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Development of the Adherence Predictive Index (API) for Medication Taking

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Abstract
The objective for this study was to explore if characteristics of personality type using the Preferred Communication Style Questionnaire, in concert with the demographic characteristics of age, education, and race/ethnicity, are associated with, and help predict, individuals' medication adherence behavior.

Data were collected via an on-line survey, sent to a sample of adults residing in the United States, between April 28 and June 22, 2015. Out of 26,173 responses to the survey, 16,736 reported taking one or more medications and were eligible for inclusion in this study.

The development of the Adherence Predictive Index (API) used mean Morisky Medication Adherence Scale (MMAS-8) scores for each of eight personality types as a starting point. API scores were calculated by adding or subtracting specific values to each group's mean MMAS-8 score based on personality type, age, education and race/ethnicity characteristics which were demonstrated to have significant effects on adherence. The weighting system was informed by linear regression, logistic regression, personality type literature, researcher experience, and previous qualitative and quantitative research. The resultant score was converted to an API score that ranged from 1 to 5 so that it would be feasible for health care providers to understand and use.

The findings showed that an Adherence Predictive Index (API) could be developed based upon a relatively small number of questions that focus on personality type and generational, educational, and cultural experiences. It was developed in order to be a component of a comprehensive program that has the goals of (1) identifying and describing specific behavioral strategies individuals are most likely to successfully employ, (2) motivating patients by using their preferred communication style, and (3) predicting each patient's propensity to adhere. Future research is needed to evaluate the index's validity, sensitivity, and effectiveness in actual practice compared with other risk indices.

Medication Adherence

Adherence is the term currently used most often in healthcare to describe a patient's ability and willingness to follow a healthcare provider's recommendations [1]. This definition suggests that patients perform an important role for maintaining their health by making decisions and engaging in prescribed behaviors [2,3]. A significant proportion of negative health outcomes and the estimated $290 billion dollar annual cost resulting from poor medication adherence is avoidable [4-7]. One of the first steps in promoting adherent behaviors is building an individualized, positive patient-provider relationship [8-10]. Just as precision medicine recognizes that optimal clinical outcomes require differentiation according to a patient's genetic and molecular make-up [11], it follows that achieving optimal health outcomes must recognize differentiation according to a patient's preferences for the delivery and use of health care [8-10]. For example, providers must be able to give health information in a clear manner to diverse populations with varying backgrounds and dispositions. Research has shown that conveying empathy and warmth to some patients can positively impact patient trust and satisfaction with providers and can lead to higher levels of adherence [12].

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Patient-Centered, Personalized Medication Adherence

Patients hold patient-centered viewpoints of medication use based on their personal expectations and life experiences [13]. This differs from prescribers, pharmacists, and patient advocates who apply healthcare-centered viewpoints based upon their professional training and experience [13]. That is, a patient's experience with medication is more than a clinical experience … it is a social and personal experience. Typically, the health care system views patients' experiences with medications in terms of clinical problem-solving (prescribing, monitoring, reconciling) and in terms of medication regimen adherence (i.e. following directions) [14]. Research has shown that a patient's experiences with medications are rooted in medication beliefs, personal abilities and motivations, information processing, decision-making, relationships, finances, and the effects of life experiences [13-19]. Patients vary widely in their make-up, their preferences, and their needs. Some patients don't want to receive any information

from others about their medications while others desire to take an active role in making decisions about them [13,14]. Some people want information about effects of medications, but others want to know about safety. In addition, when people seek information about medicines, there is a high likelihood that they will involve a personal contact, either lay or professional, in their search [15-19]. This all underlines the importance of social networks in the decisions people make about prescription drugs. Patients have different abilities, motivations, and needs when it comes to medication use. The challenge, then, is to meet the unique needs, preferences, and styles of each individual.

Personality Type and Adherence

These findings suggest that medication adherence likely is associated with (1) the kind of information people naturally notice, (2) how they make decisions, and (3) whether they prefer to live in a more structured way or in a more spontaneous way, all of which are associated with personality type [20-23]. The Personality Type construct reflects innate, individual characteristics and is applicable to this study since medication adherence has been shown to be affected by information processing, decision-making, and life preferences of patients [13-19]. As mentioned before, a patient's experience with medication is more than a clinical experience … it is a social and personal experience. The personality type construct used in this study (called the Preferred Communication Style Questionnaire) focused on what kind of information people naturally notice and remember, how they make decisions, and how they like to organize the world around them. The assumption for this study is that personality type can be used for developing an "adherence predictive index" (API) for medication taking since it characterizes important personal characteristics that are associated with the likelihood of medication adherence.

Study Objective

Ideally, the adherence predictive index (API) would be a tool that could be applied before a patient begins a medication regimen so that pharmacists, prescribers, and other healthcare providers could identify the likelihood of each individual patient's medication adherence using simple questions. Furthermore, the ideal API would not require any prior experiences with medications on the part of the patient. By focusing on the kind of information people naturally notice, how they make decisions, whether they prefer to live in a more structured way or in a more spontaneous way, generational experiences, educational experiences, and cultural experiences, it is proposed that the resultant API can help guide strategies for: (1) identifying and describing specific behavioral strategies individuals are most likely to successfully employ, (2) motivating patients by employing their preferred personality type, and (3) predicting each patient's propensity to adhere. Thus, the **objective for this study** was to explore if characteristics of personality type (using the Preferred Communication Style Questionnaire), in concert with the demographic factors of age, education, and race/ethnicity, may be associated with, and help predict, individuals' adherence behavior.

Methods

Study Variables

Tieger and colleagues developed and validated the **Preferred Communication Style Questionnaire** as a way to measure the specific characteristics of a persons' personality type [22,23]. Questions in that questionnaire relate to (1) the kind of information people naturally notice, (2) how people make decisions, and (3) whether people prefer to live in a more structured way or in a more spontaneous way. The questions are forced-choice (A or B) in which respondents are asked to choose A or B based upon which describes them better as a whole (See Appendix A). Each question was linked with the Myers-Briggs Type Indicator (MBTI®) [20] as summarized in **Table 1**.

From individuals' responses to these three questions, each respondent can be categorized into one of 8 personality types. Based upon work by Myers [20], Keirsey and Bates [21], and Tieger, Barron, and Tieger [22], the 8 personality types are:

- **Sensing, Thinking, Judging (STJ):** Responsible, dependable, practical, hardworking, logical, analytical, detail-oriented, organized
- **Sensing, Feeling, Judging (SFJ):** Sympathetic, sensitive, responsible, conscientious, hard-working, collaborative, traditional, helpful
- **Sensing, Thinking, Perceiving (STP):** Pragmatic, fun loving, realistic, casual, responsive, present-oriented, observant, adaptable
- **Sensing, Feeling, Perceiving (SFP):** Sensitive, gentle, practical, realistic, present-oriented, observant, nurturing, cooperative
- **iNtuition, Thinking, Judging (NTJ):** Logical, analytical, strategic, innovative, intellectual, confident, organized, goal-oriented
- **iNtuition, Thinking, Perceiving (NTP):** Creative, logical, analytical, flexible, strategic, confident, complex, perceptive
- **iNtuition, Feeling, Judging (NFJ):** Empathetic, creative, idealistic, goal-oriented, committed, tactful, original, productive
- **iNtuition, Feeling, Perceiving (NFP):** Idealistic, creative, perceptive, communicative, unconventional, spiritual, flexible, empathetic

In addition to these eight personality types, three demographic variables were included for this study: age, education, and race/ethnicity. They were chosen for study since it is feasible to measure these directly from individuals and they represent life experiences and cultural background influences that could shape attitudes and beliefs about using medications [13-19].

Age was operationalized as four categories that represent the following age groups at the time of the study (2015) and corresponding generational types [24]:

- Age 18 to 33 (Millennials, born between 1982 and 1997 for this study)
- Age 34 to 50 (X'ers, born between 1965 and 1981)
- Age 51 to 69 (Boomers, born between 1946 and 1964)
- Age 70 or older (Pre-1946'ers, born before 1946)

Education was categorized as (1) Bachelor's Degree or More or (2) Less than a Bachelor's Degree. Race/Ethnicity was categorized as (1) White or (2) Not White.

In addition to personality type and the three demographic variables (age, education, and race/ethnicity), one medication adherence behavior measure was used for this study. This behavioral measure was used for developing the Adherence Predictive Index (API) as described in the "Data Analysis and Development of the Adherence Predictive Index" section.

The measure of medication adherence used for this study was the Morisky Medication Adherence Scale (MMAS-8) [25-28]. This eight-item measure was adopted with permission (refer to Appendix B). The potential range of scores on the MMAS-8 is from 0 to 8 (see Appendix B). A score of 0 is considered "high adherence", with scores of greater than 0 but less than 3 "medium adherence", and scores of 3-8 "low adherence".

Data Collection

The data source for this study was the 2015 National Consumer Survey of the Medication Experience and Pharmacists' Roles [29]. Data were collected via an on-line, self-administered survey coordinated by Qualtirics Panels between April 28, 2015 and June 22, 2015. Data were obtained from 26,173 adult individuals residing in the United States with at least 500 responses from each of the 50 states and the District of Columbia. Out of the 26,173 responses, 16,736 reported taking one or more medications and were eligible for inclusion in this study.

Data Analysis and Development of the Adherence Predictive Index

Descriptive statistics were computed for all study variables. Linear regression analysis was conducted to describe the associations between the three questions used to measure personality type, age, education, and race/ethnicity with the raw medication adherence score (MMAS-8 that has a range from 0 to 8). Linear regression was conducted in an exploratory and comparative manner even though the distribution of MMAS-8 scores was not normal and linear regression is not typical for analysis of MMAS-8 scores. Linear regression provided evidence to use in decision-making related to the development of the Adherence Predictive Index (API).

In addition to linear regression, the more typical logistic regression analysis was completed to describe the associations between the eight personality type categories, age, education, and race/ethnicity with a dichotomized score for medication adherence (1 = MMAS-8 score from 3 to 8 considered to be low adherence and 0 = MMAS-8 score less than 3 considered to be moderate to high adherence). These analyses were completed to verify associations among the variables and also to help guide decisions about weighting for these variables as they were utilized for development of the Adherence Predictive Index (API).

The development of the Adherence Predictive Index (API) used mean MMAS-8 scores for each of the eight personality types as a starting point. API scores were calculated from this starting point by adding or subtracting specific values to the mean MMAS-8 score based on personality type, age, education and race/ethnicity characteristics which were demonstrated to have significant effects on adherence. The weighting system was informed by linear regression, logistic regression, personality type literature, researcher experience, and previous qualitative and quantitative research conducted by Tieger [22,23]. After the weighting was completed, the resultant score was converted to an API score that would be feasible for health care providers to understand and use.

Results

Descriptive Findings

Descriptive results for personality type, age, education, and race/ethnicity are summarized in **Table 2**

The measure of medication adherence (MMAS-8) ranged from 0 to 8 with a median equal to 2.25 and mode equal to 0 (21% of respondents had scores equal to 0). The mean score was 2.4 with a standard deviation equal to 2.0. Of the 16,736 respondents, 6,483 (39%) reported MMAS-8 scores from 3 to

8 (low adherence) and 10,253 (61%) reported moderate to high adherence (scores less than 3.0).

Linear Regression and Logistic Regression

As described in the Methods section, linear and logistic regression analyses were conducted to describe statistically significant associations among study variables with the outcome of interest (medication adherence). Linear regression used the raw adherence score (range 0 to 8). Findings from this analysis are presented in **Table 3**. Findings from both the linear and logistic regression analysis revealed consistent patterns. Age was associated the strongest with medication adherence followed by: personality type (specifically the Judging or Perceiving characteristic), Race/Ethnicity, and Education. These patterns of findings, combined with personality type literature, researcher experience, and previous qualitative and quantitative researcher conducted by Tieger and colleagues [22,23], were used to develop the Adherence Predictive Index (API).

The Adherence Predictive Index (API)

The development of the Adherence Predictive Index (API) used mean MMAS-8 scores for each of the eight personality types as a starting point. API scores were calculated from this starting point by adding or subtracting specific values to the mean MMAS-8 score based on personality type, age, education and race/ethnicity characteristics which were demonstrated to have significant effect on adherence. The weighting system was informed by linear regression, logistic regression, personality type literature, researcher experience, and previous qualitative and quantitative research conducted by Tieger and colleagues [22,23].

Variables that positively affected self-reported medication adherence were: having more education, being white, being 70 years of age or older, and having a "Judging" personality type preference. Variables that negatively affected self-reported medication adherence were: having less education, being non-white, and having a "Perceiving "personality type preference. Since a higher MMAS-8 score in the scoring system used in this study was associated with lower adherence, the following weights were applied:

- 0.3 was added for subjects with less than a bachelor's degree education
- 0.3 was added for non-white subjects
- 0.5 was *subtracted* if the subject was 70 years of age or older
- 0.3 was *subtracted* if the subject had a personality preference for "Judging"

To improve the usability of the index, the resultant scores were converted to a 1 to 5 scale with 1 being the *lowest* score (least adherent) and 5 being the highest (most adherent). The following conversion table was employed:

Computed Score based upon MMAS-8 Group Mean as Starting Point		Adherence Predictive Index (API) Score	
0 – 1.5		5	High Adherence
1.6 – 2.0		4	
2.1 – 2.5		3	
2.6 – 3.0		2	
3.1 – 8.0		1	Low Adherence

Scores were computed for each of the 128 combinations that resulted from eight personality type categories, four age categories, two education categories and two race/ethnicity categories (8 x 4 x 2 x 2 = 128). Findings are summarized in **Table 5**.

The findings show that the most adherent STJs are educated, white Pre 1946'ers, followed by less educated, white Pre 1946'ers. The least adherent STJs are less educated, non-white Millennials and Boomers. Higher API scores corresponded to increased age of subjects. The relatively low Ns for non-white Pre 1946'ers is probably due to the lack of educational opportunity and necessity of obtaining a college degree at the time these subjects were college age.

The most adherent SFJs are educated, white Pre 1946'ers, the least adherent SFJs are less educated, non-white Millennials. Higher API scores corresponded with increased age of subjects. The relatively low Ns for non-white Pre 1946'ers is probably due to the lack of educational opportunity and necessity of obtaining a college degree at the time these subjects were college age.

The most adherent STPs are educated, white Pre 1946'ers, the least adherent STPs are educated, non-white Millennials. Higher API scores corresponded to increased age of subjects. The relatively low Ns for non-white Pre 1946'ers is probably due to the lack of educational opportunity and necessity of obtaining a college degree at the time these subjects were college age.

The most adherent SFPs are less-educated, white Pre 1946'ers, the least adherent SFPs are less educated, non-white Millennials. Higher API scores corresponded with increased age of subjects. The relatively low Ns for non-white Pre 1946'ers is probably due to the lack of educational opportunity and necessity of obtaining a college degree at the time these subjects were college age.

The most adherent NTJs are educated, white Pre 1946'ers, the least adherent NTJs are less-educated non-white X'ers. Higher API scores corresponded to increased age of subjects. The relatively low Ns for non-white Pre 1946'ers is probably due to the lack of educational opportunity and necessity of obtaining a college degree at the time these subjects were college age.

The most adherent NTPs are educated, white Pre 1946'ers, the least adherent NTPs are educated, non-white Millennials. Higher API scores corresponded to increased age of subjects. The relatively low Ns for non-white Pre 1946'ers is probably due to the lack of educational opportunity and necessity of obtaining a college degree at the time these subjects were college age.

The most adherent NFJs are less educated, white Pre 1946'ers, the least adherent NFJs are less and more educated non-white Millennials. Higher API scores corresponded to increased age of subjects. The relatively low Ns for non-white Pre 1946'ers is probably due to the lack of educational opportunity and necessity of obtaining a college degree at the time these subjects were college age.

The most adherent NFPs educated, white Pre 1946'ers, the least adherent NFPs are less-educated, non-white Millennials. Higher API scores corresponded to increased age of subjects. The relatively low Ns for non-white Pre 1946'ers is probably due to the lack of educational opportunity and necessity of obtaining a college degree at the time these subjects were college age.

Discussion and Conclusions

Before the findings are discussed, limitations of the study should be noted. First, some of the cells in Table 5 for which API scores were computed have sizes less than 30. While most of the cells are robust from a sample size perspective, the cells with relatively small sample sizes should be interpreted with caution. Second, respondents to the survey were part of a panel and may not be representative of the whole United States adult population. Overall the respondents in this study were matched well in terms of geographic location and age. However, the proportion of female respondents was higher than the U.S. population census estimate. The goal of this study was not to make population estimates. Rather the goal was to use the data to develop a tool that could be used for improving patient care. If population estimates were of interest, weighting of the data to match the population of interest would be needed. Third, the Adherence Predictive Index was developed based upon self-reported medication adherence (MMAS-8) and not on actual behavior data. It is possible that self-reports are biased. However, the MMAS-8 is widely accepted as reliable and valid for the purposes of this study. It should be noted that a relatively large group of respondents (21%) had MMAS-8 scores of zero (high adherence). This is a reasonable finding since respondents in this study were from the general population and took varied, often simple drug regimens. This is in contrast to application of the MMAS-8 in other studies that often are focused on patient populations using specific medications for a single disease. Finally, the application of personality type has limitations such as the amount of variance explained and applicability in certain situations [30-32]. We acknowledge these limitations and were careful to apply a personality type measure (Preferred Communication Style Questionnaire) that had direct relevance to medication adherence.

Overall, the findings described the development of the Adherence Predictive Index (API) that was built upon personality type, a self-reported adherence measure, and demographic variables. It should be noted that the application of the MMAS-8 measure in this study was novel in that it was used for development of the API. Henceforth, the computation of the API only requires relatively few questions of patients (three personality type questions, plus information about the person's age, education, and race/ethnicity). Thus, the API can be applied before a patient begins a medication regimen and can help predict the likelihood of adherence. This can help identify patients a priori who may need assistance in order to achieve good medication adherence. This approach is in contrast to other adherence estimators that rely on the need to (1) know patients' past adherence behavior, (2) measure patients' perceptions about medications after they are prescribed or taken, or (3) have access to proprietary medical records or claims data in order to conduct predictive analytics [33-35].

The Adherence Predictive Index (API) can have great practical value for pharmacists, prescribers, and other healthcare providers by identifying the likelihood of each individual patient's medication adherence using simple questions. The utility of the API is that it can be used as a predictive tool without any prior knowledge about a person's past medication adherence behaviors and without any prior experiences with medications on the part of the patient. The focus of the API is on patient-centered information (the kind of information people naturally notice, how they make decisions, whether they prefer to live in a more structured way or in a more spontaneous way, generational experiences, educational experiences, and cultural experiences). Furthermore, the API can help guide strategies for: (1) identifying and describing specific behavioral strategies individuals are most likely to successfully employ, (2) motivating patients by employing their preferred personality type, and (3) predicting each patient's propensity to adhere.

Future research is needed to evaluate the index's validity, sensitivity, and effectiveness in actual practice compared with other risk indices.

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Table 1: Preferred Communication Style Questionnaire with Link to MBTI®

Question in the Survey	Response Option	Link to MBTI®
Are you more of a realistic person who pays attention to what is happening now? Or a person who thinks about what may happen in the future?	A: You'd rather talk about real things than ideas that don't have much practical value. B: You enjoy thinking about new ideas and possibilities.	(S) Sensing (N) iNtuition
Do you tend to make decisions based more on logic or on your personal feelings?	A: You are most convinced by logical arguments. B: When making a decision, you consider how people will feel about it.	(T) Thinking (F) Feeling
Do you prefer to live in a more planful, organized way? Or a more open-minded, spontaneous way?	A: You like things decided and feel best when you've got a plan. B: You like to keep your options open before making some decisions.	(J) Judging (P) Perceiving

Table 2: Summary of Study Variables (n = 16,736)

Personality type	n (%)
Sensing, Thinking, Judging (STJ): Responsible, dependable, practical, hardworking, logical, analytical, detail-oriented, organized	2585 (15%)
Sensing, Feeling, Judging (SFJ): Sympathetic, sensitive, responsible, conscientious, hard-working, collaborative, traditional, helpful	4679 (28%)
Sensing Thinking, Perceiving (STP): Pragmatic, fun loving, realistic, casual, responsive, present-oriented, observant, adaptable	752 (4%)
Sensing Feeling, Perceiving (SFP): Sensitive, gentle, practical, realistic, present-oriented, observant, nurturing, cooperative	1483 (9%)
iNtuition, Thinking, Judging (NTJ): Logical, analytical, strategic, innovative, intellectual, confident, organized, goal-oriented	1659 (10%)
iNtution, Thinking, Perceiving (NTP): Creative, logical, analytical, flexible, strategic, confident, complex, perceptive	1061 (6%)
iNtuition, Feeling, Judging (NFJ): Empathetic, creative, idealistic, goal-oriented, committed, tactful, original, productive	2795 (17%)
iNtuition, Feeling, Perceiving (NFP): Idealistic, creative, perceptive, communicative, unconventional, spiritual, flexible, empathetic	1722 (10%)
Age Category	
Age 18-33 (Millennials)	4403 (26%)
Age 34-50 (Xer's)	4904 (29%)
Age 51-69 (Boomers)	5879 (35%)
Age 70+ (Pre 1946'ers)	1550 (9%)
Education Category	
Less than Bachelor's Degree	10,523 (63%)
Bachelor's Degree or Higher	6231 (37%)
Race/Ethnicity Category	
White	13,967 (83%)
Not White	2769 (17%)

Note: Percentages may not sum to 100% due to rounding.

Table 3: Linear Regression results for Associations between Personality Type Questions, Age, Education, and Race/Ethnicity with MMAS-8 Score (n = 16,736)

Variable	Standardized Beta	p-value
Are you more of a realistic person who pays attention to what is happening now? Or a person who thinks about what may happen in the future? (Sensing = 1 or iNtution = 2)	0.04	< 0.001
Do you tend to make decisions based more on logic or on your personal feelings? (Thinking = 1 or Feeling = 2)	0.02	0.004
Do you prefer to live in a more planful, organized way? Or a more open-minded, spontaneous way? (Judging or Perceiving)	0.12	< 0.001
Age Category (Millennials =1, X'ers = 2, Boomers = 3, Pre 1946'ers = 4)	-0.29	< 0.001
Education Category (Bachelors or more = 1, Less than Bachelors = 0)	-0.05	< 0.001
Race/Ethnicity Category (White = 1, Not White = 0)	-0.08	< 0.001

Adjusted R-square = 0.13

Logistic regression used a dichotomized measure of medication adherence (1 = MMAS-8 score from 3 to 8 considered to be low adherence and 0 = MMAS-8 score less than 3 considered to be moderate to high adherence). Logistic regression findings are summarized in Table 4.

Table 4: Logistic Regression results for Associations between Personality Type Categories, Age, Education, and Race/Ethnicity with Dichotomized MMAS-8 Score (n = 16,736)

Variable	Exp(B)	95% C.I. for Exp(B)	p-value
Personality type			
Sensing, Thinking, Judging (STJ): Responsible, dependable, practical, hardworking, logical, analytical, detail-oriented, organized	0.49	0.43-0.56	<0.001
Sensing, Feeling, Judging (SFJ): Sympathetic, sensitive, responsible, conscientious, hard-working, collaborative, traditional, helpful	0.54	0.48-0.61	<0.001
Sensing, Thinking, Perceiving (STP): Pragmatic, fun loving, realistic, casual, responsive, present-oriented, observant, adaptable	0.83	0.70-1.00	0.46
Sensing, Feeling, Perceiving (SFP): Sensitive, gentle, practical, realistic, present-oriented, observant, nurturing, cooperative	0.93	0.81-1.07	0.33
iNtuition, Thinking, Judging (NTJ): Logical, analytical, strategic, innovative, intellectual, confident, organized, goal-oriented	0.62	0.54-0.72	<0.001
iNtution, Thinking, Perceiving (NTP): Creative, logical, analytical, flexible, strategic, confident, complex, perceptive	0.93	0.79-1.09	0.37
iNtuition, Feeling, Judging (NFJ): Empathetic, creative, idealistic, goal-oriented, committed, tactful, original, productive	0.62	0.55-0.70	<0.001
iNtuition, Feeling, Perceiving (NFP): Idealistic, creative, perceptive, communicative, unconventional, spiritual, flexible, empathetic	*	*	*
Age Category			
Age 18-33 (Millennials)	6.0	5.2-7.1	<0.001
Age 34-50 (Xer's)	4.5	3.9-5.3	<0.001
Age 51-69 (Boomers)	2.1	1.8-2.5	<0.001
Age 70+ (Pre 1946'ers)	*	*	*
Education Category			
Less than Bachelor's Degree	1.3	1.2-1.3	<0.001
Bachelor's Degree or Higher	*	*	*
Race/Ethnicity Category			
Not White	1.5	1.3-1.6	<0.001
White	*	*	*

(1 = MMAS-8 score from 3 to 8 considered to be low adherence and 0 = MMAS-8 score less than 3 considered to be moderate to high adherence)

* signifies comparison group

Table 5: Summary of Adherence Predictive Index (API) Scores

Personality type	Age Category	Ethnicity/Race	Education	N	API
Sensing, Thinking, Judging (STJ): Responsible, dependable, practical, hardworking, logical, analytical, detail-oriented, organized	Millennial	White	Higher	188	3
	Millennial	White	Lower	237	2
	Millennial	Not White	Higher	60	2
	Millennial	Not White	Lower	83	1
	X'er	White	Higher	271	3
	X'er	White	Lower	313	3
	X'er	Not White	Higher	73	2
	X'er	Not White	Lower	89	1
	Boomer	White	Higher	331	5
	Boomer	White	Lower	498	4
	Boomer	Not White	Higher	54	4
	Boomer	Not White	Lower	96	4
	Pre 1946'er	White	Higher	122	5
	Pre 1946'er	White	Lower	155	5
	Pre 1946'er	Not White	Higher	8	5
	Pre 1946'er	Not White	Lower	7	4
Sensing, Feeling, Judging (SFJ): Sympathetic, sensitive, responsible, conscientious, hard-working, collaborative, traditional, helpful	Millennial	White	Higher	337	3
	Millennial	White	Lower	393	1
	Millennial	Not White	Higher	81	2
	Millennial	Not White	Lower	98	1
	X'er	White	Higher	406	3
	X'er	White	Lower	648	3
	X'er	Not White	Higher	90	2
	X'er	Not White	Lower	97	1
	Boomer	White	Higher	523	5
	Boomer	White	Lower	1228	4
	Boomer	Not White	Higher	59	4
	Boomer	Not White	Lower	130	3
	Pre 1946'er	White	Higher	133	5
	Pre 1946'er	White	Lower	421	4
	Pre 1946'er	Not White	Higher	16	5
	Pre 1946'er	Not White	Lower	19	4
Sensing, Thinking, Perceiving (STP): Pragmatic, fun loving, realistic, casual, responsive, present-oriented, observant, adaptable	Millennial	White	Higher	71	2
	Millennial	White	Lower	124	1
	Millennial	Not White	Higher	25	1
	Millennial	Not White	Lower	50	1
	X'er	White	Higher	70	2
	X'er	White	Lower	91	1
	X'er	Not White	Higher	18	2
	X'er	Not White	Lower	24	1
	Boomer	White	Higher	68	5

	Boomer	White	Lower	125	3
	Boomer	Not White	Higher	15	3
	Boomer	Not White	Lower	12	1
	Pre 1946'er	White	Higher	29	5
	Pre 1946'er	White	Lower	23	5
	Pre 1946'er	Not White	Higher	4	3
	Pre 1946'er	Not White	Lower	3	2
Sensing, Feeling, Perceiving (SFP): Sensitive, gentle, practical, realistic, present-oriented, observant, nurturing, cooperative	Millennial	White	Higher	128	1
	Millennial	White	Lower	211	1
	Millennial	Not White	Higher	42	1
	Millennial	Not White	Lower	50	1
	X'er	White	Higher	121	3
	X'er	White	Lower	246	1
	X'er	Not White	Higher	33	1
	X'er	Not White	Lower	44	1
	Boomer	White	Higher	146	3
	Boomer	White	Lower	316	3
	Boomer	Not White	Higher	13	3
	Boomer	Not White	Lower	35	2
	Pre 1946'er	White	Higher	27	4
	Pre 1946'er	White	Lower	67	4
	Pre 1946'er	Not White	Higher	1	3
	Pre 1946'er	Not White	Lower	3	1
iNtuition, Thinking, Judging (NTJ): Logical, analytical, strategic, innovative, intellectual, confident, organized, goal-oriented	Millennial	White	Higher	137	2
	Millennial	White	Lower	297	2
	Millennial	Not White	Higher	61	1
	Millennial	Not White	Lower	78	1
	X'er	White	Higher	163	3
	X'er	White	Lower	221	1
	X'er	Not White	Higher	66	2
	X'er	Not White	Lower	57	3
	Boomer	White	Higher	173	4
	Boomer	White	Lower	263	4
	Boomer	Not White	Higher	31	3
	Boomer	Not White	Lower	51	3
	Pre 1946'er	White	Higher	73	5
	Pre 1946'er	White	Lower	701	5
	Pre 1946'er	Not White	Higher	6	4
	Pre 1946'er	Not White	Lower	12	3
iNtution, Thinking, Perceiving (NTP): Creative, logical, analytical, flexible, strategic, confident, complex, perceptive	Millennial	White	Higher	91	1
	Millennial	White	Lower	190	1
	Millennial	Not White	Higher	33	1
	Millennial	Not White	Lower	82	1
	X'er	White	Higher	106	1
	X'er	White	Lower	154	1

	X'er	Not White	Higher	28	1
	X'er	Not White	Lower	44	1
	Boomer	White	Higher	96	4
	Boomer	White	Lower	130	3
	Boomer	Not White	Higher	17	1
	Boomer	Not White	Lower	22	3
	Pre 1946'er	White	Higher	34	5
	Pre 1946'er	White	Lower	31	5
	Pre 1946'er	Not White	Higher	0	3
	Pre 1946'er	Not White	Lower	3	2
iNtuition, Feeling, Judging (NFJ): Empathetic, creative, idealistic, goal-oriented, committed, tactful, original, productive	Millennial	White	Higher	204	2
	Millennial	White	Lower	401	2
	Millennial	Not White	Higher	67	1
	Millennial	Not White	Lower	115	1
	X'er	White	Higher	264	3
	X'er	White	Lower	447	3
	X'er	Not White	Higher	61	1
	X'er	Not White	Lower	75	1
	Boomer	White	Higher	243	5
	Boomer	White	Lower	599	4
	Boomer	Not White	Higher	39	4
	Boomer	Not White	Lower	75	3
	Pre 1946'er	White	Higher	59	5
	Pre 1946'er	White	Lower	126	5
	Pre 1946'er	Not White	Higher	7	5
	Pre 1946'er	Not White	Lower	13	3
iNtuition, Feeling, Perceiving (NFP): Idealistic, creative, perceptive, communicative, unconventional, spiritual, flexible, empathetic	Millennial	White	Higher	137	1
	Millennial	White	Lower	300	1
	Millennial	Not White	Higher	47	1
	Millennial	Not White	Lower	85	1
	X'er	White	Higher	168	1
	X'er	White	Lower	313	1
	X'er	Not White	Higher	47	1
	X'er	Not White	Lower	56	1
	Boomer	White	Higher	142	3
	Boomer	White	Lower	296	3
	Boomer	Not White	Higher	16	3
	Boomer	Not White	Lower	37	2
	Pre 1946'er	White	Higher	32	5
	Pre 1946'er	White	Lower	40	4
	Pre 1946'er	Not White	Higher	0	3
	Pre 1946'er	Not White	Lower	2	1

Age was operationalized as four categories that represent generational types: 1) **Millennial** - Age 18 to 33 (born between 1982 and 1997 for this study); 2) **X'er** - Age 34 to 50 (born between 1965 and 1981); 3) **Boomer** - Age 51 to 69 (born between 1946 and 1964);

4) **Pre 1946'er** - Age 70 or older (born before 1946). Race/Ethnicity was categorized as (1) White or (2) Not White. Education was categorized as (1) Higher (Bachelor's Degree or More) or (2) Lower (Less than a Bachelor's Degree). N = Sample Size

Appendix A

Preferred Communication Style Questionnaire
(3 items relevant for this study)

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Are you more of a realistic person who pays attention to what is happening now? Or a person who thinks about what may happen in the future?

Style A:
You'd rather talk about real things than ideas that don't have much practical use. You have good common sense and appreciate others who do, too.

You tend to:
- Pay attention to details and specifics
- Appreciate practical solutions
- Be pretty realistic and "down to earth"
- Remember important facts and details
- Trust things that you know from your own past experience
- Prefer using skills you already have
- Be aware of what's going on in the present moment

OR

Style B:
You enjoy thinking about new ideas and possibilities. You are good at seeing how ideas are related and connected to each other.

You tend to:
- See "the big picture"
- Appreciate new or creative ideas, even if they are untested
- Enjoy using your imagination
- Look for and see the deeper meaning in things
- Trust your hunches and "gut instincts"
- Enjoy learning new skills
- Think more about the future than the present

Which style seems to fit you best?
- □ Style A
- □ Style B

Do you tend to make decisions based more on logic or on your personal feelings?

Style A:
You are most convinced by logical arguments. You tell the truth even if it might hurt someone's feelings.

You tend to:
- Look at things objectively, not personally
- Try to treat everyone fairly
- Be competitive
- Take few things personally
- See and point out, how things can be improved
- Sometimes find it fun to argue or debate
- Be motivated to achieve

OR

Style B:

When making a decision, you consider how people will feel about it. You tend to avoid arguments and conflicts.

You tend to:

Be aware of other's feelings
Try to treat everyone kindly
Be cooperative
Sometimes take things too personally
Not criticize others if it will upset them
Want people to get along and be happy
Be motivated to help others

Which style seems to fit you best?

□ Style A
□ Style B

Do you prefer to live in a more planful, organized way? Or a more open-ended, spontaneous way?

Style A:

You like things decided and feel best when you've got a plan. And once you've made a plan, you like to stick with it.

You tend to:

Take your responsibilities seriously
Be sure to prepare in advance
Feel best when you finish projects
Like to cross things off your "to do" list
Find it easy making most decisions
See the need for most rules
Almost always be on time

OR

Style B:

You like to keep your options open before making some decisions. And, you're often comfortable changing plans when necessary.

You tend to:

Like to mix business with pleasure
Complete some tasks at the last minute
Often enjoy starting new projects best
Don't always finish items on your "to do" list
Find it easy to be flexible
Question the need for many rules
Sometimes be late for appointments

Which style seems to fit you best?

□ Style A
□ Style B

Appendix B
Measure of Adherence
MMAS-8

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MMAS-8

1a. Do you sometimes forget to take your pills?	_1_ Yes _0_ No
1b. People sometimes miss taking their medications for reasons other than forgetting. Thinking over the past two weeks, were there any days when you did not take your medicine?	_1_ Yes _0_ No
1c. Have you ever cut back or stopped taking your medicine without telling your doctor because you felt worse when you took it?	_1_ Yes _0_ No
1d. When you travel or leave home, do you sometimes forget to bring along your medicine?	_1_ Yes _0_ No
1e. Did you take all your medicine yesterday?	_0_ Yes _1_ No
1f. When you feel like your symptoms are under control, do you sometimes stop taking your medicine?	_1_ Yes _0_ No
1g. Taking medicine every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?	_1_ Yes _0_ No
1h. How often do you have difficulty remembering to take all your medicine?	__0__ Never/Rarely _.25__ Once in a while _.50__ Sometimes _.75__ Usually __1__ All the time