Title: Assessing the impact of pre-test education on patient knowledge, perceptions, and expectations of pharmacogenomic testing to guide antidepressant use

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This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1002/jgc4.1612

Abstract

Pharmacogenomic (PGx) testing is an increasingly utilized technology that offers the potential for precision drug selection to treat depression. Though PGx-guided therapy is associated with increased rates of remission of depression symptoms, for many patients, treatment will not change based on PGx testing results. Lack of consensus guidelines for pre-test counseling may hinder the communication of PGx testing limitations, and patients often have high expectations for test outcomes. To explore this issue, we created and evaluated the impact of a pre-test education video for patients with depression. Individuals in the education group (n=198) viewed this brief video about PGx testing prior to completing a survey that explored knowledge, perception, and expectations of PGx testing developed using a theoretical framework to measure intention to test. Individuals in the survey-only group (n=189) completed the same survey but were not provided with any PGx educational materials. Analyses demonstrate efficacy of the video in improving knowledge of PGx. The education group also reported more positive attitudes and greater perceived control over pursuing PGx testing compared to the survey-only group. Further analyses identified significant differences in expectations, attitudes, and intention to pursue PGx testing based on number of previous medication trials. Path analyses identified the best model for predicting PGx testing intention, specifically that social norms and ease of testing have a strong positive association, and knowledge has a strong negative association with patients' intentions to test across the full sample, the education group, and the survey-only group. The findings of this study serve as a foundation for future tailored educational initiatives in the PGx testing space.

Keywords: Pharmacogenomics, pharmacogenetics, health behavior, education, practice models, decision-making

What is known about this topic:

Pharmacogenomic (PGx) testing can impact treatment for individuals with depression in some cases; however, there are no standards for pre-test counseling for patients undergoing PGx testing to review benefits and limitations. Patients often have heightened expectations that PGx testing will improve their depression management.

What this paper adds to this topic:

This study assessed a brief educational intervention about PGx testing for patients with depression and demonstrated improvement in patient understanding. Further, the study identified predictors of intention to test and demonstrated the value of an intervention early in treatment.

Introduction

Depression impacts 8.1% of American adults in a given 2-week period and affects twice as many women (*M*=10.4%) as men (*M*=5.5%). Further, nearly 50% of those with depression report difficulty with work, home, or social activities due to their symptoms (Brody et al., 2018). Despite many medications approved to treat depression, 30-50% of patients with major depressive disorder fail their first antidepressant treatment due to intolerance or ineffectiveness (Rush et al., 2006). Therefore, patients commonly trial multiple antidepressant treatments before finding an effective agent, and unfortunately, medication trials can require 6-8 weeks to determine drug efficacy (Rush et al., 2006). Pharmacogenomic (PGx) testing may help shorten trials by identifying effective treatment (Lesko & Woodcock, 2004; Phillips et al., 2017).

PGx refers to the translation of genetic information into a predicted medication impact via assessment of genomic markers related to drug metabolism, adverse reactions, and efficacy, and has been hailed as a potent solution to reduce failures in

antidepressant treatment (Lesko & Woodcock, 2004; Phillips et al., 2017). However, results from studies on treatment impact based on drug metabolism have been mixed (Bousman & Dunlop, 2018; Bousman et al., 2017). In two of the largest randomized controlled trials comparing PGx-guided antidepressant management to treatment as usual, PGx testing did not lead to a recommendation for medication adjustments in the majority of patients (Bousman et al, 2019; Greden et al., 2019). However, importantly, some research has demonstrated that patients are more adherent to medication when using PGx testing-guided therapy compared to treatment as usual (Winner et al., 2015). Since adherence is critically important to medication response, the summarized mixed results adds another level of complexity in discussing cost/benefit ratios with individual patients.

There is not a set delivery model for clinical administration of PGx testing for antidepressant treatment. Practice varies, but often physicians (primary care or psychiatry) facilitate PGx testing, as opposed to pharmacists or genetic counselors. Consensus guidelines for pre-test counseling about PGx testing do not exist (Zierhut et al., 2017) and discussion about PGx testing may be hindered by limited provider knowledge in some settings (Haga, 2017). Studies suggest that patients have high expectations that PGx testing will lead to improvement in depression treatment (Lemke et al., 2017; Liko et al., 2020) and report limited understanding of PGx test results (Haga & Liu, 2019; Haga et al., 2015). Therefore, educational interventions are needed to improve patient understanding of the benefits and limitations of PGx testing to inform antidepressant treatment. Assessing patient perceptions of PGx testing can improve our ability to educate and support patients through testing.

Therefore, the study purposes were to 1) learn how patients with depression perceive PGx testing as part of their care, and 2) create and assess an educational intervention to promote better patient understanding of PGx testing. This study serves as a step towards ensuring appropriate pre-test PGx education for patients with depression.

Methods

Participants

Eligible study participants were identified on the crowd-sourcing platform Amazon's Mechanical Turk (MTurk) from September to December 2019. Inclusion criteria included living in the United States, being at least age 18, self-identifying as having depression, and reporting no history of PGx testing. Two tasks were published on MTurk. The survey-only task was published initially, and then two weeks later, the survey and education task was published. Task titles and descriptions were identical except for a statement that there would be a 5-minute video in the survey and education task description. Participation was restricted to one of the two tasks using task eligibility settings within MTurk to prevent duplicate responders. Study procedures were approved prior to launch by the University of Michigan IRB (IRB#: HUM00167705).

Procedures

We designed a case-controlled study that utilized an educational intervention and survey based on the Theory of Planned Behavior (TPB) framework to measure intention to pursue PGx testing in patients with depression (Ajzen, 1991). The TPB model measures perceived behavioral control (i.e., ability to have PGx testing), attitudes toward a behavior (i.e., attitudes about PGx testing), normative beliefs about the behavior (i.e., beliefs about whether others would have PGx testing), and intentions to enact a behavior

(i.e., intention to have PGx testing). This model has been used to predict many health behaviors (Albarracin et al., 2001; Cooke et al., 2016).

Materials

Educational Intervention. We designed a brief (5-minute) video to provide participants with basic information about PGx testing. Video content and format was based on evaluation of a previous PGx educational video (Mills et al., 2017), a review of the literature on PGx testing education, and a review of videos about PGx testing published by testing companies (Genomind, 2018; Genesight, 2017) and medical centers (Mayo Clinic, 2017a; 2017b; University of Florida Health, 2012). The video script and images were compiled using Microsoft PowerPoint and video and voice-over was recorded over the slides. Optional subtitles were available.

Content included: definition of PGx, basic genetic concepts, drug metabolism categories (types of metabolizers), information PGx testing provides, and test logistics. Providers who could answer additional participant questions were also identified. A summary slide reviewed how PGx testing is used in depression management and that not all patients have a change in their depression treatment. The video is available at the following link (https://rb.gy/rojaqo).

Survey. A 19-question survey was designed to measure perceptions (n=16) and knowledge (n=3) of PGx testing. Perceptions of testing were divided into seven domains: expectations (n=2), utility (n=4), attitude (n=3), social norms (n=3), perceived behavioral control (n=2), and intention (n=2). Responses were measured using 5-point Likert scales. Three domains were created by the study team: expectations, utility, and knowledge. The remaining four domains were adapted based on the TPB model to measure intention to

pursue PGx testing (Ajzen, n.d.). Participants also reported demographics, medication history, and perception of the financial impact of pursuing PGx testing.

Those in the education group (n=198) answered Likert-scored questions about the video's impact on their 1) knowledge and 2) expectations for PGx testing, 3) their interest in PGx testing, and 4) feelings about the content and length. They could respond to optional open-ended questions about their opinions of the video. The survey is included in Appendix A. Data were collected and managed using REDCap electronic data capture tools hosted at the University of Michigan (Harris et al., 2009; Harris et al., 2019). The video and survey were piloted by representatives of stakeholders in PGx testing: three genetic counseling students, two pharmacists, and four patients with depression. Minor changes were made after piloting (e.g., adjusting video images and expanding the explanation of medication metabolism).

Analysis

A power analysis was conducted using G*Power version 3.1.9.7 (Faul et al., 2007) to determine the sample size needed to assess group differences. The sample size needed to detect a medium effect, at a significance criterion of $\alpha = .05$, was $N = 210$ for a t-test. Thus, the final sample size ($N = 387$) was sufficient to assess group differences.

Domain and survey question performance were assessed prior to analyzing group differences. Analyses were conducted using SPSS 26. Survey domain means were compared between the survey-only and education groups, and then the sample was divided into groups based on each participants' numbers of previous medication trials, (>1 and ≤1), using independent samples t-tests to assess how well survey responses in each domain predicted intention to test. Intention to test was simultaneously regressed on each domain mean.

For domains that differed between groups, post-hoc analyses were conducted to determine which items in the domain accounted for the differences. To assess the impact of the variables on intention to test and model relationships between variables, we conducted a path analysis.

Results

Participant Demographics

A total of 1,090 individuals accessed the study via MTurk, and 566 individuals were excluded because they did not report having depression or had previously completed PGx testing. . In total, 387 participants (60.9% female) met eligibility criteria, consented to participate, and completed study procedures. The sample included education (n=198) and survey-only (n=189) groups. Sex, gender identity, race, ethnicity, and educational attainment did not significantly differ between groups. The sample was primarily white (80.3%, n=310) and largely non-Hispanic or Latinx (87.8%, n=339). Educational attainment was high: nearly 90% of the sample reported some college education or a higher degree. Over 50% of participants were under 40 (n=240), but participants' ages ranged from 18-70 years old in both survey-only (M = 34.87, SD = 11.52) and education (M = 37.61, SD = 10.88) groups (Supp. Table 1).

Impact of Intervention

A psychometric assessment of knowledge questions revealed that most participants correctly chose the definition of *gene*. Thus, this question was removed from the analysis, and participants were scored out of two. There was a significant difference in score for the education (M = 1.61, SD = 0.62) and survey-only (M = 1.16, SD = 0.74), ($t(384)=6.44$, $p < 0.0001$) groups, demonstrating that the intervention effectively improved knowledge (Supp. Fig. 1).

Participants reported positive opinions of the video and endorsed a positive impact on their knowledge and expectations. Most participants (83.7%, *n*=165) endorsed that they *agree* or *strongly agree* that the video impacted their knowledge of PGx testing and 71% of participants (*n*=140) endorsed *agree* or *strongly agree* that the video impacted their expectations of testing. Further, 75% of participants (*n*=148) were more interested in testing after viewing the video. When asked about video format, 91.9% (*n*=180) felt that the amount of information was appropriate, and 74.1% (*n*=146) felt that the length was appropriate. Some participants (22.8%, *n*=45) felt the video was long.

The groups were compared across domains (expectations, utility, attitudes, perceived control, social norms, and knowledge) to evaluate their impact on intention to have PGx testing. Attitude scores were significantly different between groups, such that the education group had more positive attitudes toward testing ($M = 3.75$, $SD = 0.83$) compared to the survey-only group ($M = 3.53$, $SD = 0.88$), ($t(384) = 2.60$, $p < 0.01$). Perceived control scores were also significantly different, as the education group felt that they had greater control over having testing ($M = 3.79$, $SD = 0.80$) than the survey-only group ($M = 3.59$, $SD = 0.72$), ($t(384) = 2.62$, $p < 0.01$). There were no significant differences in expectations, utility, social norms, or intention between groups (Fig. 1a). Due to low reliability of a question in the social norms domain, this domain was assessed using two questions only (see supplementary information, social norm questions 1-2). Perceived control was divided into two constructs, ease and efficacy. The ease variable drove the group difference (Fig. 1b), which was not the case in other domains. Further, ease was positively associated with intention, whereas efficacy was negatively associated with intention in path analyses (Supp. Fig. 2). There was no difference in expected

financial impact of testing in the survey-only (M = 3.48 SD = 1.09) and education (M = 3.39, SD = 1.18) groups. Means, standard deviations, reliabilities, and correlations between domains assessed in the survey in both groups are provided (Table 1a, 1b).

History of Medication Trials

A greater proportion of male participants reported ≤1 medication trial (n=152, 48.0% male versus 51.9% female participants), compared to >1 trial (n=231, 29.8% male versus 70.1% female participants), ($t(381) = -2.79, p < 0.01$). Further, of the 226 participants currently taking medication to manage their depression, 54 (23.8%) participants were in the ≤1 trial group and 172 (76.1%) participants were in the >1 medication trial group. In both groups, most individuals endorsed a moderate to high level of medication effectiveness (≥3 on a 5-point scale) and there was no significant difference in effectiveness between those with ≤1 medication trial (M=3.42, SD=0.91) and those with >1 trial (M=3.43, SD=.79), ($t(246) = -0.37, p = 0.35$). Groups did not differ in any survey domain based on medication effectiveness (Supp. Table 2).

History of medication trials significantly affected test perception. Those with >1 medication trial had higher expectations (M = 3.66, SD = 0.75) than those with ≤1 trials (M = 3.50, SD = 0.78), ($t(382) = -2.03, p < 0.05$), greater perceived utility of PGx testing, ($M_{>1}$ = 3.80, SD = 0.82; $M_{\leq 1}$ = 3.58, SD = 0.91), ($t(381) = -2.41, p < 0.05$), and more positive attitudes, ($M_{>1}$ = 3.74, SD = 0.79; $M_{\leq 1}$ = 3.50, SD = 0.94), ($t(382) = -2.72, p < 0.01$). However, those with >1 medication trial had lower intention to test (M = 2.08, SD = 0.86) than those with ≤1 trials, (M = 2.45, SD = 1.11), ($t(381) = 3.69, p < 0.0001$) (Fig. 2a). When analyzing the survey-only group, participants with a history of ≤1 trial (n=77) reported significantly higher intention to pursue PGx testing compared to those with >1 trial (n=111) (Fig. 2b). Conversely, in the education group, participants with a history of >1 trial (n=115) had greater perception of

utility of testing and more positive attitudes toward testing, compared to those with ≤1 trials (n=80) (Fig. 2c). The number of individuals currently taking medication did not differ, (t(382)=0.42, p = 0.33) between survey-only (n=108) and education (n=118) groups, nor did the number of previous trials, (t(382)=0.02, p = 0.48) between survey-only (n=111) and education (n=116) groups.

Predictors of Intention to Pursue PGx Testing

When intention to test was simultaneously regressed on expectations, utility, attitude, social norms, ease, efficacy, and knowledge score, all significantly predicted intention to test, except utility, (B = -0.02), (t(375) = -0.28, p = 0.78). The model explained significant variation in intention when including all variables, R^2=0.43, (F(7, 375) = 41.46, p < 0.001). The strongest predictors were knowledge (B = -0.41), (t(375) = -7.51, p < 0.001), social norms (B=0.21), (t(375) = 4.12, p < 0.001), and ease of testing (B=0.25), (t(375) = 6.45, p < 0.001). To assess the impact of the best predictor variables on intention and model relationships between variables, we conducted a path analysis (Fig. 3a). Social norms (β = 0.31, p < 0.0001) and ease of testing (β = 0.33, p < 0.0001) were positively associated with test intention, whereas knowledge (β = -0.29, p < 0.0001) and efficacy (β = -0.16, p < 0.0001) were negatively associated with intention. Knowledge explained more variance in intention to test than efficacy, so the final model included knowledge, social norms, and ease of testing. Knowledge (β = -0.32, p < 0.0001) had a direct negative relationship to intention, whereas social norms (β = 0.30, p < 0.0001) and ease of testing (β = 0.31, p < 0.0001) had direct positive relationships to intention (Fig. 3a). The education and survey-only groups showed the same pattern (Fig. 3b, 3c).

Discussion

With the increasing use of PGx testing in clinical care, it is important to ensure that patients are appropriately educated and have reasonable expectations about benefits and limitations of PGx testing. This study aimed to assess the perspectives of patients with depression on PGx testing for depression management and study the impact of an educational intervention for this population. Therefore, this study posed opportunities to learn about this population and identify parameters that can be useful to genetic counselors working in PGx.

Little research has been conducted to assess knowledge about PGx testing or factors that predict test intention in those with depression, though previous research on patients' experiences with PGx testing shows that patients often lack understanding of test results (Haga & Liu, 2019; Haga et al., 2015). Consistent with that research, our data showed a significant difference in understanding of key aspects of PGx testing when comparing the survey-only and education groups. Further, we found that even a brief intervention improved patient understanding. Our findings serve as a foundation for designing efficient pre-test counseling interventions for patients receiving PGx testing to guide antidepressant selection.

Past studies have also reported that patient-directed materials on PGx testing tend to emphasize the benefits of testing and fail to delineate limitations. For example, patient videos from the Mayo Clinic about PGx testing describe significant benefit (i.e., avoid adverse drug reactions) but do not describe limitations or risks (Mayo Clinic, 2017a; 2017b). Further, researchers found that media reporting about PGx testing for multiple medication categories emphasized benefits 5.3 times more than risks (Almomani et al., 2015). Our participants had largely positive attitudes about PGx testing, but the intervention still significantly affected attitudes, perceived

control, and testing beliefs. Specifically, patients in the education group had more positive attitudes, perceived testing to be easier, and endorsed stronger beliefs that testing would lead to improvement in depression compared to those who did not view the video.

Interestingly, providing education also negatively affected test intention—those who received the intervention had lower levels of intention to pursue PGx testing compared to the survey-only group. Groups did not differ in the proportion of patients taking an antidepressant or in the number of past medication trials, so these variables do not provide an explanation for the difference in intention. Though participants endorsed positive attitudes toward testing and beliefs that testing would lead to improved depression management, intention to test was predicted best by practical considerations. Participants were more motivated to pursue PGx testing if it felt easy to obtain and felt like something that others would do in the same situation.

We also found evidence that personal treatment history influences perception of PGx testing. When comparing those with a history of ≤1 medication trial and those with >1 trial, consistent with previous reports, more participants had a history of >1 trial (Barak et al., 2011) and 75% of those with >1 trial were women (Brody et al., 2018). Those with a history of >1 trial had higher expectations, perceived greater utility, and had more positive attitudes than those with ≤1 trials. However, those with ≤1 trials had a significantly greater intention to pursue the novel treatment strategy of PGx testing. As this group has fewer experiences of medication failure, they may be more hopeful that subsequent trials will result in positive outcomes. Additionally, most participants reported a moderate to high level of medication effectiveness. In clinical management of depression, providers typically do not recommend that patients who are responding well to medication make changes unless they are experiencing side effects. Therefore, it is unlikely that

providers would recommend that patients pursue PGx testing if they are tolerating and responding well to their current antidepressant medication.

To understand this finding, we conducted the same analyses within survey-only and education groups and found that the effect was driven by the survey-only group. This suggests that education may temper testing expectations, particularly in those with a history of fewer trials. Thus, patients encounter a discussion about PGx testing differently based on treatment history— patients with a less extensive history of medication trials may benefit more than those with an extensive history from discussion of test limitations, in order to set realistic expectations.

Study Strengths and Limitations

This study assessed a large pool of participants and utilized a controlled study design, allowing us to compare groups based on whether they received education. The intervention successfully increased knowledge scores and affected patient perception of testing. The data allow us to better understand baseline perceptions of PGx testing in patients with depression. Finally, feedback collected from participants will allow us to further tailor the video and survey for this population.

There are also study limitations to address in future research. First, the study population, which was young, highly educated, and responding well to current antidepressants, may not reflect the population of patients who consider this testing. Therefore, we are limited in our ability to extrapolate the findings to the general population. Further, though we measured test intention, we do not know whether participants later had PGx testing or if it affected their care. We relied on self-report for depression and treatment history and

used few questions to gauge understanding. Finally, we did not assess some factors that affect treatment effectiveness, such as access to healthcare services and medication adherence (Sirey et al., 2018; Winner et al., 2015).

Future Directions

Future studies should survey patients who have completed PGx testing to gather information about their perception of PGx testing as part of depression management, their understanding of PGx testing, and their outcomes. The video and survey could be used in clinics ordering PGx testing to incorporate efficient pre-test counseling and assess the impact of the intervention in a clinical setting. Ideally, this study would use a pre- and post-test study design to assess how patient perceptions change over the course of PGx testing and any treatment changes.

Practice Implications

While genetic counselors are required to have knowledge of PGx (ACGC, 2019), the current PGx testing delivery model generally does not include pre-test genetic counseling. Studies have reported genetic counselors feel that they should have a role in PGx testing; however, patients who undergo PGx testing should not be seen initially by a genetic counselor, due to limited resources (Callard et al., 2012), and expanded training and collaboration with pharmacists is needed to best serve these patients (Loudon et al., 2021). As testing demand grows, genetic counselors may best utilize their unique training by developing balanced resources and counseling strategies for patients having PGx testing.

Utilizing a pre-test counseling video is an efficient, effective way to provide information about genetic testing to patients in many clinical settings (Hernan et al., 2020; Watson et al., 2016). Individuals with depression had positive feedback about the video,

suggesting that this population would be amenable to receiving information by video. A video intervention can allow patients to learn basic information before the visit, allowing more time at the visit for discussion. Our results provide a foundation for future interventions that should be designed to provide balanced and clear information about PGx testing and possible outcomes.

Further, this study found that education had the greatest impact on patients' perceptions of testing in those who had a limited treatment history compared to those with a significant treatment history. The intervention improved understanding of PGx benefits and limitations, and therefore, serves as a valuable tool for those with fewer antidepressant trials.

Conclusions

The current delivery model of PGx testing does not often include genetic counselors in pre-test counseling. There is an opportunity in this space to leverage our skills to ensure that patients receive effective and appropriate pre-test education. This study has been a first step to explore education for patients with depression receiving PGx testing and lays a strong foundation from which we can build.

Author Contributions

N.S., B.Y., and K.W. developed the study idea and design. N.S. created the video images and storyboard. All authors reviewed and recommended edits. N.S. built and administered the survey and conducted statistical analyses. All authors discussed the results and contributed to the final manuscript. N.S. had full access to all the data in the study and takes responsibility for the data integrity and the accuracy of the analysis. All authors gave final approval of this version to be published and agree to be accountable for all aspects

of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Acknowledgements

This work was conducted by the first author to fulfill a genetic counseling master's degree requirement. The authors thank their funding sources: the NSGC Health Information Technology SIG, the Rackham Graduate School Student Research Fellowship, and the University of Michigan Genetic Counseling Program. Special thanks to the University of Michigan HIT eLearning Team, especially Aki Yao for recording and editing the video, the Michigan Medicine Office of Patient Experience, the Center for Statistical Consulting and Research, the Michigan Medicine Depression Center, and Meagan Dean, University of Michigan PharmD student, for contributing to the video content and design planning.

Compliance with Ethical Standards

Authors N.S., K.W., V.E., and B.Y. declare that they have no conflicts of interest.

Human Studies and Informed Consent

Approval to conduct this human subjects research was obtained from the Michigan Medicine Institutional Review Board (IRB#: HUM00167705). All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all study participants.

Animal Studies

No non-human animal studies were performed by the authors for this paper.

Data Availability Statement

The study data are available from the corresponding author upon reasonable request.

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Table 1a. Means, standard deviations, reliabilities, and correlations between variables in the survey only group.

Variable	***M***	***SD***	**Correlations**							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1. Expectations	3.63	0.75	(0.80)							
2. Perceived Utility	3.68	0.85	0.75*	(0.80)						
3. Knowledge	1.16	0.74	-0.05	-0.07	(0.25)					
4. Attitude	3.53	0.88	0.60*	0.66*	-0.10	(0.80)				
5. Perceived Social Norms	3.37	0.93	0.49*	0.57*	-0.10	0.55*	(0.82)			
6. Perceived Ease	2.96	1.09	0.25*	0.36*	-0.15	0.45*	0.31*	(—)		
7. Perceived Efficacy	4.23	0.88	0.12	0.08	0.10	0.00	0.03	0.05	(—)	
8. Intention to Test	2.26	1.03	0.32*	0.40*	-0.32*	0.46*	0.44*	0.47*	-0.15	(0.63)

Note. $N = 189$. $^{*}p < 0.001$, $^{+}p < 0.01$. Values on the diagonal represent Cronbach's alpha.

Table 1b. Means, standard deviations, reliabilities, and correlations between variables in the education group.

Variable	*M*	*SD*	Correlations							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1. Expectations	3.57	0.78	(0.75)							
2. Perceived Utility	3.74	0.88	0.67*	(0.77)						
3. Knowledge	1.61	0.62	-0.12	-0.02	(0.40)					
4. Attitude	3.75	0.83	0.51*	0.65*	0.10	(0.78)				
5. Perceived Social Norms	3.39	1.02	0.61*	0.55*	-0.04	0.55*	(0.86)			
6. Perceived Ease	3.27	1.14	0.29*	0.28*	-0.03	0.43*	0.36*	(—)		
7. Perceived Efficacy	4.32	0.94	0.02	0.05	0.24+	0.16	0.08	0.18	(—)	
8. Intention to Test	2.22	0.95	0.43*	0.31*	-0.43*	0.33*	0.43*	0.40*	-0.16	(0.59)

Note. $N = 198$. $^{*}p < 0.001$, $^{+}p < 0.01$. Values on the diagonal represent Cronbach's alpha.

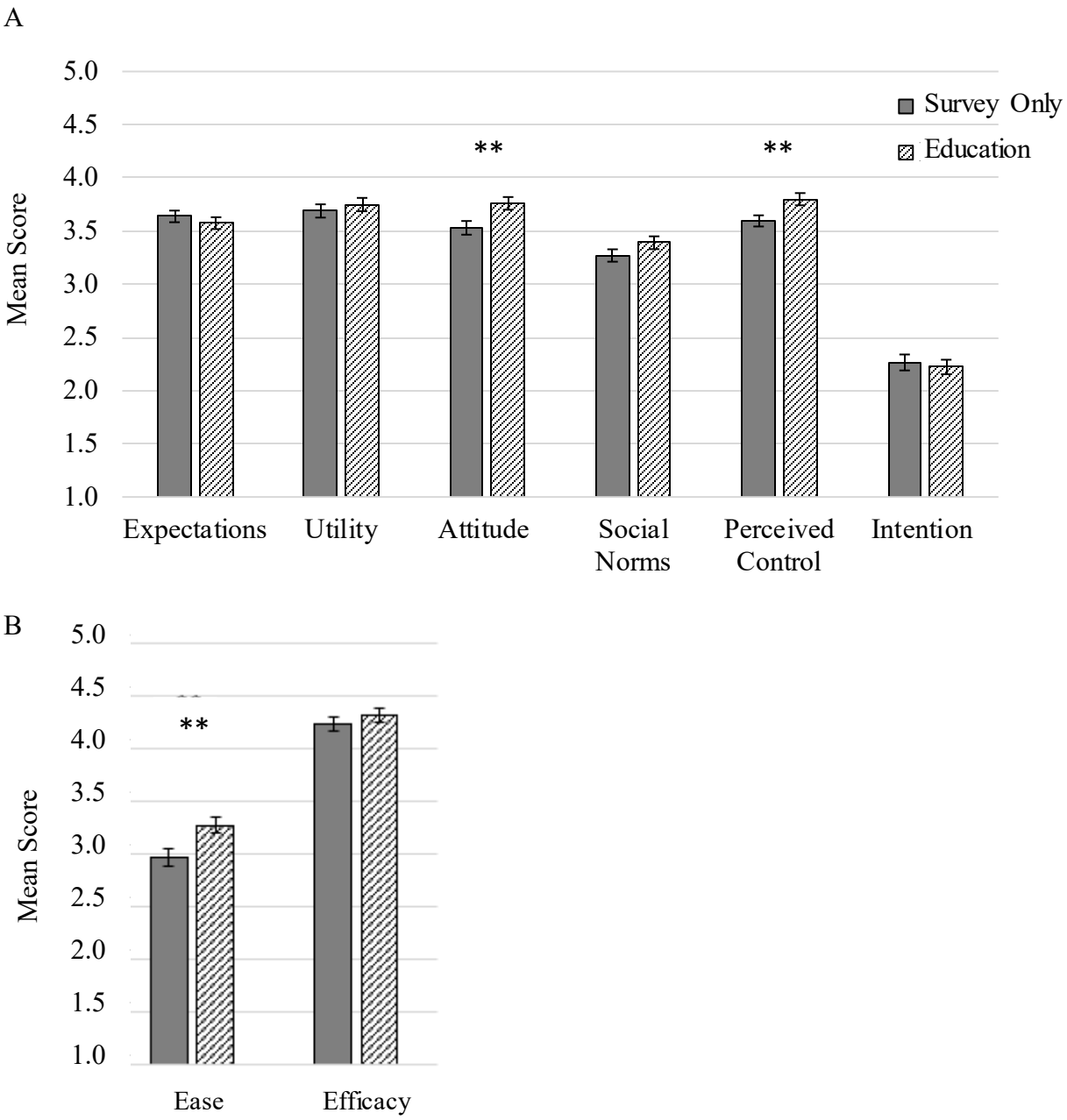

Fig. 1. A) Impact of education on survey domains, comparing the survey only and education groups using independent samples t-tests, and B) Perceived behavioral control domain divided into ease and efficacy variables. $^{**}p < 0.001$.

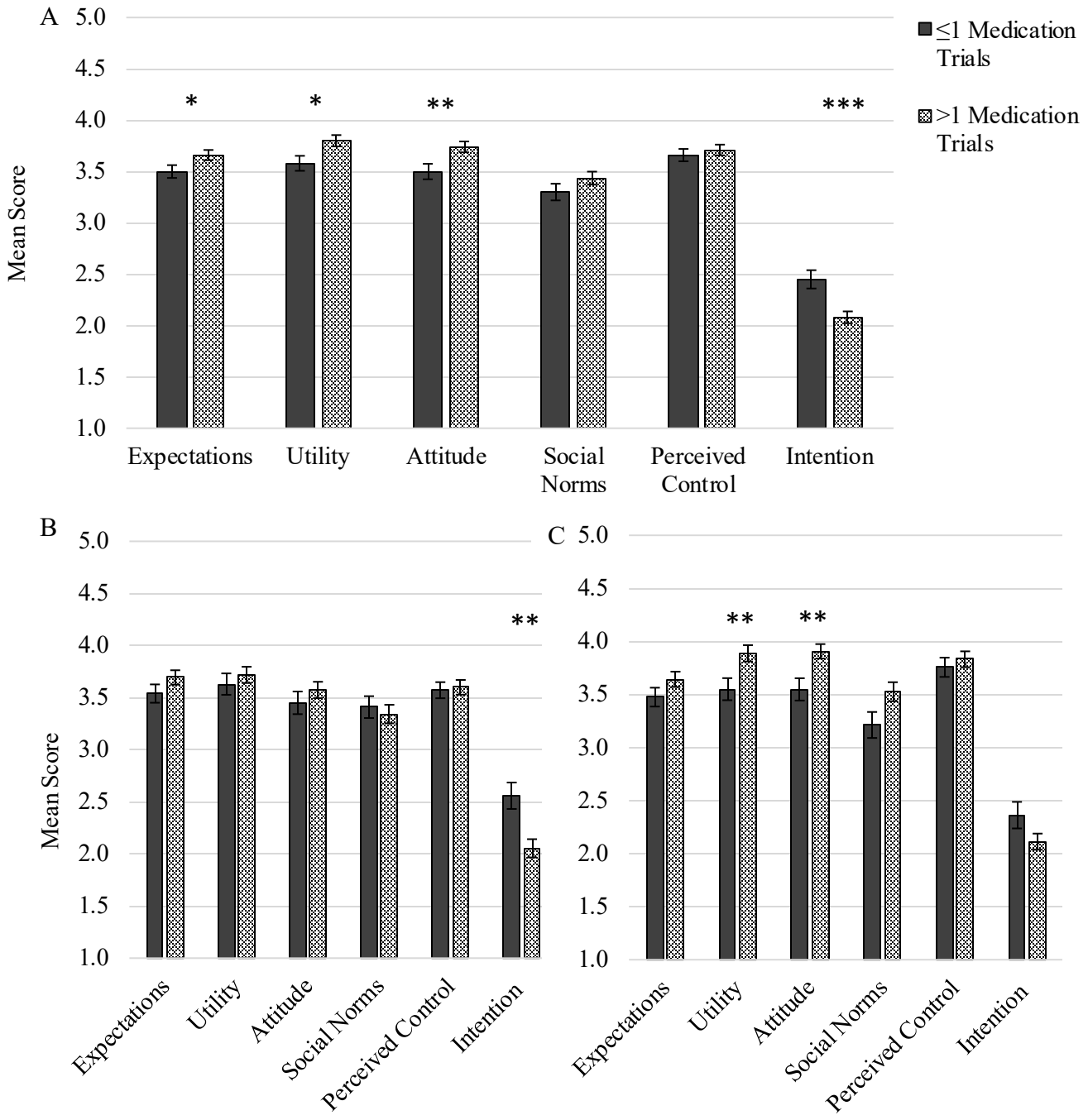

Fig. 2. The impact of history of medication trials on perception of testing in the A) full sample, B) survey only group, and C) education group.
*$p < 0.01$, **$p < 0.001$, ***$p < 0.0001$.

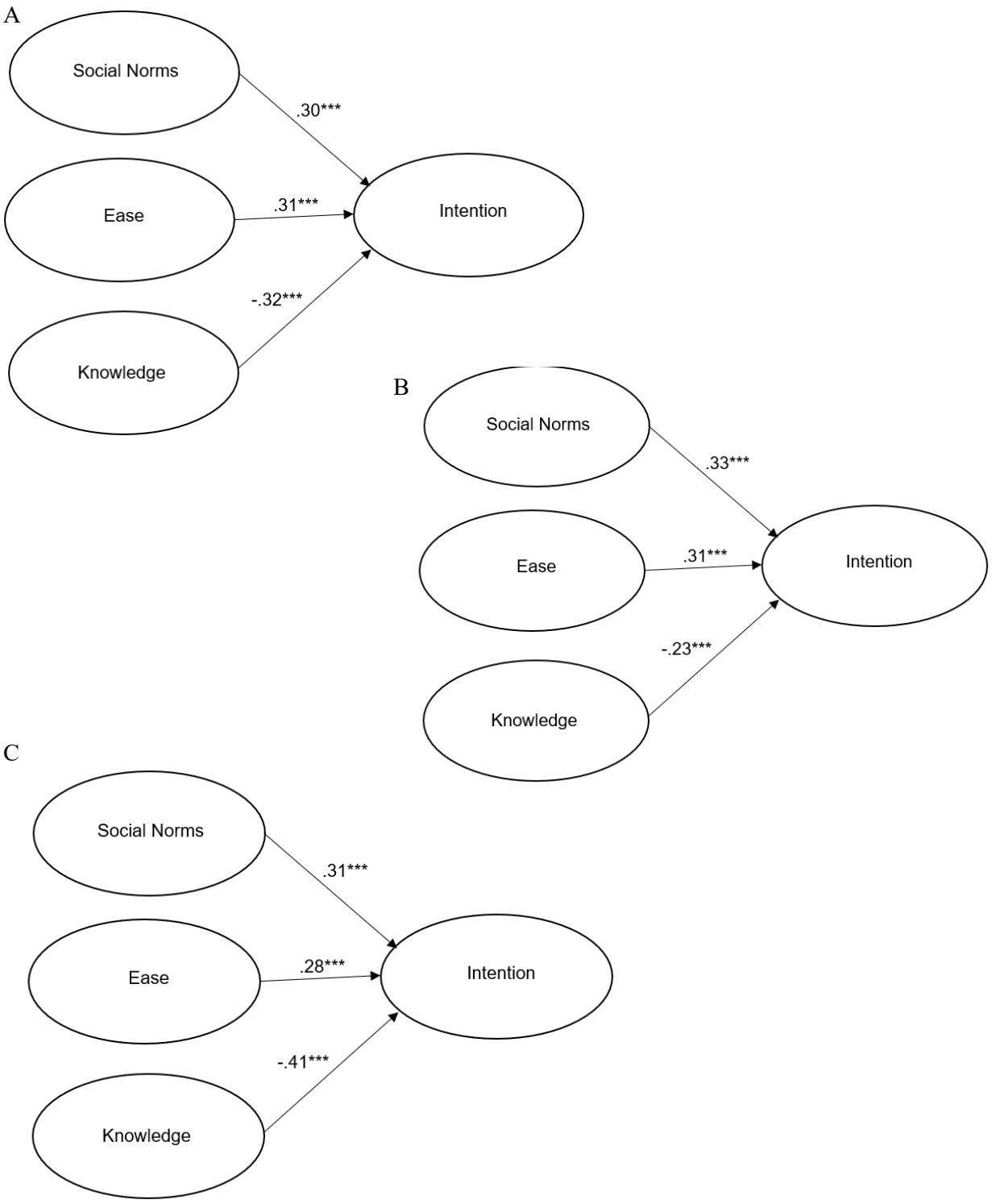

Fig 3. Path analysis assessing relationship between variables associated with intention to test. A) Path analysis of full sample, B) survey only group, and C) education group.
*$p < 0.01$, **$p < 0.001$, ***$p < 0.0001$.