gender-identity-inclusive anti-discrimination policy	217 (80.97%)
Domestic partner benefits	236 (88.06%)
Name of choice	188 (70.15%)
Transition coverage	193 (72.01%)
Institutional initiatives/resources	
LGBTQ office/staff	217 (80.97%)
General LGBTQ campus awareness	210 (78.36%)
LGBTQ ally/safe space	183 (68.28%)
LGBTQ student support initiatives	216 (80.60%)
LGBTQ for-credit course	199 (74.3%)
LGBTQ alumni initiative	195 (72.76%)

State policies	
Same-sex relationships recognition	
No recognition	212 (79.10%)
Civil unions	20 (7.46%)
Legal marriage	36 (13.43%)
Employment discrimination prohibitions	
None	210 (78.36%)
Sexual orientation only	32 (11.94%)
Sexual orientation and gender identity	26 (9.70%)
Gender	
Man	113 (42.16%)
Woman	155 (57.84%)
Sexual orientation	
Bisexual	52 (19.40%)
Gay	94 (35.07%)
Lesbian	71 (26.49%)
Queer	38 (14.18%)
Other	13 (4.85%)
All respondents were cisgender (i.e., each person's self-identity corresponds with their assigned sex at birth).	

On average, the students were 24 years old. Their mean gender presentation was somewhat atypical with a mean of 2.21, where 1 indicated typical to 5 indicating atypical. The majority were women (58%), White (75%), and undergraduate students (58%). Participants represented 58 colleges located in 24 different states, with the largest group of participants from institutions in Michigan (66%). The sample represented each U.S. Census region.

Overall, LGBTQ inclusive policies and resources were common at the college level. The vast majority of the students attended schools with domestic partner benefits (88%), sexual orientation and gender identity inclusive anti-discrimination policies (81%), and LGBTQ office/staff (81%). Likewise, 78% of the participants attended colleges that offered some sort of general LGBTQ campus education/awareness program, while 68% attended colleges that offered LGBTQ ally/safe space trainings. Four of the 58 institutions represented in our sample did not have any LGBTQ student organizations. The average number of LGBTQ student organizations was 4.00 (SD = 4.94).

Table 1 was generated with two SAS macros written by Brandy Sinco, %ChiFreqN and %UniStatN. ChiFreqN computes counts and percentages for categorical variables. UniStatN creates univariate summary statistics. Both macros were designed to combine the results from multiple runs into a SAS dataset, that would easily be output to Excel for processing.

```
************************************************************************;
* %ChiFreqN tests the variable alone and has no class variable.        *;
* Written By: Brandy Sinco                                             *;
************************************************************************;

/* Create dataset for Proc Freq output */
Data FreqOuN;
  Format VARNAME $30. VARVALUE COUNT 8.0 DSET $30.;
Run;

%Macro ChiFreqN(VarName, DatSet);
/* Remove previous output file */
```

```
Proc Datasets Memtype=Data;
  Delete FreqOuN0;
Run;

Proc Freq Data=&DatSet NoPrint;
  Tables &VarName / ChiSq NoCum Out=FreqOuN0 ;
Run;

Data FreqOuN0;
   Format VARNAME DSET $30.;
   Set FreqOuN0;
   Rename &VarName=VarValue;
   VARNAME="&VARNAME";
   DSET="&DATSET";
Run;

Data FreqOuN;
  Set FreqOuN FreqOuN0;
Run;

%MEnd ChiFreqN;

proc print data=FreqOuN;
  Var VARNAME VarValue Count DSET;
run;


*************************************************************************;
* %UniStatN generates summary statistics on dataset and stores results in *;
* the UNCLines dataset, which can easily be uploaded to Excel.            *;

* Include the p values for the T-Test and Wilcoxon's Signed rank to test   *;
* whether the values are significantly different from zero                 *;
*************************************************************************;

/* ProbT = p value from Student T-Test */
/* ProbS = p value from Wilcoxon Signed Rank Test */

Data UNCLines;
  Format VARNAME DSNAME $30. N NMISS 7.0 MEAN MEDIAN STD SKEWNESS KURTOSIS
STDERR LCLM UCLM MIN MAX 7.2 PROBT PROBS 7.4;
Run;

%Macro UniStatN(VarName, DatSet);
/* Delete Previous Univariate Output File */
Proc Datasets MemType=Data;
  Delete UniOut UniOutNm;
Run;

Proc Univariate Data=&DatSet NoPrint;
  Var &VarName;
  Output Out=UniOut N=N NMISS=NMISS MEAN=MEAN MEDIAN=MEDIAN STD=STD
      MIN=MIN MAX=MAX SKEWNESS=SKEWNESS KURTOSIS=KURTOSIS
      PROBT=PROBT PROBS=PROBS;
Run;
```

```
/* Add Variable Name and Class Name to Univariate Output */
Data UniOutNm;
  Format VARNAME $30.;
  Set UniOut;
  VarName="&VARNAME";
  DSNAME="&DATSET";
Run;

/* Append Most Recent Univariate Output to OutStats */
Data UNCLines;
   Set UniOutNm UNCLines;
Run;
%MEnd UniStatN;
```

2)_ Background: Microaggressions, Violence, and Mental Health

In this data analysis project, the heterosexism factor was constructed from overt hostility and microaggressions. Overt hostility was measured by Herek's scale, that was also used in a Yale University study. Questions on Herek's scale included threats due one's perceived sexual orientation, physical assault, property damage, threatening e-mails, and being chased or followed. The responses to each question on the scale ranged from 0 (never) to 5 (very frequently)[1].

In contrast, micro-aggressions are verbal, nonverbal, and environmental slights, snubs, or insults, whether intentional or unintentional, that communicate hostile, derogatory, or negative messages to target persons based solely upon their marginalized group membership[2]. Examples of inter-personal and environmental microaggressions are given below.

- Examples of Interpersonal Microaggresions. Saying to a female, "You shouldn't lift weights because people might think you are a lesbian." Saying to a male, "You should dress more masculine, you look too gay."
- Examples of Environmental Microaggession. Choir director telling the choir that normal women will sing "he" and normal men will sing "she" in songs about romantic relationships, creating an environment where same sex orientation is stigmatized and not considered normal.
- Example of Interpersonal Microaggressions Scale. Comment from one student to another, "LGBQ people should not be around children."
- Example of Environmental Microaggessions Scale. 'I heard someone say "It's so gay" to describe something as negative, stupid, or uncool'.

LGBQ students report experiencing blatant and subtle forms of mistreatment, and an unsafe climate[3],[4]. Positive associations documented between experiences/perceptions of discrimination on campus and negative mental health outcomes among LGBQ students [5,6,]. A growing body of research suggests that anti-discrimination policies and resources for lgbt college students are associated with positive mental health outcomes[7,8,9].

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3)_Introduction to Structural Equation Modeling (SEM).

Before discussing structural equation modeling results on LGB college students, I will give a brief introduction. Structural Equation Modeling (SEM) is a system of linear equations based on a diagram that describes the relationships between the variables. Although the interpretation of SEM model coefficients is the same as in linear regression, SEM differs from multivariate linear regression in several ways. First, variables can be predictors (or exogenous) in one equation and outcomes (or endogenous) in another equation. Second, variables can be manifest, meaning measureable, or latent factors. SEM is also called the marriage of linear regression and factor analysis. Third, SEM models are estimated by maximum likelihood, rather than by least squares. SEM models the covariance matrix between all variables in the system of equations.

Design Equations and Matrices

Assume a simple random sample of size n from an infinite population. Let

- p = Number of manifest exogenous variables; q = Number of manifest endogenous variables.
- r = p + q = Number of manifest exogenous + endogenous variables.
- X = Matrix of manifest exogenous variables, with dimension n × p.
- Y = Matrix of manifest endogenous manifest variables, with dimension n × q.
- Z = [X Y] = Matrix of manifest endogenous and exogenous variables, dimension n × r.

- μ = Column vector of means of manifest variables based on SEM model, dimension r × 1.
- Σ = Covariance matrix of manifest variables based on SEM model, dimension r × r.
- Both μ and Σ are functions of the SEM model parameters.[10]

- $\bar{z}$ = Column vector of sample means of manifest variables, dimension r × 1.
- S = Sample covariance matrix , containing all sample variances and covariances of the columns of z, with (n – 1) in the denominator, dimension r × r.
- $|S|$ = Generalized Variance of S = determinant(S).
- $\hat{\Sigma}$ = Estimated covariance matrix of Z based on the SEM model.
- $|\hat{\Sigma}|$ = Generalized Variance of $\hat{\Sigma}$ = determinant($\hat{\Sigma}$).

The goals of SEM are to estimate the conditional means and covariances of the endogenous variables. $\hat{\Sigma}$ must be a positive definite matrix, meaning that the determinant must be positive. SEM models are often fit by the method of Maximum Likelihood. The maximum likelihood process minimizes the discrepancy function, F_{ML}, where

- $F_{ML} = \ln|\Sigma| - \ln|S| + tr\left(S\Sigma^{-1}\right) + \left(\bar{z} - \mu\right)^T \Sigma^{-1}\left(\bar{z} - \mu\right) - r$ and F_{ML} = -2log(likelihood)/n.
- Model χ^2: $\chi^2_{ML} = (n-1)F_{ML}$. If the SEM model fits perfectly, the model $\chi_{ML}^2 = 0$, because S = $\hat{\Sigma}$.

Evaluating the Goodness of Fit of a SEM Model[11,12]

Goodness of fit indices are best understood by dividing them into four categories: absolute fit, incremental fit, parsimony, and prediction ability of the model.

Let df_{ML} = degrees of freedom for the model under consideration,
df_B = degrees of freedom for the null model with no covariates.
The model χ^2 is given by $X^2_{ML} = (n-1)F_{ML}$ and null model's χ^2 is $X^2_B = (n-1)F_B$

Absolute Fit Indices are analogous to R^2 in linear regression and estimate the proportion of the sample covariance that is explained by the model. The AGFI (Joreskorg-Sorbom Goodness of Fit Index) is analogous to R^2 in linear regression. AGFI > .9 indicates a good absolute fit.

Incremental Fit Indices compare the hypothesized model to the null model with no predictors ($Y_1 = \varepsilon_1, \ldots, Y_q = \varepsilon_q$). Kline recommends the CFI (Bentler's Comparative Fit Index). A value of CFI from .90 - .95 is considered acceptable, while above .95 indicates a better incremental fit. CFI = $1 - (\chi_{ML}^2 - df_{ML})/(\chi_B^2 - df_B)$

Parsimony Adjusted Indices include penalty terms in their formulas for more complex models. When two models with similar fit to the data are compared with parsimony adjusted indices, the indices will favor the less complex model. The RMSEA (Steiger-Lind Root Mean Square Error of Approximation) with a 90% confidence interval). RMSEA < .05 is considered ideal, .05 to .08 indicates acceptable parsimony, .08 to .10 is considered mediocre, and above .10 signals a poor fit. Also, "Probability of Close" fit is the p-value for the null hypothesis that RMSEA ≤ .05.

Predictive Fit Indices estimate model fit in in samples of the same size and estimate the model's ability to make predictions for the population. The SRMR (Standardized Root Mean Square Residual) is related

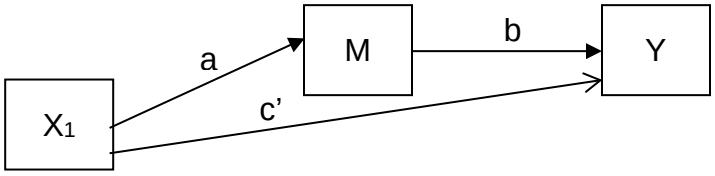
to the correlation residuals. SRMR < .10 is the goal, with values under < .08 indicating better predictive ability of the model.

Because SEM is based on maximum likelihood estimation, AIC (Akaike's Information Criteria) can be used to compare any two models and the LRT (likelihood ratio test statistic) can be used to compare two nested models. In SEM, the LRT is computed by subtracting the chi-squares between the reference model, χ^2_M, and the nested model, χ^2_0. LRT = $\chi^2_M - \chi^2_0$. The degrees of freedom will be the difference in degrees of freedom between the reference model and the nested model.

When data is missing at random (MAR), full information maximum likelihood produces robust estimates. FIML uses all available data. If the model contains 10 variables and a record contains data on 7 of 10 variables, FIML uses the 7 variables, rather than discarding records with incomplete.

For an SEM example, consider the mediation model below. All variables are manifest, indicated by the squares.

Figure 1: Model With Mediation (a, b, c' = linear regression coefficients)



The equations indicated by the above diagram are:

- $M = aX_1 + \varepsilon_M$.
- $Y = bM + c'X_1 + \varepsilon_Y$.

An arrow going into a variable indicates that it is an outcome. The model implies two equations, one for M and one for Y.

The second equation is equivalent to $Y = (ab + c')X_1 + \varepsilon_{Y'}$, where $\varepsilon_{Y'}$ includes ε_M and ε_Y.
If $c = (ab + c')$, then $Y = cX_1 + \varepsilon_{Y'}$

A variable M mediates the effect of X_1 on Y if X_1 has an effect on Y via M. Mediation is also called an "Indirect Effect" in Structural Equation Modeling. The proportion of mediation of X_1 by M is given by ab/c or (1 – c'/c). In a model with complete mediation, c' = 0. For example, let c = 6.558, a =1.831, b = 1.398, c' = 3.998; 6.558 = 1.831*1.398 + 3.998.

Mediation is statistically significant when, a, b, c', and ab are statistically significant. Sobel derived a formula to test for the statistical significance of the product, ab[14].

se_a = standard error of a; se_b = standard error of b.
se_{ab} = standard error of the product, ab =

$$se_{ab} = \sqrt{a^2 se_b^2 + b^2 se_a^2 + se_a^2 se_b^2}$$

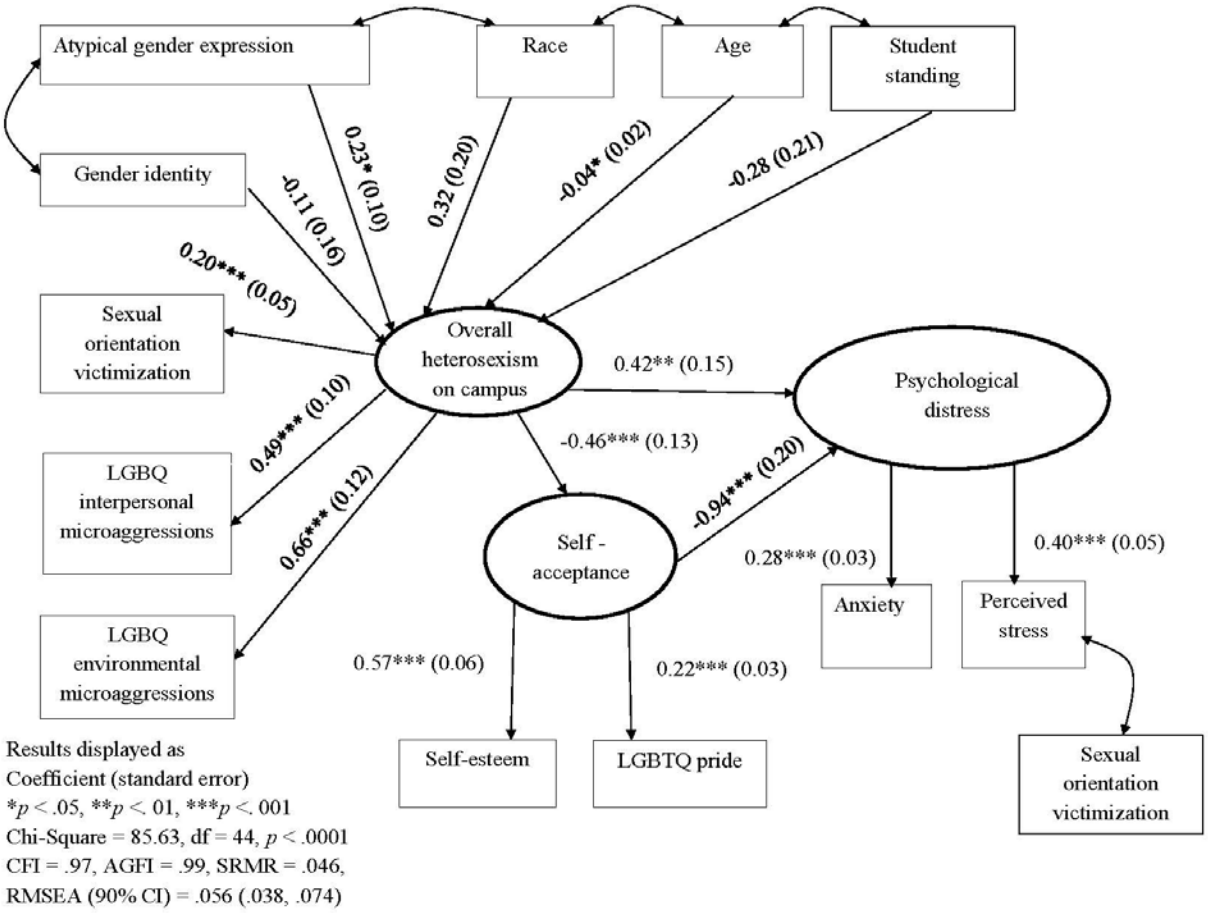
The Sobel-Goodman test for significant mediation is a 2-sided Z test with $Z = ab/ se_{ab}$.

4) First Study: Microaggressions, Violence, Psychological Well Being[4].

Our first SEM project included the following outcomes.
α = Cronbach's alpha.

Scale	α	Description
Environmental LGBQ microaggressions[15] (Woodford et al., 2015)	.70	5 items; "In my school/workplace it was OK to make jokes about LGBQ people."
Interpersonal LGBQ microaggressions[15] (Woodford et al., 2015)	.89	15 items; "Someone said or implied that my sexual orientation is a result of something that went wrong in my past (e.g., your mother was too overbearing.)".
LGBQ victimization[1] (Herek, 1993)	.92	9 items; verbally threatened, physically assaulted
Perceived stress[16] (Cohen et al., 1983)	.89	10 items; frequency of stress symptoms past month
Anxiety[17] (Spitzer et al., 2007)	.90	7 items; frequency of anxiety symptoms past 2 weeks
Self-Esteem[18] (Rosenberg, 1965)	.92	10 items
LGBQ Pride[19] (Mayfield, 2001)	.82	5 items; general comfort being LGBQ

Figure 2: SEM Model on Heterosexism, Psychological Distress, Self-Acceptance



Due to high mutual correlation between hostility and micro-aggressions, a factor, named Heterosexism by Dr. Michael Woodford, was constructed from microaggressions and hostility. Heterosexism was assessed through overt victimization (hostility), interpersonal micro-aggression, and environmental micro-aggression.

The factor equations for the heterosexism factor are given below.

- Let F_1 = heterosexism factor, ~ Normal(0,1).
- Let Y_1 = overt hostility (sexual orientation victimization scale) with mean μ_1.
- Let Y_2 = interpersonal microaggressions with mean μ_2.
- Let Y_3 = environmental microaggressions with mean μ_3.
- Let λ's be factor loadings and ε's be error terms.

- $Y_1 = \mu_1 + \lambda_1 F_1 + \varepsilon_1$; $Var(Y_1) = \lambda_1^2 + Var(\varepsilon_1)$.
- $Y_2 = \mu_2 + \lambda_2 F_1 + \varepsilon_2$; $Var(Y_2) = \lambda_2^2 + Var(\varepsilon_2)$.
- $Y_3 = \mu_1 + \lambda_3 F_1 + \varepsilon_1$; $Var(Y_3) = \lambda_3^2 + Var(\varepsilon_3)$.

In the above diagram, $\lambda_1 = .20$, $\lambda_2 = .49$, and $\lambda_3 = .66$. Each of victimization (hostility), interpersonal micro-aggression, and environmental micro-aggression loads significantly on the heterosexism factor.

Similarly, the self-acceptance factor included the Rosenberg Self-Esteem Scale and internalized LGBTQ Pride. The diagram indicates significant loadings from self-esteem, .57, and from pride, .22. Anxiety and Perceived Stress comprised the psychological distress factor. From the diagram, anxiety had a distress factor loading of .28 and stress had a loading of .40.

We hypothesized that self-esteem would mediate the psychological distress from hostility and microaggressions. From figure 1, the heterosexism factor has significant effect on psychological distress, $\beta_1 = 0.42$, $p<.01$. The self-acceptance factor also has a significant effect on psychological distress, -0.94, $p < .001$, and heterosexism has a significant effect on self-acceptance, $\beta_3 = .-0.46$, $p < .001$. To check for significant mediation from self-esteem, we need to check whether $\beta_2\beta_3$ is significant and this can be done with the TestFunc statement in Proc CALIS. The TestFunc statement tests whether a product or linear combination of path coefficients is statistically significant.

```
/* SAS Proc CALIS Code for Significant Mediation */
TestFunc H4_DiscrimMediate;
H4_DiscrimMediate =  P_SelfAccept_Discrim*P_Distres_SelfAccept;
```

Further hypothesized that males and younger students would experience more heterosexism, and that non-traditional gender expression would lead to more heterosexism for males than for females. The equation with the arrow going into the heterosexism factor is

F_1 = -.11(male gender, referenced to female) + .23(atypical gender expression) +
.32(person of color, referenced to white) - .04(age) -.28(graduate, referenced to undergraduate).

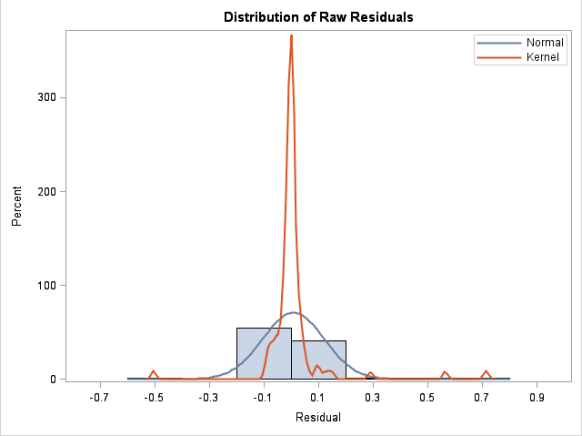
The significant values for atypical gender expression ($p < .05$) and age ($p < .05$) indicate that students with a great atypical gender presentation and younger students experience more heterosexism. However, gender was not significant.

```
/* SAS Proc CALIS Code for SEM Analysis of Figure 2 */
ods html path="c:\temp"; ods graphics on;
proc calis data=MicroAggression method=fiml kurtosis
modification plots=residuals effpart;

   path
     /* Factor equations */
     F_Discrim  --->  LGBQ_Hostility   =  P_Hostility_Discrim,
     F_Discrim  --->  LGBQ_Interpersonal_Micro   =  P_Interpers_Discrim,
     F_Discrim  --->   LGBQ_Enviro   =  P_Enviro_Discrim,

     F_SelfAccept  ---> Self_Esteem_New   =  P_SelfEsteem_SelfAccept,
     F_SelfAccept  ---> Internal_LGBQ_Pride   =  P_Pride_SelfAccept,

     F_Distress  ---> Anxiety   =  P_Anxiety_Distress,
     F_Distress  ---> Stress   =  P_Stress_Distress,

/* Analysis Equations */
Race_White_POC Age_Recode StudentStanding_UGrad_YN
Cisgender_atypical_expression2 gender2    ---> F_Discrim =
 P_Discrim_Race P_Discrim_Age P_Discrim_GradUGrad  P_Discrim_GenderExp
P_Discrim_Gender ,

F_Discrim  --->  F_Distress   =  P_Distres_Discrim,
F_Discrim ---> F_SelfAccept = P_SelfAccept_Discrim,
F_SelfAccept ---> F_Distress = P_Distres_SelfAccept
;
```

```
/* Set factor variances to 1 */
pvar
  F_Discrim=1, F_SelfAccept=1, F_Distress=1;

/* Specify covariances */
pcov  /* added cov between hostility & stress per lagrange multiplier */
Stress LGBQ_Hostility;

/* Test for Mediation */
TestFunc H4_DiscrimMediate;
H4_DiscrimMediate =  P_SelfAccept_Discrim*P_Distres_SelfAccept;

/* List all variables in the SEM Model */
/* Important to tell SAS which variables to consider. */
/* Otherwise, diagnostic tests will include all variables */
/* in the dataset. */
var Race_White_POC Age_Recode StudentStanding_UGrad_YN
Cisgender_atypical_expression2 gender2  gender_exp_interact
    LGBQ_Hostility LGBQ_Interpersonal_Micro LGBQ_Enviro
    Self_Esteem_New Internal_LGBQ_Pride Anxiety Stress;
run;
ods graphics off; ods html close;
```

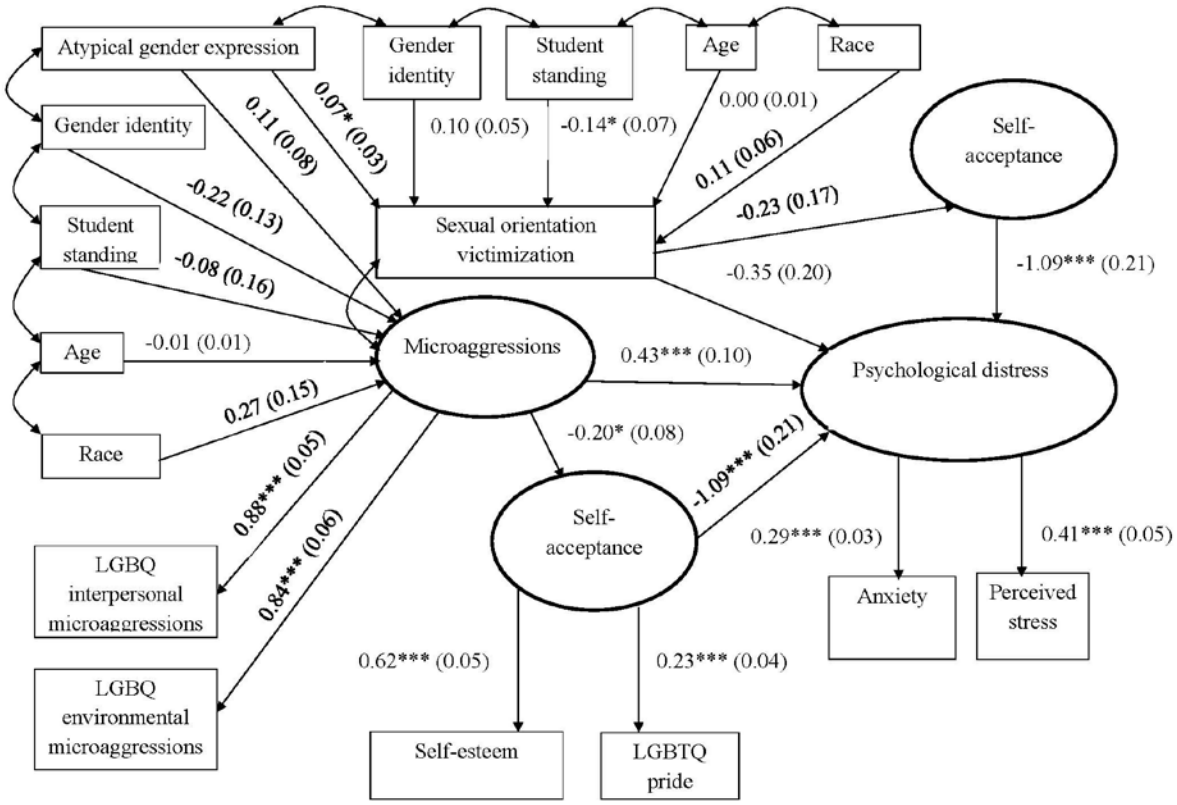
The residual option on the Proc CALIS statement produces a residual plot. For a well-fitting model, the residuals should follow a standard normal distribution.

Figure 3: Residual Plot for SEM Model in Figure 2



We also explored a model in which hostility was separated microaggressions. In this model, displayed in figure 4, the results were similar, except that students with greater atypical gender expression experienced more of the hostility component of the heterosexism factor.

Figure 4: SEM Model with Microaggressions and Victimization Separated



Results displayed as Coefficient (standard error); *$p < .05$, **$p < .01$, ***$p < .001$
Chi-Square =77.94, df = 41, $p = .0004$, CFI = .98, AGFI = .99, SRMR = .051, RMSEA (90% CI) = 0.055 (0.036, 0.073)

5) Second Study: Effect of Policies and Resources on Model in First Study.

In the second study, we explored whether state or college policies and resources effected any of the outcomes.

5.1) State-Level Correlations.

First, we checked the Spearman correlation coefficients between state non-discrimination policy and relationship with all of the outcomes. The Spearman correlation coefficient was chosen because the coding for each state policy variable was 0, 1, .2. The Spearman correlation coefficient is a rank correlation coefficient and compares correlation between the ranks of two variables. We examined employment discrimination law (none, sexual orientation only, sexual orientation and gender identity), relationship recognition (none, civil unions, legal marriage) with microaggressions, hostility, pride, self-esteem, anxiety, and stress.

```
/* Spearman correlation coefficients in SAS */
Proc Corr Data=StateEnviro spearman pearson;
var  LGBQ_Hostility LGBQ_Interpersonal_Micro LGBQ_Enviro Anxiety Stress
Self_Esteem_New Internal_LGBQ_Pride;
with relationship_recognition employment_protection;  run;
```

At the state level, no Spearman correlation coefficients were significant. To double check, Pearson correlation coefficients were calculated and none were significant. A college student working on the study added the following insight, ""The college student's world revolves around the campus. Most students experience only the campus environment and have no idea what the state laws are."

In contrast to college students, an article in the American Journal of Public Health focused on the psychological health of lesbian, gay, and bisexual adults with state anti-discrimination laws. Hatzenbuehler's 2009 AJPH article, "State-Level Policies and Psychiatric Morbidity In Lesbian, Gay, and Bisexual Populations"[20] compared psychiatric morbidities among LGBQ population between states with and without laws on employment discrimination and hate crimes. "Living in states with policies that did not extend protections predicted a stronger relation between lesbian, gay, or bisexual status and psychiatric comorbidity (p=.04)".

5.2) College-Level Correlations.

At the college-level, policies and resources were significantly correlated with micro-aggressions, hostility, and the psychological well-being.

Table 1: Correlation Matrix of Individual School Resources and Policies on Outcomes (Pearson Correlation Coefficient) N =268

	Overt Hostility	LGBQ Inter-personal Micro-Aggressions	LGBQ Environmental Micro-Aggressions
College prohibits gender Identity discrimination	**-0.142***	**-0.155***	**-0.133***
Domestic partner benefits	-0.034	-0.071	-0.086
Name of choice	-0.078	-0.028	-0.061
LGBTQ courses	-0.083	-0.112	**-0.146***
Alumni programs	-0.064	-0.053	-0.087
LGBTQ student organization ratio per 1000 students	**-0.133***	**-0.140***	**-0.124***

	Anxiety	Perceived Stress	Self Esteem	LGBTQ Pride
College prohibits gender Identity discrimination	-0.114	**-0.121***	0.119	0.112
Domestic partner benefits	-0.067	**-0.135***	0.112	**0.152***
Name of choice	**-0.129***	**-0.124***	**0.120***	**0.144***
LGBTQ courses	-0.104	-0.115	**0.138***	**0.181****
Alumni programs	**-0.126***	-0.104	0.098	**0.146***
LGBTQ student organization ratio per 1000 students	-0.120	**-0.123***	0.118	0.081

*p<.05, **p<.01, ***p<.001

Specifically, a negative correlation was observed between anti-discrimination policy that enumerated both sexual orientation and gender identity sexual orientation (compared to sexual orientation only) and the frequency of victimization, r = -.14, p = .02, interpersonal microaggressions, r = -.16, p = .01,

environmental microaggressions, r = -.13, p = .03, and perceived stress r = -.12, p = .047. Domestic partner benefits was correlated with lower perceived stress, r = -.14, p = .03, and greater pride, r = .15, p = .01. Name of choice was associated with less anxiety, r = -.13, p = .04, and stress, r = -.12, p = .04, along with greater self-esteem, r = .12, p = .049 and pride, r = .14, p = .02. The presence of at least one for-credit LGBTQ course correlated with fewer environmental microaggressions, r = -.15, p = .02, and greater self-esteem, r = .14, p = .02, and pride, r = .18, p = .003. LGBTQ alumni initiatives was correlated with less anxiety, r = -.13, p = .04, and greater pride, r = .15, p = .02. The ratio of LGBTQ student organizations was negatively correlated with victimization, r = -.13, p = .03, interpersonal microaggressions, r = -.14, p = .02, environmental microaggressions, r = -.12, p = .04, and stress, r = -.12, p = .04.

5.3) Structural Equation Model

Our original plan was to input policies and resources directly into each factor. In this model, the significant effects were only on the heterosexism factor.

Figure 5: Initial SEM Model for Impact of College Policies and Resources

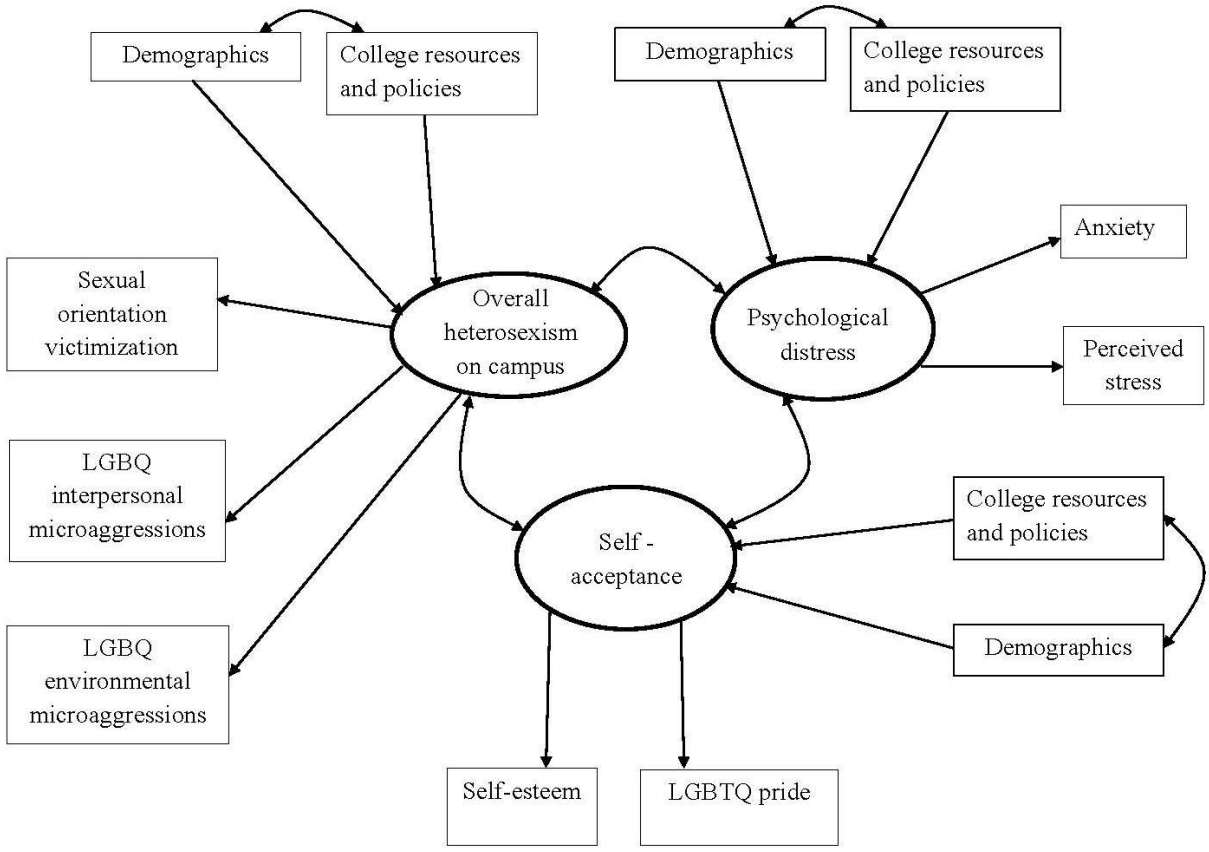


Table 2: Significant Path Loadings on Heterosexism Factor

Predictor	Coefficient (Std Err)	P-Value
Demographics not significant: Race, gender, undergraduate or graduate, atypical gender expression		
College prohibits both sexual orientation and gender identity discrimination	**-0.73 (0.22)**	**<0.001**
LGBTQ course offered	**-0.69 (0.26)**	**0.008**
Student organization ratio	**-0.70 (0.28)**	**0.013**

```
/* SAS Code for model in figure 5/ table 2 with correlated factors */
proc calis data=StateEnviro method=fiml kurtosis modification plots=residuals
effpart;
   path
      /* Factor equations, same as figure 2, omitted to save space */

/* Demographics, Policies, Resources input to Heterosexism Factor */
Race_White_POC Age_Recode StudentStanding_UGrad_YN
Cisgender_atypical_expression4 gender2
POLICY_gi Domestic_partner_benefits LGBT_Office2 Ally_programs LGBTQ_courses
Alumni Name_choice StudentOrgRatio ---> F_Discrim =
 P_Discrim_Race P_Discrim_Age P_Discrim_GradUGrad  P_Discrim_GenderExp
P_Discrim_Gender
P_Discrim_POLICY_gi P_Discrim_DomPartBen P_Discrim_LGBT_Office2
P_Discrim_Ally_programs P_Discrim_LGBTQ_courses
P_Discrim_Alumni P_Discrim_Name_choice P_Discrim_StudentOrgRatio,

/* Demographics, Policies, Resources input to Distress Factor */
 Race_White_POC Age_Recode StudentStanding_UGrad_YN
Cisgender_atypical_expression4 gender2
POLICY_gi Domestic_partner_benefits LGBT_Office2 Ally_programs LGBTQ_courses
Alumni Name_choice StudentOrgRatio --->  F_Distress =
 P_Distres_Race P_Distres_Age P_Distres_GradUGrad  P_Distres_GenderExp
P_Distres_Gender
P_Distres_POLICY_gi P_Distres_DomPartBen P_Distres_LGBT_Office2
P_Distres_Ally_programs P_Distres_LGBTQ_courses
P_Distres_Alumni P_Distres_Name_choice P_Distres_StudentOrgRatio,

/* Demographics, Policies, Resources input to Self-Acceptance Factor */
Race_White_POC Age_Recode StudentStanding_UGrad_YN
Cisgender_atypical_expression4 gender2
POLICY_gi Domestic_partner_benefits LGBT_Office2 Ally_programs LGBTQ_courses
Alumni Name_choice StudentOrgRatio --->  F_SelfAccept =
 P_SelfAcc_Race P_SelfAcc_Age P_SelfAcc_GradUGrad  P_SelfAcc_GenderExp
P_SelfAcc_Gender
P_SelfAcc_POLICY_gi P_SelfAcc_DomPartBen P_SelfAcc_LGBT_Office2
P_SelfAcc_Ally_programs P_SelfAcc_LGBTQ_courses
P_SelfAcc_Alumni P_SelfAcc_Name_choice P_SelfAcc_StudentOrgRatio;
;
/* Set factor variances = 1 */
Pvar F_Discrim=1, F_SelfAccept=1, F_Distress=1;

/* Estimate factor covariances */
pcov
F_Discrim F_SelfAccept,
F_Discrim F_Distress,
F_SelfAccept F_Distress;

/* List of variables same as above, omitted var statement*/
run;
```

In order to test whether reduced heterosexism has indirect effects on distress and self-acceptance, direct paths, rather than correlated factors were needed. In words, this model tests the hypothesis that policies and resources will directly impact heterosexism on campus, and then have indirect effects on psychological distress and self-acceptance. To find the indirect effects of policies or resources on psychological distress, the path coefficients from the policy or resource to heterosexism would be

multiplied by the path coefficient from heterosexism to psychological distress. The same procedure, multiplying path coefficients, would be used to check for indirect effects on self-acceptance.

The curved line with arrows between self-acceptance and psychological distress indicates covariance between the factors. The model results are displayed in table 3.

Figure 6: Indirect Effects Model

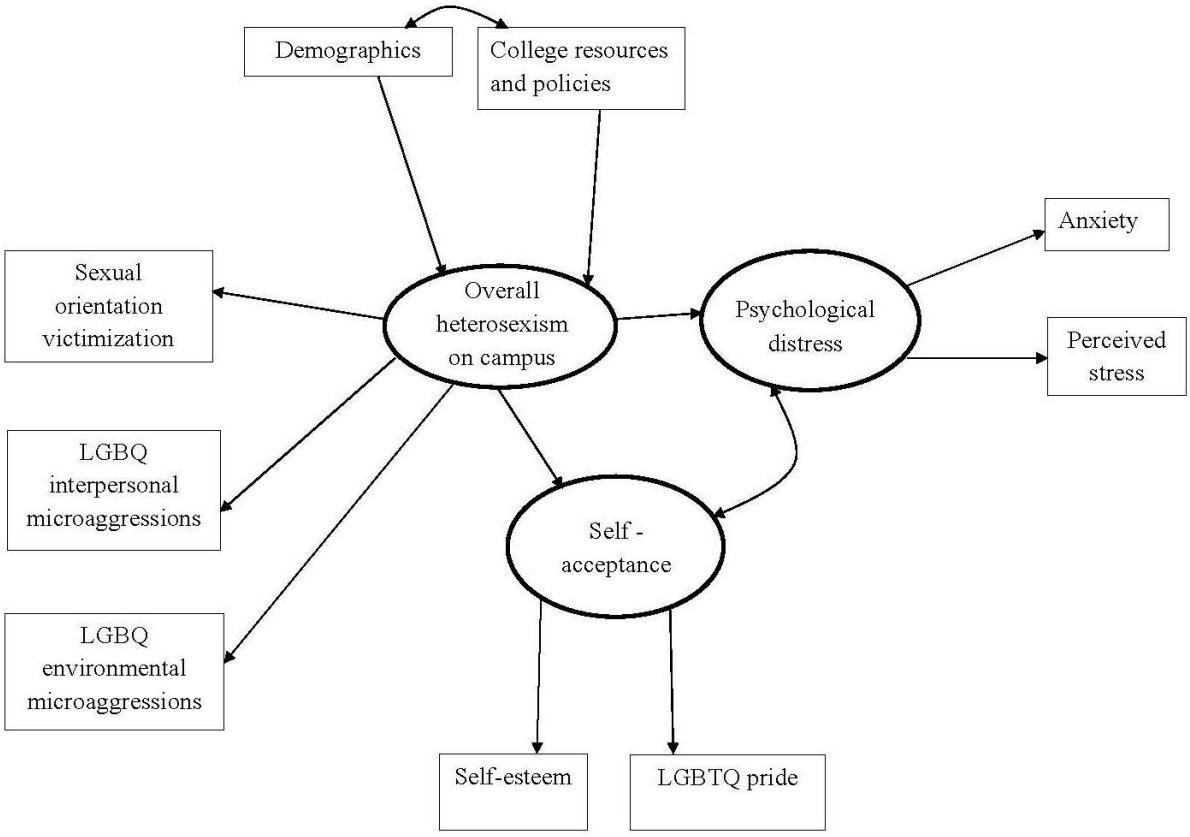


Table 3: SEM Coefficients For Model on Effects of Student Demographics, College Resources, and Policies on Overall Heterosexism, Plus Effects of Heterosexism on Self-Acceptance and Psychological Distress, N =268

Demographic, Policy, or Scale	Coefficient (Std Error)	P-Value
Loadings on "Overall heterosexism on campus" factor		
Sexual orientation victimization	**0.23 (0.03)**	**<.001**
LGBQ interpersonal microaggressions	**0.80 (0.05)**	**<.001**
Environmental microaggressions	**0.81 (0.06)**	**<.001**
Direct Effects on "Overall heterosexism on campus" factor		
Race	0.19 (0.16)	0.226
Age (years)	-0.02 (0.01)	0.179
Student standing	-0.10 (0.18)	0.579
Atypical gender expression	0.12 (0.09)	0.150
Gender identity	-0.26 (0.14)	0.062
College prohibits gender identity discrimination	**-0.76 (0.22)**	**0.001**
Domestic partner benefits	-0.13 (0.27)	0.637
LGBT office or staff	0.52 (0.28)	0.059
Ally programs	0.05 (0.24)	0.849
LGBTQ courses	**-0.69 (0.26)**	**0.009**
Alumni programs	0.36 (0.33)	0.270
Name of choice	0.26 (0.33)	0.434
Student organization ratio	**-0.75 (0.29)**	**0.009**
Loadings on "Psychological distress" factor		
Anxiety	**0.43 (0.04)**	**<.001**
Perceived Stress	**0.60 (0.04)**	**<.001**
Direct Effect on "Psychological distress" factor		
Heterosexism Factor	**0.42 (0.07)**	**<.001**
Loadings on "Self-acceptance" factor		
Self-esteem	**0.58 (0.05)**	**<.001**
LGBTQ pride	**0.24 (0.04)**	**<.001**
Direct Effect on "Self-acceptance" factor		
Heterosexism Factor	**-0.31 (0.08)**	**<.001**
Correlation Between Self-acceptance and Psychological distress	**-0.77**	**<.001**

Chi-Square = 138.47 df = 96, p .003, CFI = 0.985, SRMR = 0.0499,
RMSEA (90% CI) = . 0.041 (0.024, 0.055)

Description of Model Results in Figure 6 / Table 3.
Although the chi-square test was significant, X^2 (96) = 138.47, p = .003, the CFI = .99, was above the .90 threshold for comparative fit. Further, the RMSEA (90% confidence interval [CI]) = 0.04 (0.02, 0.06) and the SRMR = .05, which indicate parsimony and good predictive ability, respectively.

Overall Heterosexism. As displayed in Table 3, statistically significant associations were found for heterosexism on campus and inclusive anti-discrimination policy, for-credit LGBTQ courses, and the ratio of LGBTQ student organizations. The results are reported as unstandardized coefficient B (standard error). Specifically, students attending colleges with antidiscrimination polices that included both sexual orientation and gender identity (versus only sexual orientation), B = -0.76 (0.22), p = .001, that offered at least one for-credit LGBTQ course, B = -0.69 (0.26), p = .009, and had a higher ratio of LGBTQ student organizations, B = -0.75 (0.29), p = .009, tended to report encountering less overall heterosexism on campus.

Psychological Distress. In addition to heterosexism having a direct effect on psychological distress of 0.42 (0.07), p < .001, anti-discrimination policy, for-credit LGBTQ course, and the ratio of LGBTQ student organizations had significant negative indirect effects on psychological distress. Specifically, unstandardized coefficients B (standard errors) for the indirect effect of an inclusive anti-discrimination policy were -0.32 (0.11), p = .003, for-credit LGBTQ courses -0.29 (0.12), p = .015, and the ratio of LGBTQ student organizations -0.31 (0.13), p = .016.

The indirect effects were calculated by multiplying the path coefficients from the policy or resource directly into heterosexism by the path coefficient from heterosexism into psychological distress. In Proc CALIS, the EffPart option on the Proc CALIS statement will calculate the total effects from the policies and resources to each factor, along with standard errors, and p-values.

Self-Acceptance. The unstandardized coefficient B (standard error) for the direct effect from heterosexism to self-acceptance was -0.31 (0.08), p < .001. The same three policies and resources had significant positive indirect effects on self-acceptance; inclusive anti-discrimination policy 0.24 (0.09), p = .008, for-credit LGBTQ courses 0.22 (0.10), p = .026, and ratio of LGBTQ student organizations 0.23 (0.11), p = .027.

In terms of covariance, psychological distress and self-acceptance were significantly associated, r = -.77, p < .001.

Based on the Akaike Information Criteria, the above model was more parsimonious and fit better than the correlated factors mode. A smaller AIC indicates a better fit. AIC was 7631.31 for the correlated factors model, compared to 7607.62 for the indirect effects model.

```
/* SAS code for model in figure 6 / table 3 */
ods html path="c:\temp"; ods graphics on;
proc calis data=StateEnviro method=fiml kurtosis modification plots=residuals
effpart;  /* EffPart tests indirect effects */
   path
/* Factor equations, same as figure 2, omitted to save space */

/* Demographics, Policies, Resources input to Heterosexism Factor */
Race_White_POC Age_Recode StudentStanding_UGrad_YN
Cisgender_atypical_expression4 gender2
POLICY_gi Domestic_partner_benefits LGBT_Office2 Ally_programs LGBTQ_courses
Alumni Name_choice StudentOrgRatio ---> F_Discrim =
 P_Discrim_Race P_Discrim_Age P_Discrim_GradUGrad  P_Discrim_GenderExp
P_Discrim_Gender
P_Discrim_POLICY_gi P_Discrim_DomPartBen P_Discrim_LGBT_Office2
P_Discrim_Ally_programs P_Discrim_LGBTQ_courses
P_Discrim_Alumni P_Discrim_Name_choice P_Discrim_StudentOrgRatio
;
/* Paths from Heterosexisum factor into Self-Accesptance and Psychological
Distress */
F_Discrim  --->  F_SelfAccept F_Distress = P_Discrim_SelfAccept
P_Discrim_Distress,
```

```
/* Set factor variances = 1 */
Pvar F_Discrim=1, F_SelfAccept=1, F_Distress=1;

/* Estimate factor covariances */
Pcov F_SelfAccept F_Distress;

/* List of variables same as above, omitted var statement */
run;
ods graphics off; ods html close;
```

6) Conclusions.

Among LGBQ college students, college-level, rather than state-level policies were significantly associated with reduced microaggressions and hostility.

From bivariate correlations, the key policies and resources were non-discrimination policies that included both sexual orientation and gender identity, domestic partner benefit policy, name of choice policy, LGBTQ for-credit courses, alumni initiatives, and the ratio of LGBTQ student organizations per student body. In SAS, Pearson (linear) and Spearman (ordinal) correlation coefficients can be computed with Proc Corr.

From structural equation models, an inclusive non-discrimination policy, for-credit courses, and ratio of LGBTQ student organizations were associated with lower microaggressions and victimization, which have corresponding indirect effects on psychological distress and improved self-esteem. I.E., reducing microaggressions and hostility, was significantly associated with lower psychological distress and greater self-esteem. In SAS, Proc CALIS can handle complex SEM models with indirect effects, as well as models with correlated factors.

From this analysis, there are three pillars for improving the well-being of lesbian, gay, bisexual college students:

- non-discrimination policy
- education
- social support network

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