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Ophthalmologist-patient communication, self-efficacy, and glaucoma medication adherence

Betsy Sleath, PhD,
UNC Eshelman School of Pharmacy & Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill; CB # 7590, Chapel Hill, NC 27599-7590 USA; Office: 011-1-919/966-8969, Fax: 011-1-919-966-1634. betsy_sleath@unc.edu

Susan J. Blalock, PhD,
Division of Pharmaceutical Outcomes and Policy, UNC Eshelman School of Pharmacy, University of North Carolina at Chapel Hill, Chapel Hill USA

Delesha M. Carpenter, PhD, MSPH,
Division of Pharmaceutical Outcomes and Policy, UNC Eshelman School of Pharmacy, University of North Carolina at Chapel Hill, Chapel Hill USA

Robyn Sayner, PharmD,
Division of Pharmaceutical Outcomes and Policy, UNC Eshelman School of Pharmacy, University of North Carolina at Chapel Hill, Chapel Hill USA

Kelly W. Muir, MD,
Department of Ophthalmology, School of Medicine, Duke University; Durham VA Medical Center, Health Services Research and Development, Durham USA

Catherine Slota, BS,
Division of Pharmaceutical Outcomes and Policy, UNC Eshelman School of Pharmacy, University of North Carolina at Chapel Hill, Chapel Hill USA

Scott D. Lawrence, MD,
Glaucoma Service, UNC Kittner Eye Center, University of North Carolina at Chapel Hill, Chapel Hill USA

Annette L. Giangiacomo, MD,
Ophthalmology, Emory University School of Medicine, Atlanta USA

Mary Elizabeth Hartnett, MD,
Department of Ophthalmology and Visual Sciences, John A. Moran Eye Center University of Utah, Salt Lake City USA

Gail Tudor, PhD,

Corresponding author: Betsy Sleath, PhD, Sheps Center for Health Services Research, University of North Carolina at Chapel Hill; CB # 7590, Chapel Hill, NC 27599-7590; Office: 919/966-8969, Fax: 919-966-1634. betsy_sleath@unc.edu.

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Department of Science and Mathematics, Director of Institutional Research, Husson University, Bangor USA

Jason A. Goldsmith, MD, and
Ophthalmology/Visual Sciences, John A. Moran Eye Center, Salt Lake City USA

Alan L. Robin, MD
Department of Ophthalmology, University of Maryland, Baltimore, MD; Department of Ophthalmology, University of Michigan, Ann Arbor, Michigan; Department of International Health, Bloomberg School of Public Health; Department of Ophthalmology, School of Medicine; Johns Hopkins University, Baltimore USA

Abstract

Objective—The objective of the study was to examine the association between provider-patient communication, glaucoma medication adherence self-efficacy, outcome expectations, and glaucoma medication adherence.

Design—Prospective observational cohort study.

Participants—279 patients with glaucoma who were newly prescribed or on glaucoma medications were recruited at six ophthalmology clinics.

Methods—Patients' visits were video-tape recorded and communication variables were coded using a detailed coding tool developed by the authors. Adherence was measured using Medication Event Monitoring Systems for 60 days after their visits.

Main outcome measures—The following adherence variables were measured for the 60 day period after their visits: whether the patient took 80% or more of the prescribed doses, percent correct number of prescribed doses taken each day, and percent prescribed doses taken on time.

Results—Higher glaucoma medication adherence self-efficacy was positively associated with better adherence with all three measures. African American race was negatively associated with percent correct number of doses taken each day (beta= −0.16, $p<0.05$) and whether the patient took 80% or more of the prescribed doses (odds ratio=0.37, 95% confidence interval 0.16, 0.86). Physician education about how to administer drops was positively associated with percent correct number of doses taken each day (beta= 0.18, $p<0.01$) and percent prescribed doses taken on time (beta=0.15, $p<0.05$).

Conclusions—These findings indicate that provider education about how to administer glaucoma drops and patient glaucoma medication adherence self-efficacy are positively associated with adherence.

Glaucoma is one of the leading causes of blindness and visual disability. An estimated 1.5 million Americans suffer from glaucoma while approximately 120,000 of them have been blinded by the disease. Between 9 and 12% of all blindness in the United States is attributed to glaucoma.[1] A primary goal of glaucoma treatment is to reduce intraocular pressure.[2,3] Taking available glaucoma medications can significantly lower intraocular pressure and reduce the progression of glaucoma.[4,5] However, despite the availability of medications, non-adherence with using glaucoma medications is a significant problem.[6]

Each class of topical glaucoma medications has different side effects profiles and some patients may tolerate certain side effects better than others.[7–11] Additionally, eye drops are often difficult to administer.[10, 12, 13] Therefore, provider-patient communication about glaucoma and glaucoma medications is important and can potentially impact adherence. Two qualitative studies reported that poor communication between glaucoma patients and their providers negatively impacted adherence.[14, 15] Unfortunately, these studies did not investigate actual communication.[14, 15] One prior study did examine ophthalmologist and patient communication during 50 video-taped glaucoma visits but the researchers did not report how certain aspects of provider-patient communication were associated with patient adherence.[16]

One prior study found that patients who reported being less likely to ask their eye doctor questions during visits also reported being less adherent to their glaucoma medications.[17] Patient question-asking is important because it is a form of active patient participation during medical visits in which patients can ask for more information.[18, 19] Patient question-asking can potentially improve patient self-efficacy in managing glaucoma, because if patients ask questions about how to correctly use eye drops or resolve problems in using glaucoma medications, they can receive information from the doctor and gain more confidence in managing their glaucoma.[12,20,21]

In addition to provider-patient communication, patient self-efficacy, which is one of the key constructs of Social Cognitive Theory (SCT), has been found to be significantly associated with glaucoma medication adherence in prior research.[20,22] Additionally, studies in HIV, diabetes, asthma, and depression have found positive associations between self-efficacy and medication adherence.[23–29] Self-efficacy is defined as individuals' personal beliefs regarding their capabilities to carry out a specific task to achieve a desired outcome.[30,31] Another construct of SCT, outcome expectations, could also be associated with patient adherence.[32] Outcome expectations are whether an individual believes certain behaviors (e.g. taking eye drops) will have a positive impact on their health condition (e.g. glaucoma).

To our knowledge, no prior study has examined how actual video-taped provider-patient communication is associated with adherence measured using Medication Event Monitoring Systems (MEMS) caps. Therefore, the purpose of our study is to examine the association between provider education about glaucoma and glaucoma medications, patient question-asking, glaucoma medication adherence self-efficacy, outcome expectations, and adherence to glaucoma medications measured electronically (percent doses taken over 60 day period, percent correct number of doses taken each day, and percent prescribed doses taken on time).

Methods

Procedure

This prospective observational cohort study took place at six geographically distinct ophthalmology clinics located in the United States that included private offices (two sites) and academic ophthalmology departments (four sites). Patients were enrolled between December 2009 and May 2012 and eligibility criteria for enrollment included: the ability to

speak and read English, having a diagnosis of glaucoma, and being at least 18 years of age. At each site, clinic staff referred eligible patients to clinic-based research assistants, who obtained written patient and provider consent. Providers and patients were told that the study was about provider-patient communication; they were not told what specific aspects of communication were being examined. Providers completed a short demographic questionnaire after providing consent. The patient's medical encounter was video-tape recorded and patients were interviewed immediately after their medical visits. Each patient was given a large prescription vial with Medication Event Monitoring System (MEMS) cap on top for each of their prescribed glaucoma medication.[8] The MEMS caps electronically assessed patient adherence.[8] Patients used the MEMS caps for 60 days after their video-taped visit. The study was approved by the University of North Carolina Institutional Review Board, was performed in accordance with the tenants of the Treaty of Helsinki and was HIPAA compliant.

Measurement

Socio-demographic measures

Patient age was measured as a continuous variable. Self-reported patient race was measured a categorical variable (White, African American, Asian, Native American, and Hispanic) and then recoded as African American and non-African American. The majority of the non-African American patient sample was White (91 %). Gender was measured as a dichotomous variable. The research assistant recorded whether the patient was prescribed glaucoma medication for the first time during the medical visit or was already on glaucoma medication before the visit. Also, the research assistant extracted the number of glaucoma medications a subject was taking after the baseline visit from the patient's medical record.

Physician age was measured as a continuous variable and physician gender as a dichotomous variable. Self-reported physician race was measured as a categorical variable (White, African American, Asian, Native American, and Hispanic).

Self-efficacy and outcome expectation measures

All subjects were administered a 21-item previously validated general glaucoma medication adherence self-efficacy questionnaire.[20] The general glaucoma medication adherence self-efficacy questionnaire strongly correlates with self-reported measures of adherence.[20] They were given three possible response choices for the self-efficacy items: not at all confident (coded as 1), somewhat confident (coded as 2), very confident (coded as 3). Scores on the glaucoma medication adherence scale could range from 21 (lower self-efficacy) to 63 (higher self-efficacy). The scale has a Cronbach's alpha of 0.90 in the current sample. Outcome expectations were measured using four items designed to assess how much patients believed attending their ophthalmic clinical visits and taking medications would help their glaucoma and vision.[33] Responses ranged from 1 (not at all) to 9 (extremely) for each item. Scores could range from 4 to 36 on the outcome expectations scale. The scale had a Cronbach's alpha of 0.94 in the current sample.

Communication measures

All medical visit video-tapes were transcribed into text verbatim with identifiers removed. The authors developed a detailed coding tool to assess communication over a one-year period. The areas for education about glaucoma and glaucoma medications were created prior literature and input from the pharmacists and ophthalmologists on the study team.[34–36] Transcripts were reviewed by a research assistant who met twice a month with the investigators to develop and refine the coding rules.

Using the coding tool for transcribed medical visits, coders recorded the following: (a) did the patient ask a question about glaucoma, (b) did the patient ask a question about glaucoma medications, (c) did the provider educate about glaucoma, (d) did the provider educate about the purpose of the medications, (e) did the provider educate about the importance of adhering to the medication, (f) did the provider educate about side effects, and (g) did the provider educate about how to administer the glaucoma medication.

We coded for patient-provider communication variables that have been theoretically and empirically linked with adherence self-efficacy and/or medication adherence. Specifically, we chose to examine whether the provider educated about how to administer glaucoma medications because educating about how to administer the medications could improve glaucoma medication adherence self-efficacy which is one of the key components of Social Cognitive Theory.[30,31] We coded for provider education about glaucoma and provider education about glaucoma medication adherence, side effects and medication purpose because education about these areas can improve patient knowledge of their disease and how to manage it, which could ultimately lead to improved adherence self-efficacy and medication adherence. Similarly, we coded for patient question-asking about glaucoma and glaucoma medications because, in prior work, patient question-asking has been associated with adherence.[17]

Two clinics had glaucoma fellows examine some of the enrolled patients while two other clinics had ophthalmic technicians examine some of the enrolled patients. Informed consent was obtained from these providers as well. If any one of these healthcare providers, including the physician, educated the patient, it was counted as education in the categories discussed above.

Three research assistants coded 25 of the same transcripts throughout the study period to calculate inter-rater correlations as a determination of inter-rater reliability. Inter-rater reliability was 0.84 for the patient asking a question about glaucoma, 0.78 for the patient asking a question about glaucoma medications, 0.76 for the physician educating about glaucoma, 0.93 for the physician educating about the purpose of the medication, 0.85 the physician educating about adherence and adherence strategies, 0.94 for the physician educating about side effects, and 0.95 for the physician educating about how to administer the drops.

Adherence measures

Medication adherence over a 60 day period after the video-taped visit was evaluated via electronic data from the MEMS caps system (AARDEX).[8] The MEMS caps measured the

date and time that the patients opened the vial to take their eye drop bottle out to administer medication, but they do not measure if the patients actually put their drops in their eyes. Whether the patient took 80 percent or more of their prescribed doses was measured from the MEMS caps using the following formula: adherence = (number of doses used during the past two months divided by the number of prescribed doses) multiplied by 100. We dichotomized the variable since it was skewed towards patients being highly adherent. Subjects were considered adherent if they used 80% or more of the prescribed doses (79.5% or above was rounded to 80% or more) and they were classified as non-adherent if they used less than 80% of the prescribed doses as suggested in prior research.[37]

We also used the electronic data from the MEMS caps to examine the percent doses taken on time during the 60 day period after the video-taped visit.[8] If patients were on once a day dosing, taking it on time was taking it every 24 hours plus or minus 6 hours. If it was twice a day dosing, taking it on time was every 12 hours plus or minus 3 hours. We also examined using the MEMS caps data the percent correct number of prescribed doses taken each day during the 60 day period after the video-taped visit.[8]

If the subject was on more than one glaucoma medication, for each of the three adherence measures, an adherence measure was created for each medication and then an overall adherence variable was created by adding together the subject's adherence for each glaucoma medication and dividing it by the number of glaucoma medications the subject was using.

Analysis

We set the a priori level of statistical significance at $p < 0.05$. First, we ran descriptive statistics. Second, we examined the bivariate relationships between variables using Pearson correlation coefficients, chi-square statistics, and t-tests as appropriate. We conducted multivariable regression to examine how patient age, gender, race, glaucoma medication adherence self-efficacy, glaucoma outcome expectations, whether the patient was newly prescribed glaucoma medication on the day of the video-taped visit, number of glaucoma medications the patient was on, whether the physician educated about glaucoma, whether the physician educated about adherence and adherence strategies, whether the physician educated about how to administer the eye drops, whether the physicians educated about the purpose of the medication, whether the physician educated about side effects, whether the patient asked a question about glaucoma, whether the patient asked a question about glaucoma medications, physician age, and physician gender were associated with: (a) whether the patient was 80% or more adherent to their glaucoma medications, (b) the percent doses taken on time, and (c) the percent correct number of doses taken each day according to the MEMS caps during the 60 day period after the video-taped visit. Physician race could not be included in the multivariable analysis because there was only one non-White physician.

Results

Fifteen physicians who cared for glaucoma patients agreed to participate in the study; one physician refused to participate for a participation rate of 94%. Fourteen physicians were

White and one was African American. Ten physicians were male (66.7%). Physician age ranged from 26 to 66 years (mean 40.8 years, standard deviation 11.7 years).

Eighty-six percent (N=279) of eligible patients who came to the research assistant to learn more about the study, enrolled in the study. We do not have information on the characteristics of those who chose not to participate. We had useable video-tapes on 276 out of the 279 patients. Eighty-nine percent of the enrolled patients had MEMS caps data for the 60 day period after their video-taped visit (N=249). Those who did not have data either did not return their caps (N=24) or if they returned their MEMS caps, there was not useable data (N=6) (e.g. data was not downloadable due to hardware problems in the caps).

Table 1 presents the patient demographics. Forty-one percent of the sample was male and 35.5% were African American. Eighteen percent of patients were prescribed glaucoma medications for the first time. Of those already on glaucoma medications, 20.6% (47) used them less than 6 months, 25.4% (58) used them 6 months to 2 years, 19.7% (45) used them more than 2 years to less than 5 years, and 34.2% (78) used them 5 years or longer.

As we reported elsewhere, providers educating patients about glaucoma occurred during approximately two-thirds of the visits.[38] Provider education about using drops occurred during only 14% of the visits, adherence and adherence monitoring strategies during 18.3% of visits, the purpose of the medication during 17.6% of visits, and side effects during 27.2% of visits.[8]

Table 2 presents the multivariable logistic regression results predicting whether patients took 80% or more of their prescribed doses of their glaucoma medications during the 60 day period after the video-taped visit. Patients who had higher glaucoma medication adherence self-efficacy were significantly more likely to be 80% or more adherent to their medications (odds ratio=1.09, 95% confidence interval=1.02, 1.17). African American patients were significantly less likely to be 80% or more adherent to their medications than non-African American patients (odds ratio=0.37, 95% confidence interval=0.16, 0.86).

Table 3 presents the multivariable linear regression results predicting the percent of doses patients took on time. Patients with higher glaucoma medication adherence self-efficacy (beta=0.20, p=0.005) were significantly more likely to take their doses on time. Patients on more glaucoma medications (beta= −0.21, p=0.002) were significantly less likely to take their doses on time. If physicians educated about how to administer the glaucoma eye drops (beta=0.15, p=0.02), the patients were significantly more likely to take their doses on time.

Table 3 presents the multivariable linear regression results predicting the percent correct number of doses taken each day. African American patients (beta= −0.16, p=0.01), patients newly prescribed glaucoma medications (beta= −0.16, p=0.03), and patients on more glaucoma medications (beta= −0.16, p=0.02) were significantly less likely to take the correct number of prescribed doses each day. Patients with higher glaucoma medication self-efficacy (beta=0.20, p=0.005) and outcome expectations (beta= 0.16, p=0.03) were significantly more likely to take the correct number of prescribed doses each day. If physicians educated patients about how to administer their glaucoma eye drops (beta= 0.18,

p=0.008), patients were significantly more likely to take the correct number of prescribed doses each day.

Discussion

Whether physicians educated patients about how to administer their drops during visits was significantly associated with both whether patients took their drops on time and with whether they took the correct number of doses each day. Provider education about using drops occurred during only 14% of the visits.[38] Providers educating patients about how to administer their drops included statements such as telling them to lean back their head, suggesting they use a mirror, giving them tips on how to get the drop in the eye, and telling patients how long to wait between administering two different eye drops. This suggests that providers should consider taking the time to educate patients about how to administer their drops. Educating patients about how to administer their eye drops could improve glaucoma medication adherence self-efficacy or confidence in using and taking their drops.

Educating patients about glaucoma occurred during approximately two-thirds of the visits[38] and was not significantly associated with whether patients took their doses on time during the 60 day period after the visit. The provider educating about side effects, adherence, or the purpose of the medication were not significantly associated with whether patients took their doses on time during the 60 day period after the visit. The physician educating about how to administer the eye drops was the only provider communication variable that was significantly associated with adherence.

Similar to prior research which has found that African Americans are less adherent to glaucoma medications than Caucasians[20, 39–41], we did find that African Americans were significantly less likely to take 80% or more of their prescribed doses. Also, we did find that African Americans were significantly less likely to take the prescribed number of doses each day. This finding emphasizes the importance of providers educating African American patients about the importance of when to take their glaucoma medications each day and how many doses to take each day.

Patients asked one or more questions about glaucoma during 48% of visits.[42] The number of questions about glaucoma asked by the patients during their medical visit ranged from 0 to 17 (mean 1.3, standard deviation 2.0). Patients asked one or more questions about glaucoma medications during 59% of visits.[42] The number of questions about glaucoma medications that patients asked during their medical visit ranged from 0 to 16 (mean 1.7, standard deviation 2.4).

Unlike prior research[17], we did not find that patient question-asking during their visits was associated with medication adherence. A prior study found that patients who reported being less likely to ask their eye doctor questions during visits also reported being less adherent to their glaucoma medications.[17] The difference in findings might be due to the fact that we examined actual patient question-asking whereas the other study was based on patient self-report.

Patient reported glaucoma medication self-efficacy was significantly associated with all of the adherence measures. This finding is important because it relates and therefore emphasizes the importance of patient self-efficacy, or self-confidence, in using glaucoma medications to patient adherence. The patient self-efficacy scale could be used as a tool by providers to assess when patients do not feel comfortable using glaucoma medications under certain circumstances (e.g. when traveling, when they experience side effects). Providers could use the patient responses to help them problem solve and boost patients confidence in using eye drops under these circumstances.

Higher glaucoma patient outcome expectations were significantly associated with the patient being more likely to take the correct number of doses each day. Patient outcome expectations are posited under Social Cognitive Theory to influence patient behaviors such as taking medications[30, 31] and prior work in pediatric asthma did find outcome expectations to be positively associated with patient adherence.[32] We did find evidence that glaucoma patient outcome expectations was significantly associated with one of the adherence measures that we examined in the current study. More research is needed to further explore how glaucoma patient outcome expectations are associated with adherence.

The self-efficacy and outcome expectations scales could be used in other types of glaucoma research and by glaucoma clinics. Our patients had relatively high scores on the self-efficacy and outcome expectation scales so future research should examine how self-efficacy and outcome expectation might be associated with adherence among patients with lower scores.

Patients on more complex regimens were less likely to take their doses on time and they were less likely to take the correct number of prescribed doses each day. This finding emphasizes the importance of ophthalmologists simplifying patients' medication regimens if they can.

This study has several limitations. Providers and patients both knew the visit was being recorded but they did not know the study hypotheses. Our study is limited in that we could not track the characteristics of non-participants so we cannot compare the characteristics of participants and non-participants. Additionally, our coders counted the patient being educated about glaucoma or glaucoma medications during visits regardless of whether a physician, technician, or fellow provided it. A limitation is that we coded the data this way so we cannot separate out physician, technician, and fellow provision of education. Another limitation of our study is the lack of variation in physician race and how race might affect physician-patient communication and adherence. Despite these limitations, this prospective cohort study presents new information on provider-patient communication, self-efficacy, outcome expectations, and glaucoma patient medication adherence.

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Dr. Robin has been a consultant for Biolight, Lupin Pharmaceuticals, and Sucampo and he does paid lectures for Merck and Allergan. He has been a consultant and has stock options in Glaukos. Dr. Robin is on the board of Aerie

Pharmaceuticals. Dr. Hartnett is a consultant for Axikin Pharmaceuticals. Dr. Muir receives salary support from a VA HSR&D career development award.

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Table 1

Subject Characteristics (N=279)

	Percent (N)
Gender	
Male	40.9 (114)
Female	59.1 (165)
Race	
African American	35.5 (99)
Non-African American	64.2 (179)
Newly prescribed glaucoma medications at visit or was on glaucoma medication before visit	
Newly prescribed at visit	18.3 (51)
Was on glaucoma medications before visit	81.7 (228)
Range; Mean (Standard Deviation)	
Age	21 to 93; 65.8 (12.8)
Glaucoma medication adherence self-efficacy	28 to 63; 58.9 (5.5)
Glaucoma outcomes expectations	19 to 36; 34.5 (3.1)
Number of glaucoma medications	1 to 4; 1.4 (0.6)

Table 2

Multivariable logistic regression results predicting whether the patient is 80% or more adherent during the 60-day period after the visit according to MEMS caps (N=230)

Independent variables	Patient is 80% or more adherent OR (95% CI)
Patient age	1.01 (0.98, 1.04)
Patient gender-female	0.91 (0.40, 2.04)
Patient race-African American	0.37 (0.16, 0.86) *
Glaucoma medication adherence self-efficacy	1.09 (1.02, 1.17) *
Glaucoma outcome expectations	0.99 (0.87, 1.14)
Newly prescribed glaucoma medications	0.42 (0.13, 1.40)
Number of glaucoma medications	0.54 (0.28, 1.04)
Did physician educate about glaucoma	1.06 (0.39, 2.86)
Did physician educate about glaucoma adherence	0.97 (0.31, 3.05)
Did physician educate about the how to administer glaucoma medications	2.17 (0.53, 8.98)
Did physician educate about the purpose of the medications	0.52 (0.16, 1.62)
Did the physician educate about side effects	1.31 (0.44, 3.87)
Does the patient ask one or more questions about glaucoma	0.62 (0.27, 1.45)
Does the patient ask one or more questions about glaucoma medications	1.26 (0.54, 2.96)
Physician age	0.86 (0.28, 2.67)
Physician gender-female	1.00 (0.95, 1.05)

OR=Odds Ratio, 95%CI=95%, Confidence Interval;

* $p<0.05$

Table 3

Multivariable linear regression results predicting the percent doses taken on time and the percent correct number of doses taken each day during the 60 day period after the visit according to MEMS caps (N=230)

Independent variables	Percent doses taken on time Beta	Percent correct number of doses taken each day Beta
Patient age	0.11	0.02
Patient gender-female	−0.01	0.01
Patient race-African American	−0.13	−0.16 *
Glaucoma medication adherence self-efficacy	0.20 **	0.20 **
Glaucoma outcome expectations	0.11	0.16 *
Newly prescribed glaucoma medications	−0.09	−0.16 *
Number of glaucoma medications	−0.21 **	−0.16 *
Did physician educate about glaucoma	0.09	0.06
Did physician educate about adherence	−0.05	−0.04
Did physician educate about how to administer glaucoma medications	0.15 *	0.18 **
Did physician educate about the purpose of the medications	−0.06	−0.09
Did the physician educate about side effects	0.06	0.11
Does the patient ask one or more questions about glaucoma	−0.10	−0.09
Does the patient ask one or more questions about glaucoma medications	0.02	−0.02
Physician age	−0.04	−0.04
Physician gender-female	−0.09	−0.08

* $p<0.05$,

** $p< 0.01$