Published in final edited form as:

Med Decis Making. 2015 January ; 35(1): 6–11. doi:10.1177/0272989X14532531.

Subjective Numeracy and Preference to Stay with the Status Quo

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Abstract

Background—Preference for the status quo, or clinical inertia, is a barrier towards implementing treat-to-target protocols in patients with chronic diseases such as rheumatoid arthritis (RA). The objectives of this study were to examine the influence of subjective numeracy on RA-patient preference for the status quo and to determine whether age modifies this relationship.

Methods—RA patients participated in a single face-to-face interview. Numeracy was measured using the Subjective Numeracy Scale. Treatment preference was measured using Adaptive Conjoint Analysis.

Results—Of 205 eligible subjects, 156 agreed to participate. Higher subjective numeracy was associated with lower preference for the status quo in a regression model including race, employment, and biologic use [Adjusted OR (95% CI)= 0.71 (0.52–0.95), $p=0.02$]. Higher subjective numeracy was protective against status quo preferences among subjects less than 65 years of age [Adjusted OR (95% CI)= 0.64 (0.43–0.94), $p=0.02$], but not among older subjects.

Conclusions—In summary, subjective numeracy is independently associated with younger, but not older, RA patients' preferences for the status quo. Our results add to the literature demonstrating age and numeracy differences in treatment preferences and medical-decision-making processes.

Keywords

Decision making; aging; numeracy; status quo bias

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The authors do not have any financial interests that would be considered a conflict of interest. Each of the co-authors listed has had a substantial role in the creation of this manuscript and the work reported herein.

Data will be made to others under a data-sharing agreement that includes: (1) a commitment to using the data for research purposes only; (2) a commitment to protecting the data by using appropriately secure computer technology; and (3) a commitment to destroying or returning the data after analyses are completed. Data sharing will occur after all outlined analyses, presentation, and publication of the findings of the proposed study have been completed.

When faced with a choice between changing treatment versus maintaining current treatment, patients frequently prefer the latter even when change is associated with a more favorable risk-benefit ratio (1–3). This observation, frequently referred to as clinical inertia or preference for the status quo, may be an important barrier towards implementing treat-to-target protocols which have been shown to improve outcomes in chronic disease such as diabetes (4–6), hypertension (7, 8) and rheumatoid arthritis (RA) (9–11). Although the specifics of treat-to-target protocols vary, they all include frequent monitoring with subsequent treatment adjustments to minimize disease activity or severity. In order to improve the quality of care delivered to patients, it is important to understand the factors underlying reluctance to change treatment.

The decision to stay with the status quo versus opt for a new treatment is ideally based on a critical evaluation of the probabilities of both positive and negative outcomes associated with each option. Several seminal papers have highlighted relatively low levels of numeracy in the adult population and the resulting difficulty patients have in understanding, processing and applying the numerical information required to make informed decisions (12–15). Moreover, while treatment decisions are made more often by older adults than any other age group because of the various illnesses brought on by the aging process, information processing changes with age such that, compared to younger adults, older adults are less numerate (16). This innumeracy may be an impediment to making unbiased treatment decisions.

In this study, we sought to examine the influence of subjective numeracy on RA-patient preferences for the status quo, i.e. choosing to remain with active disease on their current treatment versus adopting a new treatment associated with a potentially better risk-benefit profile. We also examined whether age modifies these relationships.

Methods

Subjects

RA patients, currently under the care of one of four community-based rheumatology practices, were sent a letter describing the study. The letter notified potential participants that they would be telephoned by a research assistant and offered the opportunity to refuse this contact by calling an answering machine and leaving a message. During the telephone call, the research assistant confirmed the following inclusion criteria: at least 18 years of age, saw their rheumatologist at least two times in the past 12 months, pain of at least “3” on an 11-point numeric rating scale, and currently on at least one disease-modifying drug. These criteria were included so as to ensure that subjects had access to a rheumatologist and were eligible to change treatment. Patients reporting a contraindication to biologics were excluded. Participants were given \$25.00. The study protocol was approved by the Yale University Human Research Protection Program.

Measures

All data were collected using self-report during a single face-to-face interview. Numeracy was measured using the 8-item Subjective Numeracy Scale (17). Item responses were

averaged, and this average subjective numeracy score (average scores ranged from 1 to 6) was used for all analyses. Treatment preference was measured using an Adaptive Conjoint Analysis (ACA) survey (Sawtooth Software, Inc., Sequim, WA). The ACA survey for this study was developed to measure patient preferences for a biologic associated with improved expected benefits as well as an increased risk of toxicity versus remaining with the status quo, i.e. no improvement in current joint symptoms, function or ability to work, no effect on disease progression, and no increase in the risk of toxicity (a description of the treatment characteristics is included in the Appendix). All characteristics were described using lay terminology. Three rheumatologists, five patients with RA, and two researchers in medical decision making, reviewed the attribute descriptions to confirm that the characteristics included were easy to understand and represented the most salient medication characteristics relevant to the decision to escalate care in RA. The ranges of probabilities of benefits and common adverse effects included in the survey were based on randomized controlled data (18). Rare adverse events were obtained from observational data (19–21). We used qualitative and quantitative frequency formats to describe the likelihood of adverse effects and illustrated this information using pictographs.

Patient-reported disease activity was measured using the RAPID-4, which includes four components of the Multi-Dimensional Health Assessment Questionnaire: physical functional assessment, arthritis-related-pain numeric rating scale, patient global assessment, and a self-reported joint count (22–24).

Analysis

Data analyses were conducted in SAS (version 9.1, SAS Institute, Inc., Cary, North Carolina). Preference data derived from ACA (SMRT version 4.21, Sawtooth Software, Inc., Sequim, WA) were imported into SAS and merged with the patient characteristics data set. In ACA, regression models are constructed for each individual based on individual respondents' ratings to the survey questions. Utilities are calculated using a least squares updating algorithm. The final utility estimates reflect true least squares. We calculated the relative importance that respondents assigned to each attribute by dividing the range of utilities for each attribute by the sum of the ranges and multiplying by 100.

Market simulators are used to convert the raw utilities into preferences for specific options (25, 26). In this study, treatment preferences for the status quo [defined by the following levels: unchanged joint pain and swelling, functional limitations, rate of disease progression, and ability continue working, and no increased risk of adverse reactions] versus a biologic [defined by the following levels: 40% improved pain and function, 30% have no further erosions, 60% able to continue working, 20% risk on injection reaction, risk of tuberculosis (TB)= 5 in 10,000, extremely rare risk of neurologic disease] were generated using the first choice model, which assumes that the respondent chooses the product with the highest predicted utility.

The associations between subjects' characteristics and preference for the status quo were tested in bivariate analyses using t, Mann Whitney or chi-square tests as appropriate. We examined the correlation between subjective numeracy and the relative importances of each attribute. We then examined the association between subjective numeracy and preference for

the status quo in a logistic regression model controlling for the covariates found to be significantly associated with status quo preference ($p < 0.05$). Race, education and income were highly correlated; of these, race was included as a covariate in adjusted analyses because it was the variable most strongly associated with preference for the status quo. Age in years was entered into analyses as a continuous variable. Given the main effect of subjective numeracy on preferences for the status quo and the relation of older age to lower numeracy, we subsequently examined whether there was an interaction between subjective numeracy with age (both mean-centered) on preference for the status quo in a logistic regression model adjusting for the same covariates.

Results

Of 205 eligible subjects, 156 agreed to participate. The majority were female, White, and had at least some college education. Additional subject characteristics are presented in Table 1. Thirty-nine percent ($n = 62$) preferred the status quo alternative. Subjective numeracy was lower among subjects preferring the status quo compared to those preferring to change treatment [mean (SD) = 3.8 (1.4) versus 4.5 (1.1), $p < 0.001$]. Subjects with higher subjective numeracy assigned more importance to slowing joint damage and less importance to risks (infection, TB and neurologic disease) compared to those with lower subjective numeracy (Table 2). The associations between subjective numeracy and preference for the status quo remained significant in a regression model including covariates found to be significantly associated with the dependent variable in bivariate analyses (Table 3).

Age modified the effect of subjective numeracy on preference for the status quo ($p = 0.04$ for interaction after adjustment for age, subjective numeracy and covariates) (Table 4). Among subjects less than 65 years of age ($n = 114$), mean subjective numeracy was lower among those preferring the status quo compared to those preferring a treatment change [mean (SD) = 3.7 (1.3) versus 4.7 (1.1), $p < 0.001$]. The association between subjective numeracy and preference for the status quo among younger subjects remained significant after controlling for employment, race and biologic use [Adjusted odds ratio (95% CI) = 0.64 (0.43–0.94), $p = 0.02$]. In contrast, among older adults ($n = 42$), we found no difference in mean subjective numeracy among subjects preferring the status quo versus treatment change [mean (SD) = 3.9 (1.6) versus 4.0 (0.9), $p = 0.8$]. To facilitate interpretation of the interaction, the predicted probabilities (generated from the full model depicted in Table 4) of subjects preferring the status quo by level of subjective numeracy and age group are illustrated in Figure 1. These predicted probabilities were calculated based on ages that were 1 standard deviation above and below the mean (ages = 45.9 and 71.7 years, respectively) and subjective numeracy scores that were also ± 1 standard deviation from the mean (scores = 3.0 and 5.5, respectively, on the 1 to 6 scale). Younger, more numerate adults were the most likely to prefer a treatment change compared to less numerate younger adults and older adults, who regardless of subjective numeracy, were more likely to prefer the status quo.

Discussion

Preference to maintain the status quo (or clinical inertia) has important clinical consequences in RA because reluctance to change treatment likely increases the risk of morbidity and long-term disability (27, 28). The results of this study suggest that preference for the status quo is stronger among younger subjects who have lower subjective numeracy and among older subjects regardless of subjective numeracy. Previous studies have demonstrated that less numerate individuals tend to perceive more risk, opt out of having risky procedures more frequently, and choose less risky options compared to the more numerate (16, 29, 30). The data demonstrating that highly numerate subjects rated the risks of treatment as lower than those lower in numeracy is consistent with this literature. However, to the best of our knowledge, this is the first study to examine the relation between numeracy and status-quo preferences and specifically to examine preference for a new treatment (with additional benefits and added risk of side effects) over remaining with the status quo (i.e. no additional benefit and no added risk of side effects) after controlling for relevant covariates. Since status-quo choices may be due to loss aversion (i.e., the downsides of losing what you currently have loom larger than the potential benefits of what you could gain), the present results are consistent with recent findings demonstrating that persons scoring lower on a related measure of numeric competence show greater risk aversion (31). We also found that the impact of subjective numeracy on preference for the status quo was modified by age. Specifically, a protective effect of subjective numeracy on preference for the status quo was observed in younger but not older adults. This may be due to changing motivations and abilities as individuals age that result in age-related increases in the preference to avoid making decisions and, thus, to choose status quo options (32).

Increased risk aversion has been noted among minorities (33–35), and race was therefore included as a covariate in this study. The impact of race on preference for the status quo was not attenuated by other sociodemographic characteristics examined in this study. This finding highlights the need for further research to understand the mechanisms by which race influences treatment preference.

Strengths of this study include examination of preferences using an approach that requires patients to make explicit trade-offs between competing risks and benefits and is therefore not biased by familiarity or personal experience with specific medications. However, our study has limited generalizability due to the single patient population studied. Our study population included a relatively small number of older adults; nevertheless, mean subjective numeracy was almost exactly the same among older adults preferring the status quo versus a treatment change, suggesting that the negative finding was not due to a lack of power. In addition, although subjective and objective numeracy are correlated, we cannot comment on the potential relationship between objective numeracy skills and preference for the status quo.

In summary, our results suggest that subjective numeracy is associated with younger, but not older, RA patients' preference for the status quo. Our results add to the literature highlighting differences in decision-making processes by numeracy and by age.

Acknowledgments

Dr. Fraenkel had full access to all the data and takes full responsibility for the integrity of the data and the accuracy of the analysis. This clinical research study was made possible by a grant from the Arthritis Foundation. Research reported in this publication was supported by the National Institute of Arthritis and Musculoskeletal and Skin Diseases, part of the National Institutes of Health, under Award Number AR060231-01 (Fraenkel). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. Dr. Peters is supported by Grant support National Science Foundation Grants SES-1047757 and 1155924.

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Appendix. Treatment characteristics included in the ACA survey

Decreased joint pain and swelling	70 in 100 people feel much better, but occasionally have some joint pain and swelling 40 in 100 people feel much better, but occasionally have some joint pain and swelling People continue to have the same joint pain and swelling
Ability to get around and participate in social or	70 in 100 people can get around much easier and participate in social and leisure activities outside of the house

leisure activities outside of the house	40 in 100 people can get around much easier and participate in social and leisure activities outside of the house People continue to have the same problems getting around and participating in social and leisure activities outside of the houses
Slowing or stopping joint damage seen on x-rays	80 in 100 people have no further bone damage seen on x-rays 30 in 100 people have no further bone damage seen on x-rays Bone damage seen on x-rays continues to progress at same rate
Ability to work	80 in 100 people are able to keep working 60 in 100 people are able to continue working People continue to have the same problems being able to work
Risk of injection/infusion reaction	No risk of an injection reaction 3 in 100 people get an infusion reaction (headache, nausea, fever) 20 in 100 people get a rash or burning at the injection site
Risk of infection	No increased risk of infection 20 in 100 people get bronchitis or sinusitis 3 in 100 people get a serious infection (like pneumonia) requiring hospitalization
Risk of TB	No increased risk of TB Very rare risk of TB (1 in 10,000 people) Very rare risk of TB (5 in 10,000 people)
Risk of neurologic disease	No increased risk of neurologic disease Extremely rare risk (a few reported cases) of a neurologic disease like MS Extremely rare risk (a few reported cases) of a neurologic disease that usually causes death

Figure 1.
Association of subjective numeracy and predicted preference for the status quo by age group

Table 1

Subject characteristics and their relation to preferences for status quo vs treatment

Variable	Total	Prefer Status Quo	Prefer New Treatment	P value
Number (%)	156	62 (39.7)	94 (60.3)	
Mean subjective numeracy (SD)	4.2 (1.3)	3.8 (1.4)	4.5 (1.1)	< 0.001
Mean age (SD)	58.8 (12.9)	61.0 (13.5)	57.3 (12.4)	0.1
Female (%)	133 (85.3)	54 (87.1)	79 (84.0)	0.6
Hispanic (%)	12 (7.7)	4 (0.1)	8 (8.5)	0.7
Black (%) *	27 (17.3)	19 (30.7)	8 (8.5)	< 0.001
Married (%)	96 (61.5)	33 (53.2)	63 (67.0)	0.08
College educated (%)	109 (69.9)	36 (58.1)	73 (77.7)	0.01
Employed (%)	74 (47.4)	22 (35.5)	52 (55.3)	0.015
Annual income <\$40K (%)	53 (34.4)	29 (47.5)	24 (25.8)	0.01
Current biologic (%)	75 (48.1)	23 (37.1)	52 (55.3)	0.03
Median duration of disease (IQR)	9 (15)	12.4 (1.5)	12.3 (1.3)	0.7
Median disease activity* (IQR)	14.8 (7.8)	3.6 (0.2)	3.4 (0.2)	0.5

IQR= Interquartile Range

* Possible range=0–40

Table 2

Correlation between subjective numeracy and the relative importance* of each attribute.

Treatment Characteristic	Correlation Coefficient (p value)
Decreased joint pain and swelling	0.15 (0.06)
Ability to get around and participate in social or leisure activities outside of the house	0.11 (0.17)
Slowing or stopping joint damage seen on x-rays	0.25 (0.002)
Ability to work	0.16 (0.05)
Risk of injection/infusion reaction	−0.13 (0.10)
Risk of infection	−0.19 (0.02)
Risk of TB	−0.17 (0.04)
Risk of neurologic disease	−0.25 (0.002)

* The relative importances are contingent on the range of levels included in the survey.

Table 3
Results of a logistic regression revealing the association of subjective numeracy with preference for the status quo

Variable	Estimate	Standard Error	Wald Chi-Square	P value	Adjusted Odds Ratio (95% CI)
Black vs non Black*	1.22	0.50	5.97	0.02	3.38 (1.27 – 8.99)
Currently on a biologic vs not	−0.60	0.36	2.74	0.09	0.55 (0.27 – 1.12)
Employed vs unemployed, retired or disabled	−0.80	0.37	4.69	0.03	0.45 (0.22 – 0.93)
Subjective numeracy	−0.35	0.15	5.26	0.02	0.71 (0.52 – 0.95)

* Non Black: 125 White subjects and 1 Asian subject

Table 4

Results of a logistic regression including the interaction between mean-centered age and mean-centered subjective numeracy on preference for the status quo

Variable	Estimate	Standard Error	Wald Chi-Square	P value	Odds Ratio (95% CI)
Mean-centered age	0.03	0.02	3.62	0.06	1.03 (1.00 – 1.07)
Mean-centered subjective numeracy	−0.36	0.16	5.38	0.02	0.70 (0.51 – 0.95)
Interaction between mean-centered age and mean-centered subjective numeracy	0.02	0.01	4.13	0.04	1.02 (1.00 – 1.05)
Black vs non Black [*]	1.32	0.52	6.39	0.01	3.73 (1.34 – 10.36)
Currently on a biologic vs not	−0.54	0.37	2.13	0.14	0.58 (0.28 – 1.20)
Employed vs unemployed, retired or disabled	−0.53	0.40	1.74	0.19	0.59 (0.27 – 1.30)

^{*} Non Black: 125 White subjects and 1 Asian subject