



*The Use of Psychometrics in
Behavioral and Mental Health
Research*

The University of California Los Angeles

Neuropsychiatric Institute

Center for Community and Health

November 24, 2004

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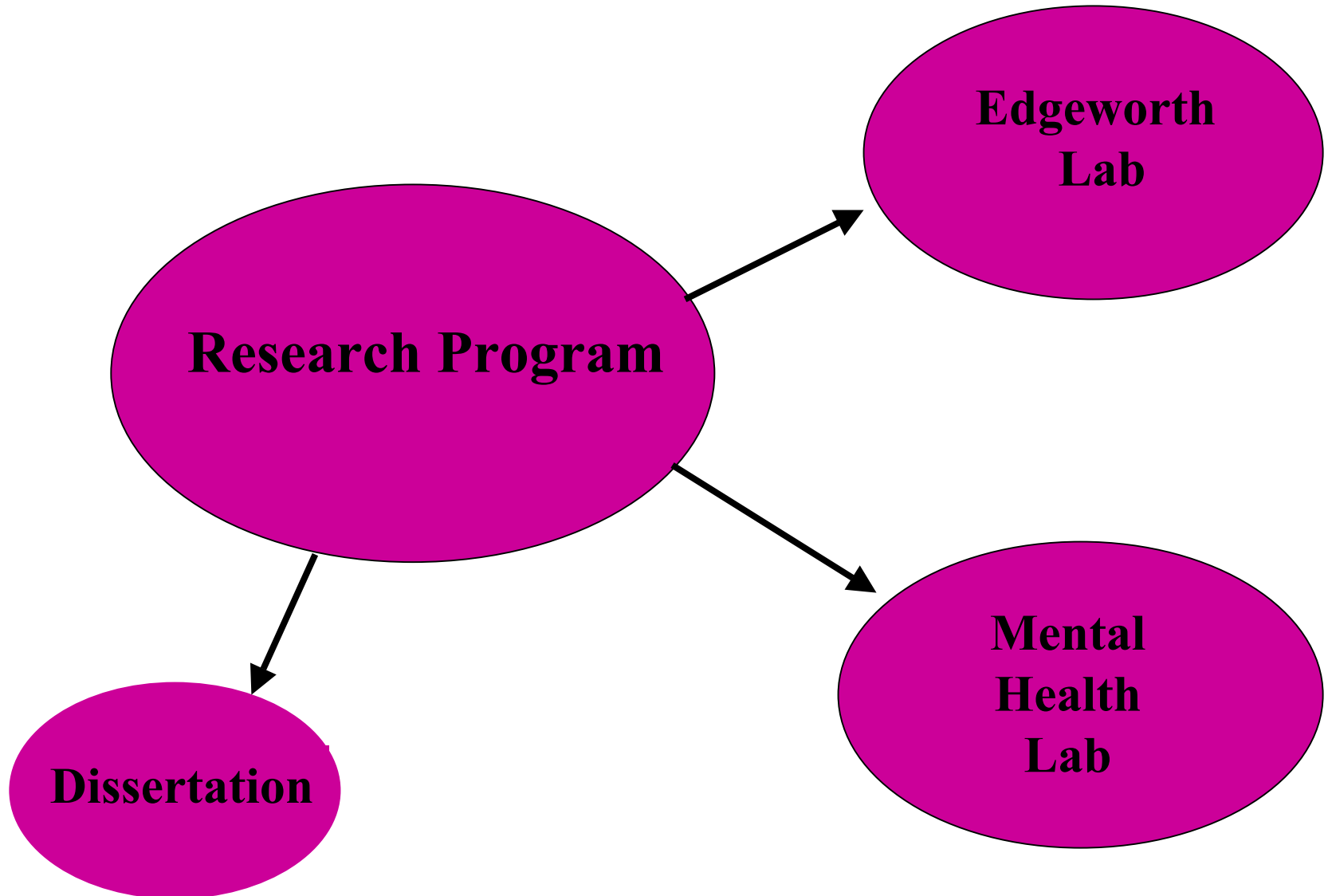


Purpose of Today's Presentation

- **To provide a taste of the nature of the quantitative behavioral research conducted.**
- **To illustrate analytic flexibility .**
 - **Research Program**
 - **Disseration**
 - **Introduction of Research Labs**
 - **Applied Research in Mental Health**



The University of British Columbia





Dissertation

Title:

Assessing Dimensionality of Psychological Scales: Using Integrative Criteria from Factor Analysis and Multidimensional Scaling.

- Inferences made from the results of tests are used to make high-stake decisions in health care systems, including for diagnosis and treatment.
- Yet, there is no universally accepted technique to determine the number of underlying dimensions (i.e., factors) to retain.
- The overall objective of the present study:
 - To develop a statistical methodology to determine the underlying structure of tests, and to provide guidelines to assist the behavioral researcher in the decision-making process of retaining factors.
- As a result, these researchers can assist practitioners with making appropriate inferences and high-stake decisions in policy and health care when interpreting the results of measures.



Edgeworth Laboratory for Quantitative Behavioral Science

Director: Dr. Bruno Zumbo

The purpose of this laboratory's research is to promote and highlight quantitative science in fields of education, psychology, sociology, and health.

➤ Funded by Social Sciences and Humanities Research Council (SSHRC), Canadian Institutes for Health Research (CIHR), and Department of National Defense.

SWLS: Satisfaction With Life Scale

➤ Ed Deiner's subjective well-being measure.

CCHS: Canadian Community Health Survey

➤ Cross-sectional survey of health determinants, health status and health system utilization.

Center of Epidemiology Scale of Depression (CES-D)

➤ Measurement of depressive symptoms in the general population.



Satisfaction With Life Scale (SWLS)

- The objective of this study was to develop a multi-step statistical strategy to allow researchers to determine the major and minor underlying latent construct(s) of psychological measures.
- Psychological latent variables (e.g., subjective well being): the inclusion of numerous minor latent variables is not merely desirable but unavoidable.
- However, an unnecessarily strict standard for quality of life and other psychological measures is unidimensionality (i.e., items load on only one latent variable). What this means is that if one holds quality of life measures to the standard of unidimensionality (i.e., use of composite score) some of the most widely used measures would fail...demonstration with SWLS.
- The SWLS assesses an individual's conscious judgment of his or her life: subjects integrate & weight personal life domains (i.e, *cognitive*). An *affective* component has been found to represent the minor dimension.

* (Slocum, S.L., Zumbo, B.D., Michalos, A., and Diener, E., under review).

Work-Stress Scale Module

- The objective was to examine whether the scale was unidimensional and performed equivalently for different groups: gender, occupation, age level, marital status, educational level, income level.
 - The work-stress scale consisted of 13 items taken from Karasek's original Job Content Questionnaire (JCQ) 49 items.
 - Participants: 158,679 individuals from Provinces across Canada
 - FA with ML estimation method were utilized.
 - The unidimensional factor model was equally poor for each group. Statistics Canada was using the total scale score. We recommended use of the six dimensions separately as a profile of work stress.
- * (Slocum S.L., Palin, J., and Zumbo, B.D., in progress).



Canadian Community Health Survey (CCHS)

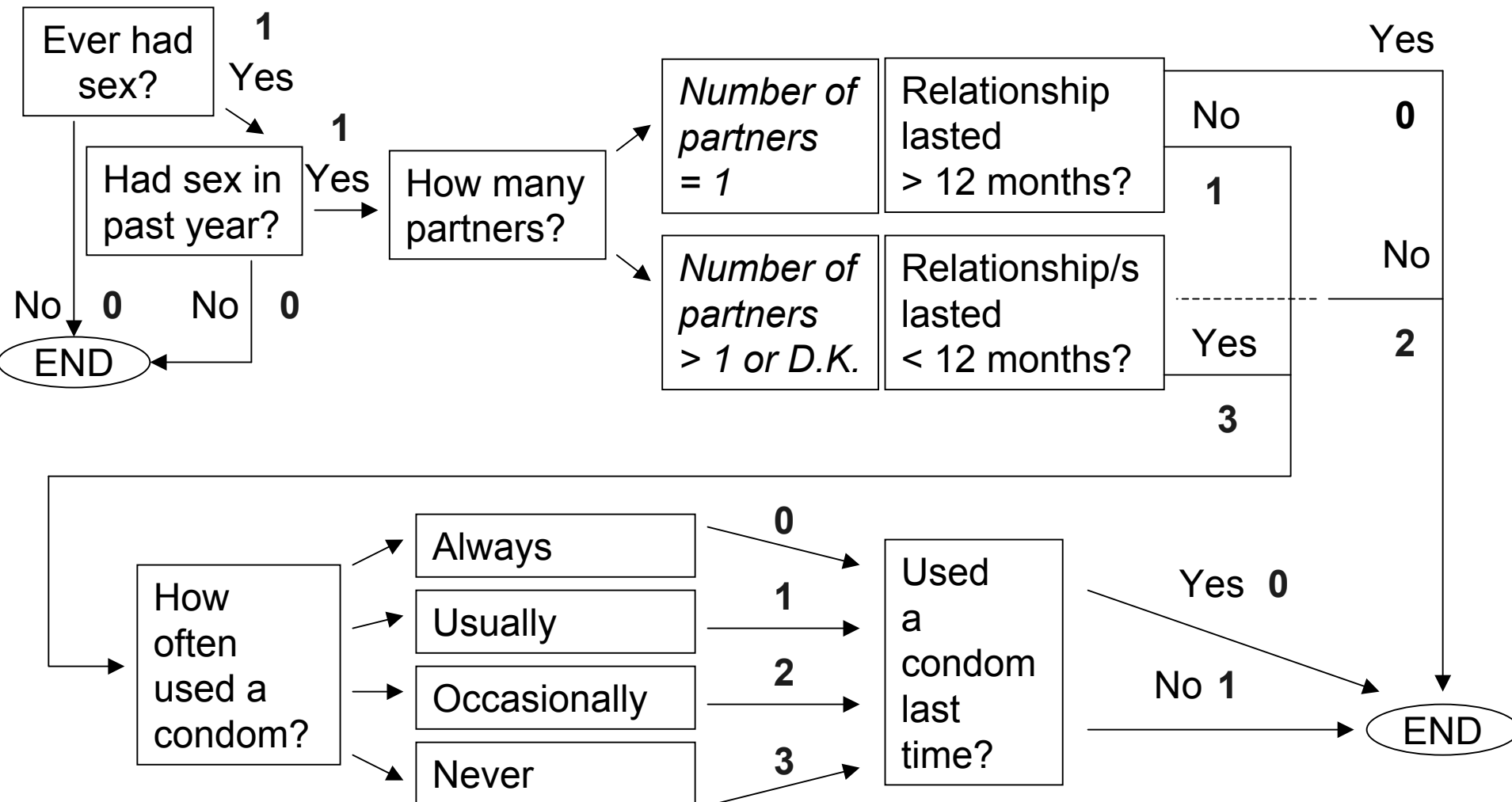
Sexual Behaviors Module

- The objective was to determine if measures could be developed using the Sexual Behavior module from the CCHS Public Use Microdata File (PUMF).
- The module consisted of 8 items with mixed item format.
- Participants: 130,000 individuals from Provinces across Canada
- Possible Uses of a measure from this Module
 - To describe the current state of sexual health of Canadians.
 - To inform policy and develop interventions.
 - To examine demographic factors associated with sexual behavior (income, education, etc.).
 - To conduct predictive studies (alcohol use, pregnancy, STIs).

* Relevant Canadian surveys: National Population Health Survey, National Longitudinal Youth and AIDS study, National AIDS Strategy studies

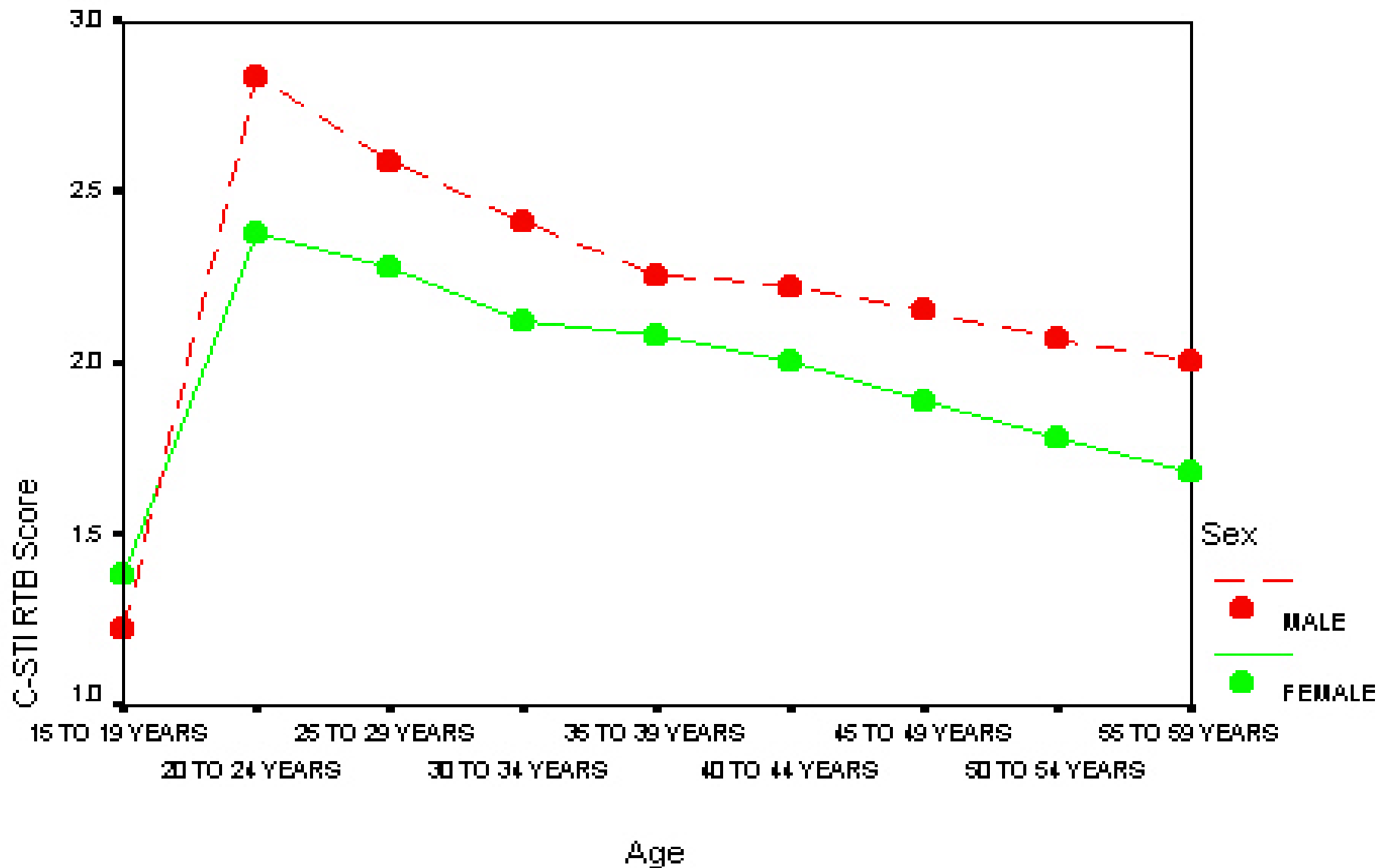
Automated Scoring Algorithm:

Current STI Risk Taking Behaviour using the CCHS Sexual Behaviour Module



Current STI Risk-Taking Behaviour Score

by Gender and Age Groups





Center of Epidemiology Scale of Depression

- The objective was to determine if gender differences existed in the reporting of symptoms by using Differential Item Functioning (DIF).
- The CES-D involves 20 items which are responded to on a 4-point rating scale. A total score is computed by summing the 20-items.
- DIF is a threat to inferences made from test scores. How is DIF a threat? If you do not investigate DIF you have no way of knowing whether or not the observed differences between specified groups are real differences (i.e., different symptoms) or whether they reflect differential responses to items.
- Participants: 724 adults, ages between 17 and 92 yrs, Northern, B.C.
- Substitution of missing values: Imputation -EM algorithm, PRELIS.

* (Slocum, S.L., Gelin, M., and Zumbo, B.D., 2003)



Differential Item Functioning Continued...

- DIF methods allow for the judgment of whether items (and ultimately the measure itself) function the same for various group of participants: do true differences exist in the underlying construct of interest, or is it measurement artifact?
- One is interested in stating a probability model to study main effects of group differences (uniform DIF) and the interaction of the group by construct (non-uniform DIF) after statistically matching on the total score, that is taking into account depressive symptoms.
- Conceptually, this is akin to ANCOVA. There is a conditioning on (statistically controlling) the different levels of depressive symptoms.
- Are the differences due to secondary dimensions- in other words, due to something relevant to what is ultimately being measured (i.e., socialization, acculturation, etc.), or is it measurement error?



Statistical Modeling of DIF: Ordinal Logistic Regression

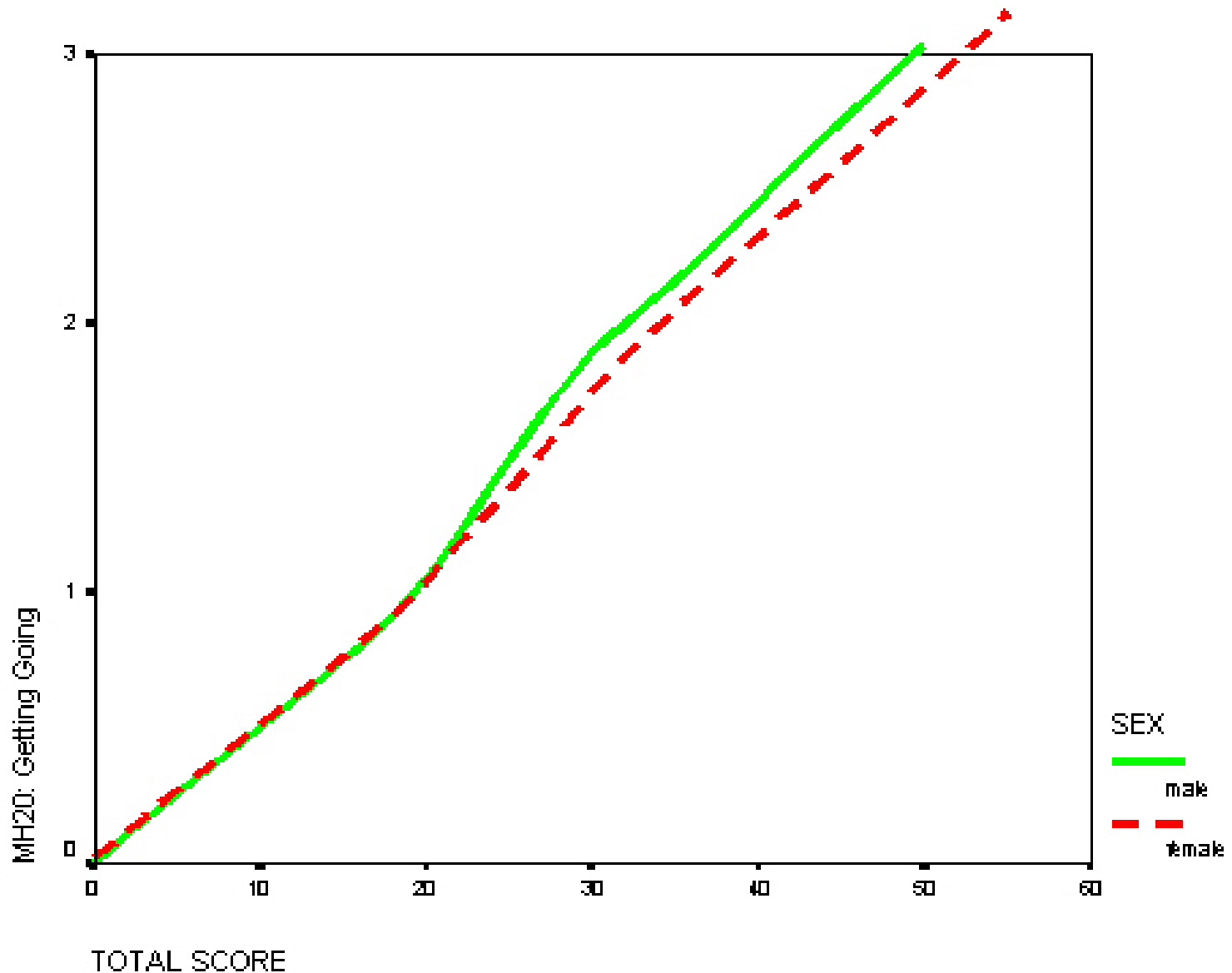
Item 20:

- *I could not get going*
- Chi-squared 0.25, $df=2$, $p=.883$
- Pseudo-R-squared of .0005 for the uniform and non-uniform effects
- No DIF and small effect size

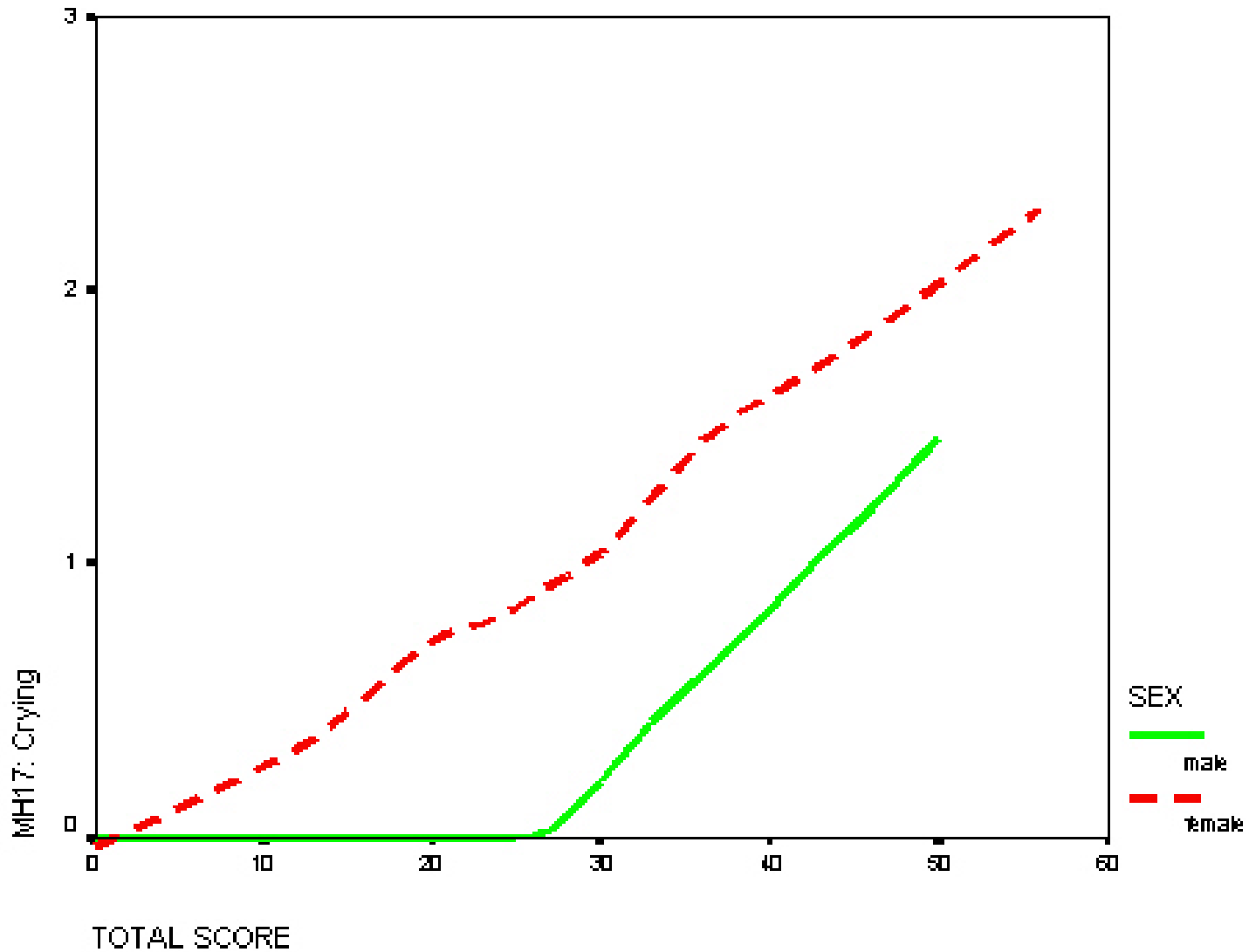
Item 17:

- *I had crying spells*
- Chi-squared 64.6, $df=2$, $p=.001$
- Pseudo-R-squared of .208 for the uniform and non-uniform effects
- Shows DIF with large effect size.

Graphic Model of no DIF: Item 20



Graphic Model of DIF: Item 17





The Culture, Spirituality and Mental Health Research Laboratory

Director: Dr. Susan James

The purpose of the lab is to conduct and disseminate research in clinical, biomedical, health services and population health research.

➤ Research funded by the Canadian Institute of Health Research (CIHR), Social Sciences and Humanities Research Council (SSHRC), and the Michael Smith Foundation for Health Research (MSFHR).

Spirituality Research

➤ Development of a multi-faith spiritual intuition measure to predict mental and physical health outcomes.

Agonias and Acculturation Research Projects

➤ Identification of cultural-specific phenomena to assess mental health of Portuguese immigrants.

➤ Investigation of the role of acculturation in assessing the mental health of immigrants.



Spiritual Intuition Inventory (SII) Research

The objective of the study was to develop a reliable and valid multi-faith spiritual intuition measure to predict mental and physical health outcomes.

- Certain experiences, practices and beliefs have been found to transcend our sensory-intellectual consciousness or rationale mind (prayer, meditation, martial arts, open-mindedness, etc.).
- Does a transcended mind (i.e., someone with spiritual intuition) promote a better physical and mental health status?
- Participants: 133 students from the UBC. The average age was 20.7 years ($SD=3.9$), ranging from 18 to 52 with a median of 20 years.
- Procedure: ULS estimation and direct oblimin rotation were used, and data Imputation was generated via ML EM Algorithm.
- Results: The SII was found to be reliable ($\alpha=.88$), and the convergent validity and factor structure results indicate that the SII may be used with confidence.

* (Slocum, S.L., James, S. Zumbo, B.D., Noranzayan, A., Rensick, R., under review)



Agonias Research Project

- The ways in which pain and sorrow are expressed are dependent on our cultural traditions.
- Researchers from many overlapping disciplines (e.g., psychology, psychiatry, medicine and anthropology) have studied idioms of distress to investigate how they vary from culture to culture
- In particular, *Agonias* is a common idiom of distress for Portuguese community members. The *Agonias* symptomology encompasses the mind, body, and society - where the somatic, the social, the religious and the moral are inextricably linked.
- *Agonias* has been found to be very common: 63% of participants reported having *Agonias* (Ontario and Boston immigrants).



Agonias Scale

The objective of the first study was to introduce and report on the psychometric properties of a new measure that assesses Agonias. Common symptoms include feeling afflicted, fainting, heart and chest pain, bad nerves, difficulty seeing and breathing, hot flashes, fever, and feeling a burning from within.

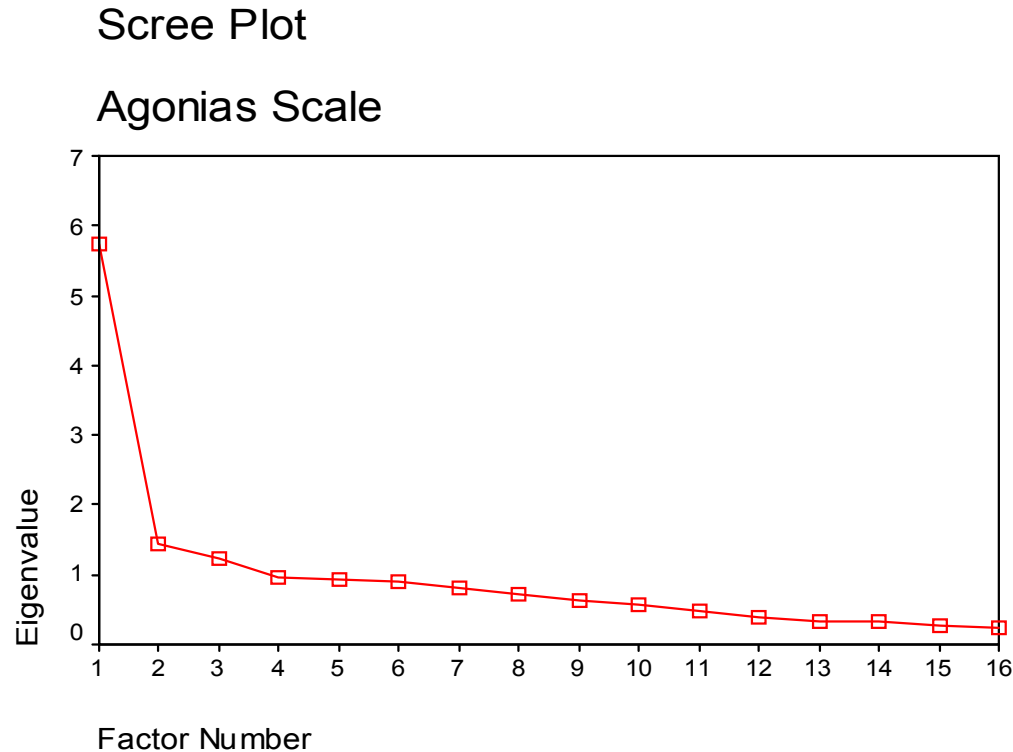
Measure developed:

- **Comprised of 13 items using a 4 point Likert Scale.**
- **Measures the severity with which subjects experience symptoms of Agonias.**

Participants:

- **201 Portuguese immigrant women from Waterloo, Ontario.**
- **Average age was 50.6 years, ranging from 16 to 90.**

Factor Analysis Scree Plot of Agonias Scale



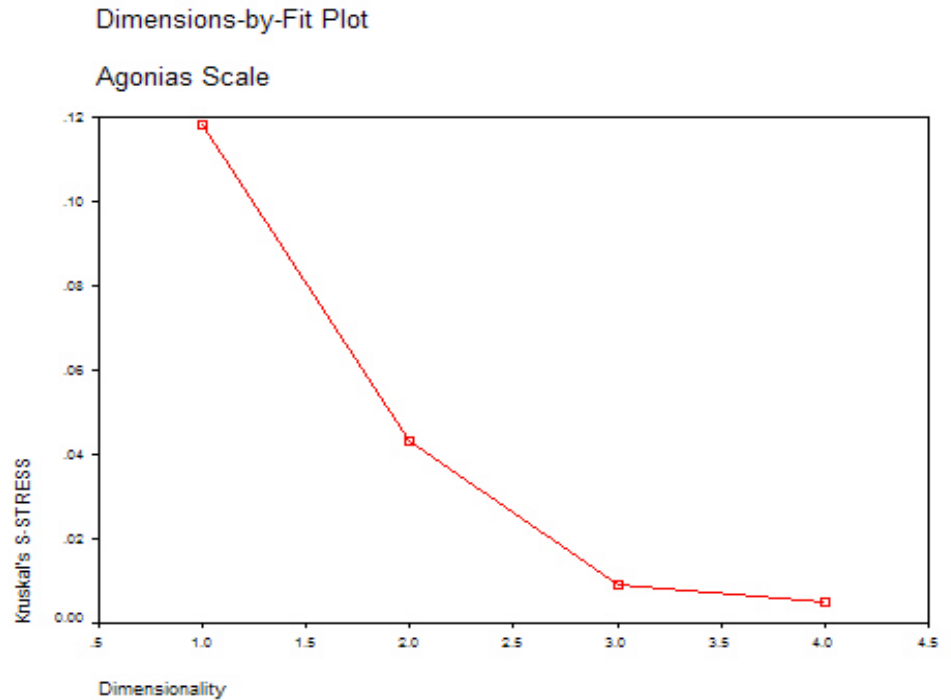
Method:

- **Data imputation: Maximum Likelihood (ML) EM algorithm**
- **Factor Analyses in LISREL 8.0 (Jöreskog & Sörbom) and PROXSCAL MDS of SPSS 11.5.0 to determine dimensionality.**

S-Stress by Dimensions

Multidimensional Scaling

Factors	S-Stress Values
One	.118
Two	.043
Three	.009
Four	.005





Predicting Outcomes of Mental Health Symptoms from Acculturation

- The Agonias study served as a baseline for this study.
- It has been found that the meaning ascribed to mental health symptoms was different between the immigrant patients and the clinicians, and as a result, the clinicians often treated the symptoms inappropriately.
- Furthermore, it has been found that certain immigrants do not utilize mental health services that are available for treatment.
- The objective of this study was to test two models. These models identify the relationship between acculturation and mental health symptoms in the context of a Portuguese community.
- The purpose of the study is to show that accurate predictions of the reporting of mental health symptoms, including cultural-specific symptoms, can allow clinicians to accurately diagnose and treat patients, and pinpoint the risk factors for unfavorable treatment.



Modes of Acculturation

- **Acculturation** is a form of culture change that results from continuous, direct contact between two independent cultures. This process is known to influence many factors including biological, physical, social, cultural, and psychological factors.
- From a psychological standpoint, there have been many studies that reported higher levels of mental health symptoms in certain immigrant groups compared to the general population. However, there have been additional studies that have reported certain immigrant groups to be healthier than non-immigrants. Why?
- **Enculturation** is defined as the degree to which an immigrant adopts the new culture or values relationships with the larger society (culture shock).
- **Biculturation** is defined as the degree to which an immigrant maintains their cultural identity as well as adopts the new culture and larger society (access to multiple resources).

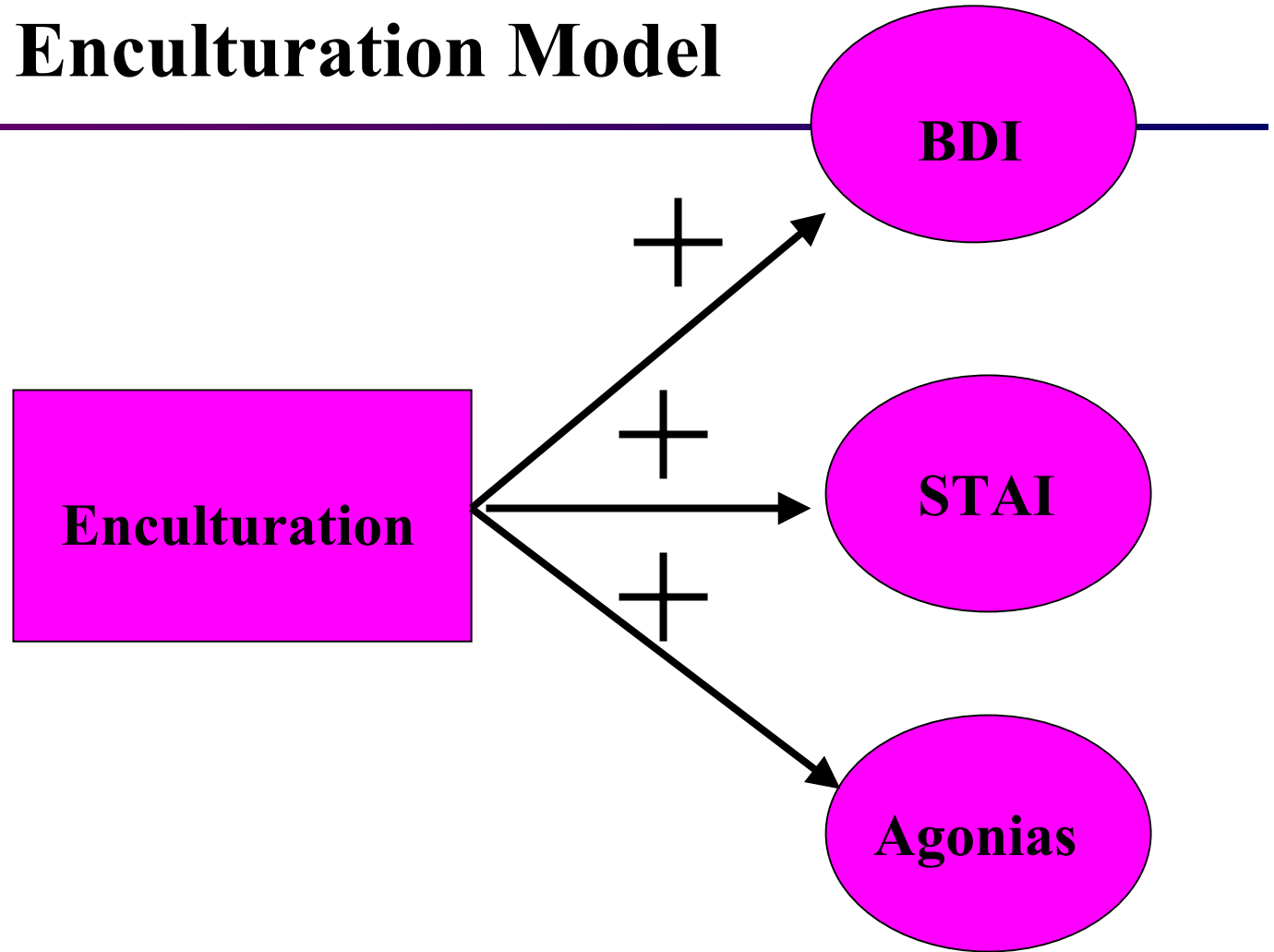


Purpose of the Acculturation Model

The objectives of the study:

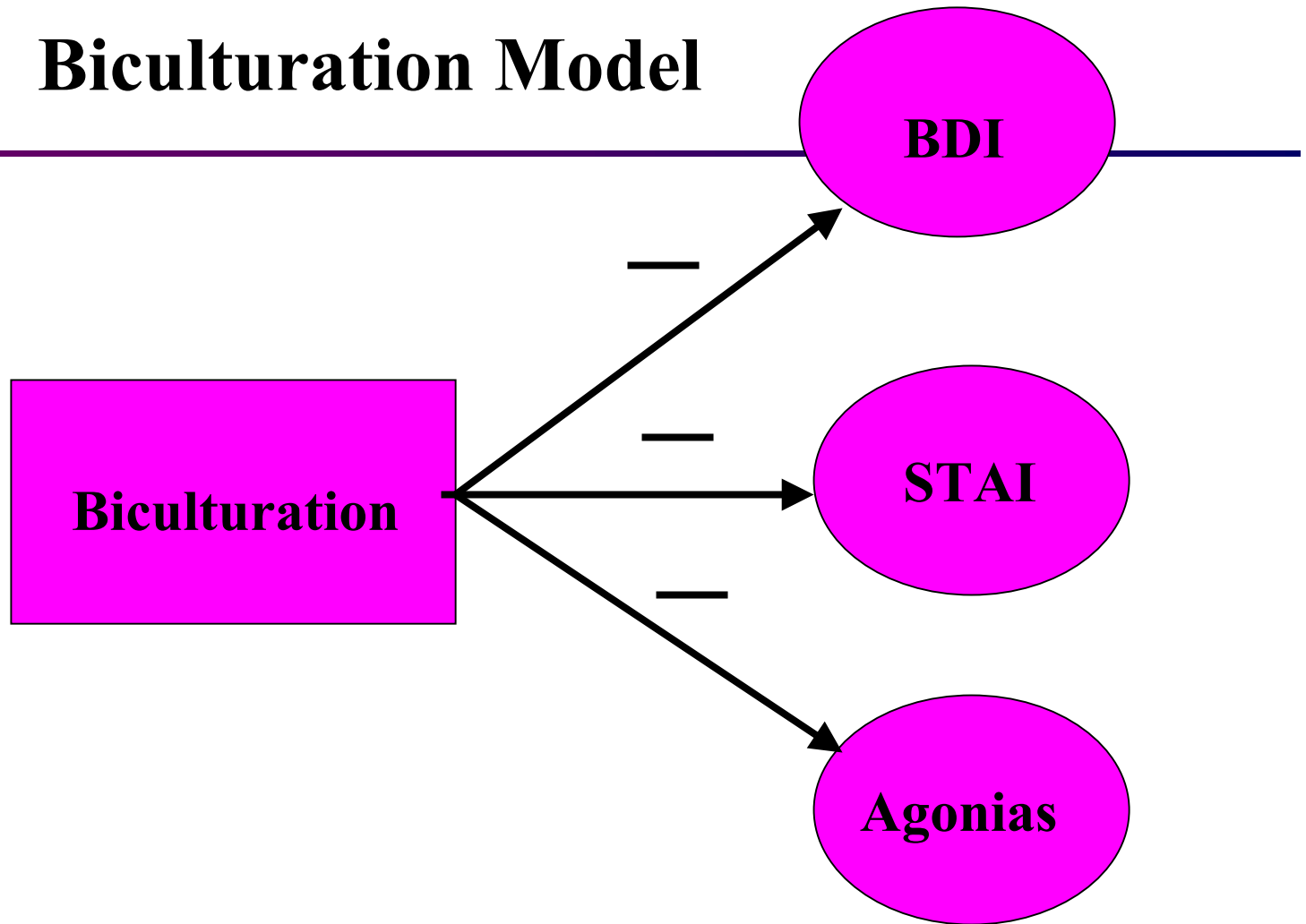
- 1) To improve the diagnostic accuracy and treatment of Portuguese immigrants, a populous but rarely studied group,
 - 2) To provide information/resources that will empower these community members when interacting with health providers,
 - 3) To provide a model for taking an interdisciplinary and mixed methods approach to immigrant health research, and
 - 4) To provide a model for researchers working with immigrant groups other than the Portuguese to study discrepancies in labeling symptoms.
-
- **Participants:** 201 Portuguese immigrant women from Waterloo, ON.
 - Screened on age & immigration: age ranged from 16 to 90, mean=50.6.
 - 70% females & only 30% of males experienced some level of Agonias.
 - **Method:** Observed Variable Path Analysis in LISREL 8.54
 - **Missing values:** Imputation - EM algorithm, PRELIS, vs. eliminating.

Enculturation Model



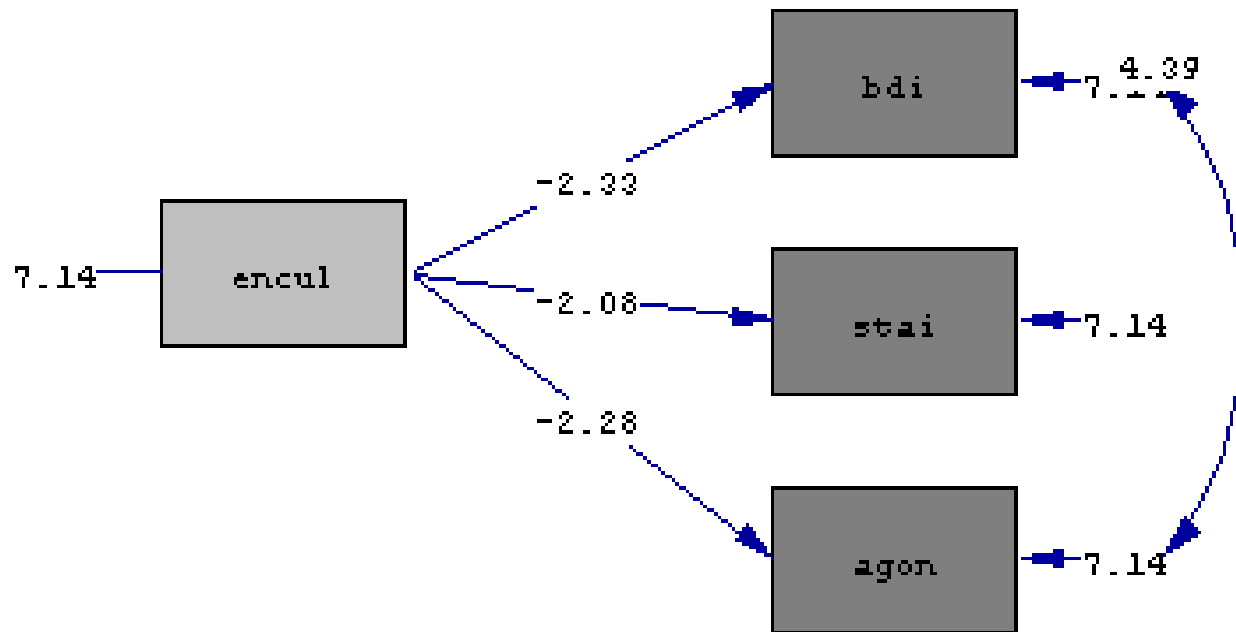
The model states that the more enculturated a patient, the more likely they are to report higher levels of depression, anxiety (i.e., BDI, STAI), and culture specific phenomena (i.e., Agonias) measures.

Biculturalization Model



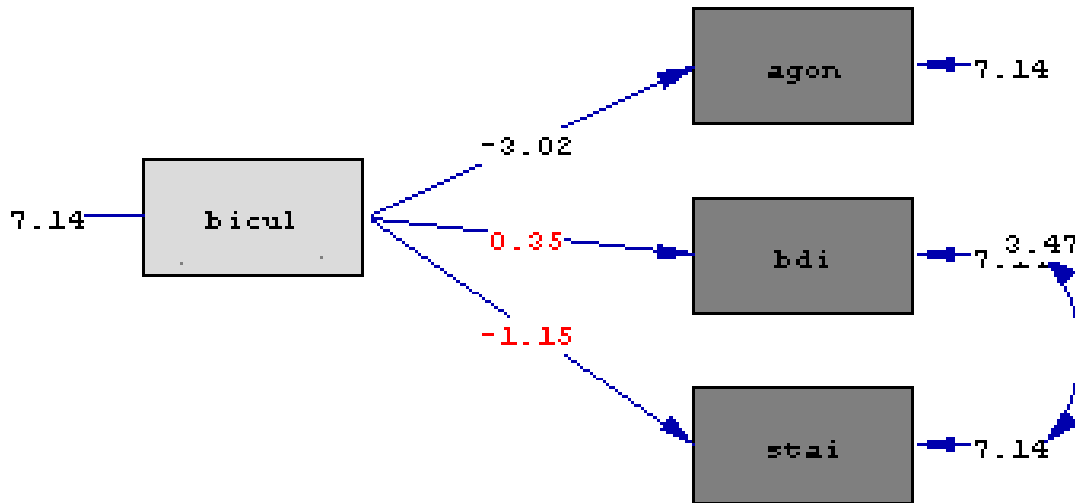
The model states that the more biculturalized a patient, the more likely they are to report lower levels of depression, anxiety (i.e., BDI, STAI), and culture specific phenomena (i.e., agonias) measures.

Preliminary Results of Enculturation Model (Including t-values)



Individual parameters were significant. Overall, the data does not seem to fit the model: RMSEA=.235; Chi Square = 13.24, df=2, $p=.00133$.

Preliminary Results of the Biculturation Model (Including t-values)



Individual parameter was significant. Overall, the data does not seem to fit the model: RMSEA=.235; Chi Square = 13.24, df=2, p=.00133.



Statistical Assessment of the Models

- Chi-Square test and path coefficients are extremely sensitive to violations of multivariate normality and linearity assumptions (Kelloway, 1998).
- Rejection of the models may be mediated largely by the low levels of Agonias, depression, and anxiety reported by the participants.
- One of this study's limitations is the sample size: the 202 participants were reduced to 130.
- Also noteworthy are the large error variances. These may indicate that there are omitted variables that affect the endogenous variables (i.e., depressive symptoms).
- Because multivariate normality was violated in this context, it is recommended that Generalized Least Squares estimation be used instead of Maximum Likelihood.



Future Research of Agonias and Acculturation

- A deeper cultural awareness is needed by clinicians in order to diagnose and treat appropriately.
 - The resulting data could allow a unique perspective into the onset and course of mental health symptoms and facilitate better treatment strategies based on levels of acculturation.
 - Where do we go from here?
 - Collect data over multiple time points (T1, T2, T3);
 - Utilize a considerably larger sample size and males;
 - Include a group of people that are from the original culture (i.e., Portuguese residents) to determine if there is a statistical difference between the immigrant and non-immigrant groups.
- * All three of these steps are currently being conducted.



In Conclusion for Today

- The research presented today provides two general classes of statistical methods:
 - 1) Psychometric work around DIF and dimensionality; and
 - 2) Use of observed variable path analysis (i.e., structural equation modeling) to test mental health prediction around acculturation and cultural-specific symptoms.
- Both the Edgeworth Laboratory for Quantitative Science and the Culture, Spirituality, and Mental Health research labs involve multidisciplinary approaches to examining factors that influence behaviors (anthropology, sociology, psychology, education, and medicine).
- Behavioral sciences encompass a broad array of factors that are critical to health outcome research. Without *accurate* assessment and investigations of various behavioral and social factors, inferences, predictions, diagnoses, treatments and problem solving may lack appropriateness and have serious consequences.



In Conclusion

The results from these studies could:

- Shed some light on the intervention methods that are used;
- Help identify and describe health disparities that exist across different communities or groups (i.e., cultures, genders, etc.);
- Increase society's acceptance of marginalized persons;
- Assist in developing a multi-faceted research program.