Published in final edited form as:

AIDS Patient Care STDS. 2006 April ; 20(4): 258–268.

Positive provider interactions, adherence self-efficacy, and adherence to antiretroviral medications among HIV infected adults: A mediation model

Mallory O. Johnson, Ph.D.¹, Margaret A. Chesney, Ph.D.¹, Rise B. Goldstein, M.P.H., Ph.D.², Robert H. Remien, Ph.D.³, Sheryl Catz, Ph.D.⁴, Cheryl Gore-Felton, Ph.D.⁵, Edwin Charlebois, M.P.H., Ph.D.¹, Stephen F. Morin, Ph.D.¹, and the NIMH Healthy Living Project Team

¹Center for AIDS Prevention Studies University of California, San Francisco San Francisco, California

²Center for Community Health University of California, Los Angeles Los Angeles, California

³HIV Center for Clinical and Behavioral Studies New York State Psychiatric Institute and Columbia University New York, New York

⁴Center for Health Studies Group Health Cooperative Seattle, Washington

⁵Center for AIDS Intervention Research Medical College of Wisconsin Milwaukee, Wisconsin

Abstract

Adherence to antiretroviral (ARV) therapy for HIV infection is critical for maximum benefit from treatment and for the prevention of HIV-related complications. There is evidence that many factors determine medication adherence, including adherence self-efficacy (confidence in one's ability to adhere) and relations with health care providers. However, there are no studies that examine how these two factors relate to each other and their subsequent influence on HIV medication adherence. The goal of the current analysis was to explore a model of medication adherence in which the relationship between positive provider interactions and adherence is mediated by adherence self-efficacy. Computerized self administered and interviewer administered self reported measures of

Corresponding author: Mallory O. Johnson, Ph.D. Center for AIDS Prevention Studies University of California, San Francisco 74 New Montgomery, Suite 600 San Francisco, CA 94105 Phone: 415–597–9374 Fax: 415–597–9213 E-mail: Mjohnson@psg.ucsf.edu.

Research Steering Committee (site principal investigators and NIMH staff collaborator)

Margaret A. Chesney, Ph.D.¹, Anke A. Ehrhardt, Ph.D.², Jeffrey A. Kelly, Ph.D.³, Willo Pequegnat, Ph.D.⁴, Mary Jane Rotheram-Borus, Ph.D.⁵

Collaborating Scientists, Co-Principal Investigators, and Investigators

Eric G. Benotsch, Ph.D.³, Michael J. Brondino, Ph.D.³, Sheryl L. Catz, Ph.D.³, Edwin D. Charlebois, Ph.D., M.P.H.¹, Don C. DesJarlais, Ph.D.⁶, Naihua Duan, Ph.D.⁵, Theresa M. Exner, Ph.D.², Rise B. Goldstein, Ph.D., M.P.H.⁵, Cheryl Gore-Felton, Ph.D.³, A. Elizabeth Hirky, Ph.D.², Mallory O. Johnson, Ph.D.¹, Robert M. Kertzer, M.D.², Sheri B. Kirshenbaum, Ph.D.², Lauren E. Kittel, Psy.D.², Robert Klitzman, M.D.², Martha Lee, Ph.D.⁵, Bruce Levin, Ph.D.², Marguerita Lightfoot, Ph.D.⁵, Stephen F. Morin, Ph.D.¹, Steven D. Pinkerton, Ph.D.³, Robert H. Remien, Ph.D.², Fen Rhodes, Ph.D.⁵, Susan Tross, Ph.D.², Lance S. Weinhardt, Ph.D.³, Robert Weiss, Ph.D.⁵, Hannah Wolfe, Ph.D.⁷, Rachel Wolfe, Ph.D.⁷, F. Lennie Wong, Ph.D.⁵

Data Management and Analytic Support

Philip Batterham, M.A.⁵, W. Scott Comulada, M.S.⁵, Tyson Rogers, M.A.⁵, Yu Zhao, M.S.⁵

Site Project Coordinators

Kristin Hackl, M.S.W.³, Daniel Hong, M.A.⁵, Karen Huchting, B.A.⁵, Joanne D. Mickalian, M.A.¹, Margaret Peterson, M.S.W.³

NIMH

Christopher M. Gordon, Ph.D.⁵, Dianne Rausch, Ph.D.⁵, Ellen Stover, Ph.D.⁵

1. University of California, San Francisco

2. New York State Psychiatric Institute/Columbia University, New York

3. Medical College of Wisconsin, Milwaukee

4. National Institute of Mental Health, Bethesda, Maryland

5. University of California, Los Angeles

6. Beth Israel Medical Center, New York

7. St. Luke's-Roosevelt Medical Center, New York

medication adherence, demographic and treatment variables, provider interactions, and adherence self-efficacy were administered to 2765 HIV infected adults on ARV. Criteria for mediation were met, supporting a model in which adherence self-efficacy is the mechanism for the relationship between positive provider interactions and adherence. The finding was consistent when the sample was stratified by gender, race, injection drug use history, and whether the participant reported receipt of HIV specialty care. Positive provider interactions may foster greater adherence self-efficacy, which is associated with better adherence to medications. Results suggest implications for improving provider interactions in clinical care, and future directions for clarifying inter-relationships among provider interactions, adherence self-efficacy, and medication adherence are supported.

Keywords

HIV/AIDS; Provider Relations; Adherence/Compliance

INTRODUCTION

The importance of adherence to antiretroviral (ARV) medications in the treatment of HIV infection is well documented [1,2]. High levels of adherence are critical for clinical benefit and the prevention of HIV-related complications and opportunistic infections. Multiple issues, including patient factors (e.g., depression, substance use, treatment beliefs), treatment factors (e.g., regimen complexity, side effects), and contextual factors (e.g., access to care) have been identified as predictors of adherence and have, to varying degrees, been the focus of interventions to improve medication adherence [3-6].

One patient factor that is consistently and meaningfully related to ARV medication adherence is adherence self efficacy [5,7-12], or confidence in one's ability to adhere to a treatment regimen in the face of challenges such as side effects, interference with daily activities, environmental barriers to treatment, depression, and lack of support from others. Self efficacy is a paramount requisite factor for health behavior change [13,14] and, along with perceptions of treatment efficacy, are central to many theories of health behavior, including the Health Belief Model [15]. Findings linking adherence to self-efficacy have indicated the potential for interventions to bolster adherence self-efficacy for persons who are struggling with adherence. The determinants of adherence self-efficacy, however, remain unclear.

Another factor that is often linked to ARV adherence is positive provider relations[16]. In a wide range of illness contexts, dimensions of patient satisfaction with providers' communication, engagement, and general interaction skills are linked to adherence to care [17-20]. In the context of diabetes treatment, patients' perceptions of provider communication skills are associated with treatment adherence[21,22]. In HIV treatment, treatment plan adherence has been associated with patients' perceived level of engagement and satisfaction with their providers [16,23,24].

An understanding of the relationship between self-efficacy and provider relations has the potential to inform interventions to improve adherence, but this understanding has not been achieved. Therefore, the purpose of this paper is to evaluate a model of medication adherence in which adherence self-efficacy mediates the association between positive provider interactions and self reported ARV adherence. We hypothesize that positive provider interactions are linked to greater self-efficacy for adherence, which in turn is associated with better ARV adherence; specifically, that higher adherence self-efficacy explains the association between provider interaction and adherence. The rationale for the proposed sequence is that we hypothesize that positive interactions with a provider (such as a greater sense of engagement with the provider and a perception that the provider understands and takes the patient's concerns

seriously) lead to greater agreement with treatment recommendations and a greater personal commitment to the treatment plan. This translates to greater adherence self-efficacy, which is linked to adherence as described above. Figure 1 illustrates the mediation model proposed in this paper.

We also explored differences in this relationship along the dimensions of gender, race, injection drug use, and whether the patient reports receiving care at an HIV specialty clinic. We distinguished HIV specialty clinics from other medical care settings in response to debate in the literature regarding relative benefit of specialist training versus generalists in the treatment of HIV disease[25-27]. Likewise, lower adherence rates among IDUs and African Americans have been reported in the literature [5] and patient history of IDU has been suggested as influencing provider perceptions about patients' ability to adhere [16,28]. Also, there is recent evidence that non-White patients rate satisfaction with provider interactions differently than White patients, providing rationale for such focus in our analyses [29]. Finally, we explored potential effects of gender in response to assertions that gender of patient (and provider) may influence patient-provider interactions [30,31].

METHODS

Study Respondents

A total of 3,818 HIV-positive individuals in four cities (San Francisco, Los Angeles, New York City, and Milwaukee) were screened for recruitment into the Healthy Living Project (HLP). Recruitment and screening of potential respondents were undertaken in community agencies and medical clinics serving HIV-positive clients. Brochures, posters, and project descriptions, as well as direct contact by study staff in clinical and social service agencies were used to recruit respondents. In addition, advertisements were placed in newspapers and magazines serving HIV-positive and gay/bisexual populations, and potential respondents learning of the study by word of mouth were eligible to be screened. Interested persons who provided verbal consent were briefly screened by project personnel to determine their self-reported HIV status as well as basic demographic and contact information, and then, if they wished to participate, scheduled for a baseline interview.

Respondents were required to be at least 18 years of age, to provide written informed consent and medical documentation of their HIV infection, to be free of severe neuropsychological impairment or psychosis, and not be currently involved in another behavioral intervention study related to HIV. Severe neuropsychological impairment and psychosis were assessed on a case-by-case basis by senior project personnel in collaboration with the clinical supervisor at the involved institution.

Overview of assessment procedures

All procedures and forms were reviewed and approved by the sites' Institutional Review Boards (IRB). Assessment interviews were conducted in private settings in research offices, community-based organizations, and clinics in the four cities. Written informed consent to participate in the study was obtained from each respondent prior to the administration of the baseline interview. The interview was then conducted over a period of two to four hours with regular breaks allowed to minimize respondent fatigue.

Procedures involved a combination of Audio Computer Assisted Self-Interviewing (ACASI) and Computer Assisted Personal Interviewing (CAPI) using Questionnaire Development System (QDS), Nova Research Company. ACASI allows the respondent to listen to an item via headphones while reading the item on a computer monitor. The respondent then enters his or her response directly into the computer. This approach has been proposed as an effective

method of decreasing social desirability and thereby enhancing veracity of self-report of sensitive behaviors and attitudes [32,33]. With CAPI, an interviewer reads items from a computer and the respondent verbally gives responses that the interviewer enters directly into the computer.

Respondents were compensated US\$50 for completing the baseline interview and those needing child care were also eligible to receive US\$10 to defray child care costs.

Interview training and quality assurance

Interviewers were trained centrally with the use of a detailed assessment manual, practice with the computer programs, participation in an intensive 3-day training program, and review and certification of audio-taped mock interviews based on standardized criteria. All interviews were audio-taped and each tape labeled with the respondent's study identification number, date of the interview, and the interviewer's identification number. A systematic sample of all tapes was reviewed for protocol adherence and feedback was provided to all interviewers on a regular basis; however, sites were notified immediately if raters identified significant violations of the assessment protocol by particular interviewers.

Measures

Demographics / Background

Detailed background and demographic data included items such as respondent age, race/ethnicity, gender, sexual orientation, relationship status, educational level, employment status, self-reported most recent CD4 count, and injection drug use (IDU) in the past 12 months.

Depression

Depression was assessed with the 21-item Beck Depression Inventory (BDI) [34,35] ($\alpha = .85$) which has been widely used in studies with HIV-infected patients to evaluate the severity of depressive symptoms [36].

Social support

A global score on the Social Provisions Scale (SPS) [37,38] was used to assess level, type, and perceived satisfaction with social supports from one's social network. This score was derived by averaging scores on the 6 SPS subscales: guidance, reliable alliance, reassurance of worth, attachment, social integration, and opportunity for nurturance (α for total score is .82).

Positive Patient-Provider Interactions

Adapted from previous studies[39], we administered an 8 item scale to assess patients' perceptions of positive interactions with their providers. Respondents were asked how often certain things occurred during recent contacts with health care providers, such as discussing side effects and other medication problems, getting providers to really listen to concerns, and feeling helped by their providers. Sample item "How often during your recent interactions with your providers did you get help in solving any problems in taking your medications or dealing with symptoms or side effects?" Response choices are never (0), some of the time (1), most of the time (2), and every time (3). For these analyses, scores on each item are averaged for each respondent with higher scores indicating more positive provider interactions. Cronbach's alpha for this administration = 0.81.

Adherence Self-Efficacy

A 12-item scale was used to assess patient confidence to carry out important treatment-related behaviors related to adhering to treatment plans, especially medication regimen adherence, in

the face of barriers. Responses range from 1 (cannot do it at all) to 10 (certain you can do it). Sample item “How confident are you that you can stick to your treatment plan when side effects interfere with daily activities?” Scores on each item were averaged for each respondent with higher scores indicating higher adherence self efficacy. Cronbach's alpha equals 0.91 for this scale, which has been used in other adherence reports[5].

Medication Adherence

Recent self-reported antiretroviral medication adherence was assessed over a three-day period using an adherence survey developed for use in AIDS Clinical Trials [7]. The measure was computerized for ACASI administration allowing respondents to indicate how many antiretroviral pills they had skipped during each of the previous three days. This measure has been used widely with diverse samples and the short term recall period has been associated with long term clinical outcomes. Adherence was assessed only for those ARV medications that were reported in the adherence section of the interview. For the present study, we calculated percent adherence based on number of pills taken divided by the number of pills respondents reported being expected to take. Respondents were classified as having achieved less than 90% adherence versus 90% or higher adherence, consistent with current literature on minimum levels of adherence to achieve HIV viral suppression and clinical benefit [2,40].

Statistical analysis

We followed established procedures to test for mediation in our analyses[41]. Specifically, each of the three variables must be bivariately associated with the other two variables. In the current application, this would mean that provider interactions must be associated with self-efficacy and adherence. Given these associations, the association between positive provider relations and adherence must become smaller (for partial mediation) or eliminated (for full mediation) if self-efficacy mediates the relationship between positive provider interactions and adherence. We conducted separate univariate logistic regression analyses in which positive provider interactions and adherence self-efficacy each were regressed onto dichotomous adherence outcomes. We then entered the provider and self-efficacy variables into the same model with adherence as the outcome. Control variables include gender, age, education, ethnicity, IDU in the past 12 months, depression, social support, usual source of HIV care, and most recent CD4 count. Comparing the results from these analyses allows the determination if mediation is supported. Among those with complete adherence data, an acceptable number (less than 4%) of cases were excluded from multivariate analyses due to missing data[42].

We then conducted post hoc analyses to determine if the pattern of results was the same when stratified by gender (male vs. females), ethnicity (African American vs. White vs. Latino), IDU status (past 12 months), and usual source of HIV care (HIV specialty clinic vs. other).

RESULTS

Sample description and treatment variables

Of the 3818 individuals interviewed, 75% were currently taking ARVs. Findings presented in the paper are based on the 2765 participants for whom adherence data are available. Sample characteristics, including demographics, treatment variables, and mean adherence self-efficacy and positive provider interaction scores are presented in Table 1. The sample was 74% male, 49% African American/Black, 18% Latino/a, and 26% White. The mean age was 42 years (SD = 7.6) and the median was 41. Twenty-five percent reported less than high school graduation, and 12% were born outside of the U.S. Forty-three percent identified as heterosexual, 43% as homosexual, and 12% identified as bisexual. With regard to clinical status, the mean CD4 count reported was 431 (SD=292) and 46% reported an undetectable viral load at last testing. The median length of time on regimen was 127 weeks (2.4 years).

Adherence rates

Overall, 31.75% (878/2,765) of persons taking antiretroviral medications indicated that they had skipped enough pills in the prior three days to result in less than 90% adherence for the reporting period. There were no differences in adherence rates by site or gender. For a complete report of the differences between adherers and nonadherers in this sample, see Johnson, et al. [5]

Test of Mediation

The Pearson correlation between positive provider interactions and adherence self efficacy is 0.260 ($p < .001$). Bivariate odds ratios of each of these two variables relationships with adherence are presented in Table 2, indicating that either higher positive provider interactions or higher adherence self-efficacy is related to reporting 90% or higher medication adherence. When both are entered into the same multivariate logistic regression analysis in which adherence is the dependent variable, self-efficacy's odds ratio remains largely unchanged, whereas the provider interactions variable is no longer significant, indicating mediation as per criteria described above. Table 2 reports these results for the entire sample and Figure 1 illustrates the mediation model tested in these analyses. In this figure, the direct line (dotted) between provider interactions and adherence is not significant once the path through adherence self-efficacy is taken into account.

There were some differences between groups in adherence, adherence self-efficacy and provider interactions scores. Specifically, Table 3 illustrates that women and those reporting HIV specialty care had higher positive provider interactions scores, and African American respondents reported lower adherence self efficacy scores than White respondents. African Americans' adherence rates were lower than White and Latino respondents and IDUs had lower adherence than non-IDUs. However, moderation analyses revealed that the pattern of results was the same for men vs. women, African American vs. White vs. Latino, IDU vs. non-IDU, and HIV specialty care recipient vs. not, indicating that these variables did not change the mediation model described above. The final odds ratios presented in Table 2 are after controlling for multiple demographic and treatment variables.

DISCUSSION

In this study, adherence self-efficacy mediated the relationship between positive provider interactions and medication adherence. This indicates that, statistically, the relationship of provider interactions and adherence can be explained by adherence self-efficacy, suggesting that self-efficacy may be the mechanism of the relationship between the other two variables. The pattern of this relationship was the same regardless of gender, race/ethnicity, injection drug use, and site of usual HIV care, suggesting substantial support for this model of adherence. Further, this relationship is maintained when controlling for important demographic variables (age, gender, education), treatment variables (CD4 count, usual source of care), and other factors often linked to adherence (depression, social support, IDU).

These findings have implications for improving adherence self-efficacy such that fostering positive interactions between providers and patients may lead to better medication adherence [43]. Effective interventions to improve provider relations may target the patient, the provider, or both. For example, helping providers create an environment in which the patient feels respected and understood may lead to greater confidence in the patient's ability to stick to a treatment regimen. This may involve structural changes within clinical settings or provider training in which interpersonal skills are addressed. Greater time per patient visit in which the provider has the opportunity to sit and talk with the patient, although challenging to implement given current healthcare delivery systems, is one example of a structural change that may result

in more positive interactions [44]. Physician training to increase collaborative negotiation in setting treatment goals and strategies is also likely to bolster adherence self-efficacy. For example, greater patient-physician agreement about top priority treatment strategies has been shown to predict greater self-efficacy for diabetes self-management⁴⁰. Because patient perceptions of stress may undermine self-efficacy for antiretroviral adherence⁴¹, it may also be beneficial to improve patient-physician communication about managing stressful life circumstances that influence medication adherence. Likewise, patient-focused interventions that enhance skills may improve provider/patient visits [45] and lead to greater self-efficacy for medication adherence. For example, assertive communication skills, in which the patient is able to respectfully make specific requests of the provider, may facilitate positive interactions. Other strategies by which the patient can influence the interaction with the provider, e.g., making lists of questions for the provider, may have a beneficial impact on the patient-provider interaction and thereby improve adherence self-efficacy. Such a focus has implications for preventive medicine in that complications from HIV infection may be avoided if adherence can be supported through positive provider interactions.

Limitations

The mediation model we have tested and presented in this paper is based on cross sectional data. For this reason, we cannot be certain of causality in the relationships among the variables and cannot rule out competing models that may fit the data. For example, it may be that better adherence leads to more positive provider interactions and to higher self-efficacy. It is also likely that reciprocity exists, in which there is a dynamic influence of provider and patient behavior that affects adherence outcomes, as suggested by some researchers[31]. Second, we do not have information on provider gender, training, or ethnicity, nor do we have providers' assessments of the interactions with the patients. Having both patient and provider perspectives would enhance our understanding of the model presented.

The use of self-reported adherence data has been questioned in HIV research. Currently, there is no gold standard for measuring adherence to antiretroviral medications. Self-reported levels of adherence are suspected of being inflated because of recall, social desirability, and other biases. To minimize the biases inherent in self-reported data, we employed several techniques. First, we used a validated measure of adherence that has demonstrated meaningful relationships with important outcomes, such as viral load, in other studies. Second, we used ACASI interviewing for the adherence portion of the interview, thereby removing the interviewer's presence and minimizing social desirability bias. Finally, we included instructions that contained recall cues, which asked the respondent to carefully think back through events in the past three days and the computer referred to each day by name. Such approaches to computerized adherence assessment have shown favorable effects in other studies [46,47].

Finally, because it is impossible to obtain a comprehensive list of HIV-positive persons from which to randomly sample and because we were recruiting for a randomized behavioral intervention trial, we interviewed a convenience sample from multiple sources in each city (e.g., infectious disease clinics, AIDS service organizations, bars, advertisements in periodicals). Nevertheless, by using a large number and range of recruitment sites, we were able to obtain a sample demographically representative of the HIV epidemic in each subgroup in the US [48]. In comparison to another large, multi-city sample of HIV-infected adults, the HIV Cost and Services Utilization Study (HCSUS) cohort [49], our study included more members of ethnic minority and low socioeconomic status groups, and included individuals who were not receiving treatment, and may thus more closely approximate the HIV-infected population in the US.

This study represents an important step in elucidating the role of provider relations in determining adherence to medications. Longitudinal studies are needed in which programs to enhance patient-provider interactions are evaluated in their effect on adherence self-efficacy and medication taking behaviors. Such investigations have the potential to maximize preventive medicine efforts in the treatment of HIV disease.

ACKNOWLEDGMENTS

This research was funded by National Institute of Mental Health grants U10-MH57636, U10-MH57631, U10-MH57616, and U10-MH57615. We also acknowledge the support of NIMH center grants P30-MH058107 (Mary Jane Rotheram-Borus, Ph.D., PI), P30-MH57226 (Jeffrey A. Kelly, Ph.D., PI), P30-MH43520 (Anke A. Ehrhardt, Ph.D., PI), P30-MH062246 (Thomas J. Coates, Ph.D., PI), and NIMH grant K08-MH01995 (Mallory O. Johnson, Ph.D., PI). The authors thank Ellen Stover, Ph.D. and Willo Pequegnat, Ph.D., at NIMH for their technical assistance in developing the study and Christopher M. Gordon, Ph.D., and Dianne Rausch, Ph.D., at NIMH for their support of this research. Thanks to the Psychosexual Core of the HIV Center for Clinical and Behavioral Studies at New York State Psychiatric Institute and Columbia University, especially Heino Meyer-Bahlburg, Terry Dugan, and Theresa Exner, for collaborating with us in developing the sexual behavior interview, to the assessors in each city who conducted the interviews, to our clinic and community based organization collaborators, to all other support staff involved in the project, and to the men and women who participated in the interviews.

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Solid lines indicate relationships that remained significant after controlling for the direct path between positive provider interactions and adherence, which is represented by the dotted line.

Figure 1.
Mediation model

Table 1

Sample Characteristics

Variable	% of sample	Mean (SD)	Median
Overall (N=2765)			
Age (Years)		42 (7.6)	41
Gender			
Male	74.3		
Female	24.4		
Transgender	1.3		
Ethnicity			
Black/African American	49.4		
Hispanic/Latino	18.2		
White	26.1		
Other	6.2		
Employment Status			
Working	29.3		
Not Working	70.3		
Sexual Orientation			
Heterosexual	42.9		
Homosexual	43.5		
Bisexual	11.5		
Other/Not Sure	2.0		
Education			
< High School	25.1		
High School	27.0		
Some College	33.0		
College Grad.	15.0		
CD4 Count		431 (292)	380
Viral load			
Undetectable	46.4		
Detectable (1396)	50.5		
Usual source of HIV Care= HIV specialty clinic	53.6		

Table 2

Univariate and adjusted odds ratios with likelihood of reporting nonadherence.

Variable	Univariate Odds Ratios [*]	95% CI	Adjusted Odds Ratios [*]	95% CI
Positive Provider Interactions	0.704 ^{**}	0.617, 0.817	0.864	0.736, 1.013
Adherence Self-Efficacy	0.666 ^{**}	0.630, 0.703	0.671 ^{**}	0.635, 0.731

* Controlling for age, gender, education, ethnicity, social support, depression, and CD4 count.

**
p<.001

Table 3
provider interactions, adherence self-efficacy, and adherence scores.

Overall (N=2765)	Male (n=2054)	Female (n=674)	Black (n=1366)	White (n=722)	Latino (n=504)	IDU (n=222)	No IDU (n=2543)	HIV Spec Care (n=1474)	No HIV Spec Care (n=1291)
2.30 (0.60)	2.28 (0.59)	2.37 (0.61)	2.32 (0.58) ^a	2.27 (0.60)	2.31 (0.60) ^a	2.21 (0.61)	2.31 (0.59) [*]	2.33 (0.59) ^{**}	2.26 (0.61)
7.37 (1.91)	7.38 (1.90)	7.47 (1.90)	7.23 (1.94) ^a	7.62 (1.79) ^a	7.50 (1.88)	7.17 (2.02)	7.41 (1.89)	7.36 (1.90)	7.43 (1.90)
68.2%	69.0%	66.5%	63.3% ^{ab}	71.6% ^a	75.8% ^b	54.5%	69.4% ^{***}	68.0%	68.6%

Is with same superscripts.