MODELING THE EFFECTS OF SURVEY TIMING ON SCORES FOR THE WORKING ALLIANCE INVENTORY IN A SECONDARY DATA ANALYSIS OF CARDIOVASCULAR GENETIC COUNSELING OUTCOMES

by
Katelynd Faler

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Abstract

Genetic counseling (GC) research has increasingly regarded the therapeutic alliance, often assessed with the Working Alliance Inventory – Short Revised (WAI-SR), as a variable through which GC outcomes may be mediated. In psychological research the WAI-SR is typically measured immediately following an encounter, but the increase in telemedicine has changed how and when patient surveys are administered. This exploratory analysis of GC outcomes aims to identify whether there may be a relationship between the time lag between the visit and administration of the WAI-SR measure.

The data for this analysis were drawn from two groups of research participants being seen for GC at the Johns Hopkins Center for Inherited Heart Disease (Group 1 N = 106, Group 2 N = 242). Multiple linear regression was used to assess possible relationships between WAI-SR scores and time to post-survey completion by quartile, controlling for demographic and session variables, and WAI-SR scores, participant empowerment, and cardiac anxiety. For Group 1, the second time quartile was found to have a statistically significant relationship to WAI-SR scores ($p = .003$) when controlling for demographic and session confounders. WAI-SR subscale scores were significantly different in the second time quartile, but there were no interaction effects between the subscale scores and time quartile. No significant relationships to time were uncovered for Group 2. The lack of replication in WAI-SR score differences in the second group with a larger sample size offers initial reassurance that therapeutic alliance scores are consistent regardless of whether the measure was administered immediately following a GC visit or at a later time.

Primary Reader and Advisor: Dr. Lori Erby

Secondary Reader: Dr. Debra Roter

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Introduction

The Working Alliance in Psychotherapy and Healthcare

The therapeutic alliance, studied extensively in psychotherapy, has been increasingly investigated as the mechanism through which change occurs in mental health counseling (Baier et al., 2020). Defined widely as the shared relationship between a provider and client that is contingent on a positive, affective bond, agreement on the goals of treatment, and congruency regarding the tasks necessary to fulfill those goals (Bordin, 1994; Baier et al., 2020), psychotherapeutic systematic reviews and meta-analyses have repeatedly found the therapeutic alliance to be directly associated with greater engagement in therapy, global symptoms reduction, and other treatment outcomes (Fluckiger et al., 2018; Baier et al., 2020; Bourke et al., 2021). Alliance is frequently, although not consistently, found to be a predictor of symptom improvement, regardless of treatment type or condition (Baier et al., 2020). Researchers have sought to measure the therapeutic alliance construct through numerous instruments (Elvins and Green, 2008). The Working Alliance Inventory (WAI), initially developed for adult psychotherapy (Horvath 1989), consists of bond, goal, and task subscales and is one of the most frequently used instruments in assessing alliance (Baier et al., 2020; Bourke et al., 2021; Shattock et al., 2018).

Across all sectors of healthcare, a trusting relationship with one's provider is theorized to contribute positively to numerous health outcomes (Duggan and Street, 2015). Despite its limitations (Paap et al., 2022), variations of the WAI have been used to assess the relationship between patients and providers (Erby et al., 2021; Takasaki et al., 2020; Sturgiss et al., 2019; Fuertes, et al., 2017; Gutierrez-Sanchez et al., 2021; Munder et al., 2010; Gonzalez et al., 2022). Higher rankings of the working alliance between physicians and patients have been associated with increased patient adherence and patient perception of treatment utility (Fuertes et al., 2017). The WAI has been adapted

for general practice (Sturgiss et al., 2019), physical therapy (Gutierrez-Sanchez et al., 2021; Takasaki et al., 2020), and recently, for genetic counseling (Erby et al., 2021).

The Working Alliance in Genetic Counseling

In the Reciprocal Engagement Model of Genetic Counseling, the therapeutic relationship is framed as central to genetic counseling practice (Veach et al., 2007). However, only a handful of genetic counseling studies have sought to directly measure the strength of the therapeutic relationship or therapeutic alliance. Erby et al. (2021) used the observer version of the Working Alliance Inventory to assess the therapeutic alliance in in-person genetic counseling after the delivery of carrier screening results. The adapted scale had high inter-rater reliability, and the strength of the therapeutic relationship was shown to increase with session length as predicted (Erby et al., 2021). Murray et al. (2021) used the Working Alliance Inventory – Short Revised (WAI-SR) adapted for in-person cardiovascular genetic counseling and found that the strength of the therapeutic alliance was directly correlated to the magnitude of change in patient empowerment, even when controlling for disease-specific anxiety (Murray et al., 2021). Morris et al. (2021) used the bond subscale of the Working Alliance Inventory – Short to understand the effect of psychiatric genetic counseling on changes in psychiatric symptoms through improved medication adherence (Morris et al., 2021). Both genetic counselor and patient participants rated their affective bond highly, and the authors discuss that patient participants did not perceive a difference in their bond with their genetic counselor whether they were experiencing active psychiatric symptoms (Morris et al. 2021). In 2022, Gonzalez et al. used items from the therapist's version of the Working Alliance Inventory to design a specialized therapeutic alliance questionnaire for genetic counselors in a pilot comparison of traditional and telehealth delivery of cancer genetic counseling (Gonzalez et al., 2022). The authors did not model the possible influence of alliance on outcomes but did report that genetic counselors perceived the alliance to be high for all visit types.

Administration and Reliability of the Working Alliance Inventory

The way the WAI has been administered has varied by healthcare specialty. In psychotherapy research, the WAI has typically been measured immediately following a given therapeutic encounter and is re-administered periodically throughout the course of treatment (Baier et al., 2020; Shattock et al., 2017). While some genetic counseling assessments of the therapeutic alliance have also been conducted immediately following a session (Morris et al., 2021; Gonzalez et al., 2022), practical differences in clinic settings, limitations of research staff, and the increase in social distancing and telemedicine encounters during the pandemic have changed how and when patient surveys can be administered, which may bias participants and affect WAI outcomes.

The effect of survey timing and the limitations in research about the effects of survey timing on patient-reported outcomes have been noted in multiple studies of patient satisfaction. Harpole et al. (1996) and Yacavone et al. (2001) acknowledge that their patient satisfaction results may have been affected by recall bias, where comparative groups on both studies were sent questionnaires by mail two weeks after a medical encounter (Harpole et al., 1996; Yacavone et al., 2001). Walker et al. (1984) did not find evidence of bias based on survey timing, but they acknowledge that their study methodology did not firmly control for survey timing (Walker et al., 1984). In 2002, Crow et al. published an assessment of a systematic review of patient satisfaction measures and emphasized that the effects of survey timing on satisfaction are not clear, with some studies reporting a decrease in satisfaction with time from an encounter, and others showing a positive effect or no effect (Crow et al., 2002). In parallel, the authors emphasized that low response rates are a source of bias in patient surveys, with non-respondents more likely to be members of marginalized groups (Crow et al., 2002). More recently, Jensen et al. (2010) documented that both participation and patient satisfaction were statistically significantly higher when measured at the clinic immediately following an outpatient visit than when measured by mail-in survey two- to- three weeks later in a test-retest scenario (Jensen et al., 2010).

Similarly, in addition to having substantially greater survey response rates, Taylor et al. (2017) found that participants who completed a patient satisfaction survey during their care experience also reported statistically significantly higher scores than equivalent patients who completed follow-up surveys later (Taylor et al., 2017). In modeling survey results from over 29,000 participants, Setodji et al. (2019) found ratings of care across multiple areas of the patient experience to decrease with passing month since the healthcare encounter (Setodji et al., 2019). Given the effects of survey timing on patient satisfaction, it is reasonable that methodological concerns about survey timing of other patient-reported outcomes like working alliance should be investigated.

Data about recall bias regarding the WAI, the most appropriate time following a healthcare encounter to administer the WAI, and the test-retest reliability of the WAI are limited and conflicting in healthcare research overall (Paap et al., 2002) and absent in genetic counseling research. Paap et al. (2022) published a systematic review using the Consensus-based Standards for the Selection of Health Measurements Instrument (COSMIN) to evaluate the WAI (Paap et al., 2022). The review found limited evidence for the test-retest reliability of the WAI, discussing that reliability studies of the WAI had a risk of bias, and did not consistently report intraclass correlation coefficients (ICCs) or describe the model used in analysis. Takasaki et al. (2020) assessed the WAI for 101 participants immediately after a third physical therapy visit and again approximately eight days later, immediately prior to a fourth physical therapy visit and found excellent test-retest reliability (ICC = 0.84) (Takasaki et al., 2020). Goldberg et al. (2004) report good overall test-retest reliability for 23 vocational rehabilitation services consumers (ICC = .78) when the WAI was conducted about two weeks apart, but that there were notable differences in the intraclass correlation coefficient of the bond, goal, and task subscales (Goldberg et al., 2004). In an assessment of the WAI for 174 adult male offenders and their working alliance with their parole officers, Tatman et al. (2010) reported strong test-retest reliability over a two-week period but did not report intraclass correlation coefficients (Tatman et al., 2010). When administering the WAI at two intervals

about one month apart in a hematologic clinic, Ely et al. (2005) found variable test-retest results for the WAI depending upon the ages of participants and subscales (Ely et al., 2005). The authors discussed low recruitment, small sample sizes, or unstable perceptions of the alliance over time as possible factors in their findings (Ely et al., 2005). For Goldberg et al., Tatman et al., and Ely et al., it was not clear from their methodology whether there had been interactions with a provider during the interval between administrations of the WAI survey, which may have confounded their test-retest results. In all, several studies have reported high overall intraclass correlation coefficients when assessing test-retest reliability of the WAI while also noting the potential effects of recall bias on WAI scores. However, the methodological limitations of these studies, including low recruitment, confounding provider interactions, prescribed rigidity in timing of WAI completion, and the variable effects of survey timing on the WAI subscales, leave open questions about WAI instrumentation. This study addresses these shortcomings with a larger sample size, flexibility in the timing of completion of the WAI, measurements of subscale variability, clearer patient-provider interaction protocols, and it contributes to the methodological research of WAI use in genetic counseling.

Summary

The use of the Working Alliance Inventory across research in professional helping environments has grown substantially since its initial development for adult psychotherapy (Horvath and Greenberg, 1989). This use in multiple settings is consistent with early conceptualizations of the working alliance, where a mutual bond is formed in the pursuit of therapeutic goals and tasks (Bordin, 1979; Paap et al., 2022). The relationship between a provider and client is frequently deemed central in healthcare (Fluckiger et al., 2018; Baier et al., 2020; Bourke et al., 2021), including in genetic counseling theory (Veach et al., 2007) and practice (Murray et al., 2021). Many attempts have been made to operationalize the working alliance for research (Elvins and Green, 2008), with the Working Alliance Inventory rising to be among the most popular survey instruments for assessing alliance (Baier et al., 20 20; Bourke et al.,

2021; Shattock et al., 2018). Only four known genetic counseling publications have utilized the Working Alliance Inventory (Erby et al., 2021; Morris et al., 2021; Murray et al., 2021; Gonzalez et al., 2022), with variation in survey administration that may leave results vulnerable to participation and recall bias, limitations which have been documented in assessments of patient satisfaction (Crow et al., 2002; Jensen et al., 2010; Taylor et al., 2017; Setodji et al., 2019).

Proper instrumentation is critical to effective research, and therefore this study seeks to contribute to the gaps in research of WAI instrumentation and methodology (Paap et al., 2022) in the context of genetic counseling research. The aims of this study were to (1) identify whether there is a relationship between WAI scores and time of survey completion controlling for potential confounders; (2) assess the relationship of WAI scores to other patient-reported variables over time; and (3) compare the relationships between the WAI subscale scores for Bond, Goal, and Task over time.

Methods

Design

This exploratory study is a secondary analysis of data collected from a prospective, longitudinal, survey-based study of participants being seen for a variety of cardiovascular indications for first-time genetic counseling at the Johns Hopkins Center for Inherited Heart Disease. Approval for this study was granted by the Johns Hopkins Medicine Institutional Review Board.

Participants

Data from two groups of English-speaking adult participants were compared in this study. The first group of participants (Group 1, N = 106) were seen between January 2017 and August 2018 for indications of a personal or family history of arrhythmogenic cardiomyopathy. The second group of participants (Group 2, N = 242) were seen between April 2020 and December 2021 for indications of a

personal or family history of dyslipidemias, channelopathies and arrythmias, cardiomyopathies, aortopathies, or a family history of sudden death.

Study Variables

Time: The variable of time was defined as the days between participants' genetic counseling appointment in the electronic health record and participants' completion of the post-session surveys as documented in SurveyMonkey (Group 1) and Qualtrics (Group 2). Participants were invited by email to complete their post-session survey, and completion took place at the discretion of the participant. Post-session surveys were completed only once as soon as hours after the genetic counseling appointment. Participants were excluded from the current analysis if their post-session survey was completed 40 days or more after genetic counseling (n = 2). For each Group, participants were divided into quartiles based on the time in which they completed their survey (Table 3).

Working Alliance: The therapeutic alliance between participant and genetic counselor was measured in a post-session survey using the client-version of the Working Alliance Inventory – Short Revised (WAI-SR), a 12-item version of the WAI addressing the affective bond between provider and patient, the agreement on the goals of the encounter, and the agreement on the tasks needed to reach the goals with four items each (Munder et al., 2010). Each item is rated from "never" to "always" by participants on a 5-point Likert scale, with higher scores indicating a stronger bond and greater agreement. Scores are summed and range from 12 to 60 for the total WAI-SR and from four to 20 for each of the subscales. Reliability and consistency of the WAI-SR have been reported as acceptable ($r > 0.64$, $\alpha = 0.80$) (Munder et al., 2010). The WAI-SR was minimally adapted from its original psychotherapeutic context for genetic counseling, where words such as "therapist" were changed to "genetic counselor".

Empowerment: The 24-item Genetic Counseling Outcomes Scale (GCOS-24) was completed by participants to measure the construct of patient empowerment, which includes aspects of decisional control, cognitive control, behavioral control, emotional regulation, and hope (McAllister et al., 2011). Items of the GCOS-24 are rated by participants on a 7-point Likert scale of "strongly disagree" to "strongly agree," where higher scores indicate greater patient empowerment. Total GCOS-24 scores could range from 24 to 168 and were completed by participants in both pre- and post-session surveys. Reliability (r = 0.86) and internal consistency (α = 0.87) for the GCOS-24 are considered good (McAllister et al., 2011). Change in patient empowerment following genetic counseling was calculated by examining the difference in scores between the two time points. An increase in 10.3 points in the GCOS-24 is considered to be a clinically significant increase in patient empowerment (Thomas and McAllister, 2019).

Cardiac Anxiety: The Cardiac Anxiety Questionnaire (CAQ) was used to assess pre-session heart-focused anxiety as a possible confounder of genetic counseling outcomes and relationship building (Eifert et al., 2000, Rosman et al., 2014). The CAQ is an 18-item patient survey with eight items assessing the cardiac-related fear subscale, five items assessing the cardiac-related avoidance subscale, and five items assessing the heart-focused attention subscale in a 5-point Likert scale. Items are scored from zero, meaning "never", to four, meaning "always." Total and subscale scores are calculated as an average with a range of zero to four. Overall reliability for the CAQ is good (r = 0.88) (van Beek et al., 2012), as is the measure's internal consistency (α_s = 0.88) (Rosman et al., 2015).

Demographic and Session Variables: Demographic and session variables collected for each participant across studies included age group; gender; education level; whether a participant's appointment was in-person or virtual; their indication; which provider the participant saw; whether they came to the

appointment with results from prior genetic testing; and whether genetic testing was ordered at their appointment.

Procedures

Data for this secondary analysis was drawn from two, similarly designed studies of cardiovascular genetic counseling. Group 1 was composed of a cohort of participants described in Murray et al. (2021). The goal of the first study was to quantify the effect of the working alliance on cardiac anxiety and patient empowerment for patients seen at the Johns Hopkins Center for Inherited Heart Disease for arrhythmogenic cardiomyopathy with a single genetic counselor. Group 2 was composed of a subset of participants from a second, ongoing, multi-site study. The goals of this study are to quantify cardiovascular genetic counseling patient empowerment, cardiac anxiety, cardiac worry, and intention to act as mediated by the patient-and-genetic counselor working alliance. Participants have a variety of cardiovascular genetic counseling indications, including dyslipidemias, channelopathies and arrythmias, cardiomyopathies, aortopathies, and a family history of sudden death. The cohort of patients comprising Group 2 were seen for any of these indications with one of four genetic counselors at the Johns Hopkins Center for Inherited Heart Disease. Both studies were prospective, longitudinal, survey-based studies. For Groups 1 and 2, participants were patients who had been scheduled for first-time genetic counseling at the Johns Hopkins Center for Inherited Heart Disease and were invited to participate in the survey-based study via email two weeks prior to their genetic counseling appointment, with a reminder email sent again one week later. Information collected in the pre-session and post session survey were used for this secondary analysis; pre-session measures consisted of demographic information, the CAQ, and the GCOS-24 and post-session measures. Following the participants' initial genetic counseling session, either in-person or via telemedicine, included the GCOS-24 and the WAI-SR. Participants were excluded from analysis if they received additional genetic testing results prior to post-session survey completion.

Analysis

Total scales were scored according to their published standards, and subscale scores were calculated for the WAI-SR. Imputation for missing responses was performed if any patient-reported survey was missing fewer than one fourth of the expected response to increase the power of the secondary analysis. Missing values were imputed as an average of that instruments' associated subscale if no other responses from that subscale were missing. Values that were not able to be imputed remained null, and that participant was excluded from analysis for the scales or subscales in which they had missing values. After imputation, participants were excluded from analysis if one fourth or more of responses were missing from the CAQ, the pre- and post-session GCOS-24, or the WAI-SR.

Group 1 and Group 2 were analyzed separately to account for differences in indication, provider, and historical trends. Time between appointment and post-session survey completion was divided into quartiles based on each group's time distribution, with the first quartile acting as the reference quartile. Data cleaning and statistical analysis was completed in R (R version 4.2.1), and $p < 0.05$ was used as a cutoff for statistical significance. Chi-square tests were used to check for relationships between categorical variables, and analysis of variance and Levene's test for homogeneity of variance was used to compare relationships between continuous and categorical variables. Continuous variables were explored with the Shapiro-Wilk test for normality, Spearman's rho, and pair-wise correlation used to measure relationships between continuous variables. Transformation of non-normal continuous variables was unsuccessful in restoring normality so continuous variables were not transformed.

For Group 1, multiple linear regression was used to assess the relationship between time, patient and session variables, empowerment as measured by the GCOS-24, pre-session cardiac anxiety as measured by the CAQ, and interactions of time with cardiac anxiety and empowerment, respectively. Models were constructed with the *olsrr* package in R using bidirectional elimination and selected based on the model containing the relevant primary variables and having the lowest Akaike Information Criterion (AIC).

Cronbach's alpha was used to assess internal consistency of the WAI-SR Bond, Goal and Task subscales over time.

In Group 2, data were nested by genetic counselor and WAI-SR scores were statistically significantly different by provider (p =0.02). However, the number of clusters (four genetic counselors) was too few to model accurately with a multilevel model (McNeish et al., 2016), and the size of the difference was too small to warrant the use of a multilevel model (ICC = 0.03) (Merlo et al., 2005. Therefore, multiple linear regression was also used for Group 2 and genetic counselor was included as a covariate. As with Group 1, models for Group 2 were constructed with the *olsrr* package in R using bidirectional elimination and selected for having the lowest AIC with the relevant primary variables. Cronbach's alpha was used to assess internal consistency of the WAI-SR Bond, Goal and Task subscales over time.

Results

Population

Group 1 consisted of data from 106 participants. There were 53 male and 53 female participants, and 47 (44.3%) were under age 40 (Table 1). The participants were highly educated, with more than 70% reporting having earned a bachelor's degree or higher. Nearly all participants in Group 1 (n = 99, or 93.4%) were seen for an in-person visit, as described in Table 2. Fewer than half of participants (n = 46, or 43.4%) came to their appointment with previous genetic testing results in hand, and 60 participants (56.6%) had genetic testing ordered at their visit. All 106 participants were seen for an indication of arrhythmogenic cardiomyopathy.

Of the 242 participants in Group 2, 100 were male, 140 were female, and 67 (27.7%) were under age 40 (Table 1). Again, over 70% of participants reported having earned at least a bachelor's degree. Compared to Group 1, nearly all (n = 230, or 95%) had a virtual genetic counseling visit, far fewer participants came to their genetic counseling appointment with previous genetic testing results in hand (n = 31, or 12.8%), and 80.2% (n = 194) had genetic testing ordered at their appointment. Whereas all

participants in Group 1 were seen for arrhythmogenic cardiomyopathy, one hundred seventeen participants (48.3%) had indications of cardiomyopathy.

Table1: Participant Demographic Information

	Group 1 (N=106)	Group 2 (N=242)
Sex		
Male	53 (50.0%)	100 (41.3%)
Female	53 (50.0%)	140 (57.9%)
Missing	0 (0%)	2 (0.8%)
Age (years)		
18-20	5 (4.7%)	6 (2.5%)
21-29	17 (16.0%)	20 (8.3%)
30-39	25 (23.6%)	41 (16.9%)
40-49	18 (17.0%)	54 (22.3%)
50-59	20 (18.9%)	48 (19.8%)
60-69	16 (15.1%)	42 (17.4%)
70 and older	4 (3.8%)	31 (12.8%)
Missing	1 (0.9%)	0 (0%)
Education		
Less than a high school diploma	0 (0%)	0 (0%)
High school diploma or equivalent	9 (8.5%)	14 (5.8%)
Some college, no degree	16 (15.1%)	38 (15.7%)
Post-secondary non-degree award	1 (0.9%)	2 (0.8%)
Associate's Degree	5 (4.7%)	18 (7.4%)
Bachelor's Degree	42 (39.6%)	67 (27.7%)
Master's Degree	17 (16.0%)	69 (28.5%)
Doctoral or professional degree	16 (15.1%)	34 (14.0%)

Table 2: Participant Session Information

	Group 1 (N=106)	Group 2 (N=242)
Visit Type		
In Person	99 (93.4%)	9 (3.7%)
Not In Person	7 (6.6%)	230 (95.0%)
Missing	0 (0%)	3 (1.2%)
Genetic Testing Sent at Visit		
Yes	46 (43.4%)	194 (80.2%)
No	60 (56.6%)	45 (18.6%)
Missing	0 (0%)	3 (1.2%)
Previous Genetic Testing Results Available at Visit		
Yes	46 (43.4%)	31 (12.8%)
No	58 (54.7%)	208 (86.0%)
Missing	2 (1.9%)	3 (1.2%)
ConditionType		
Dyslipidemia	0 (0%)	61 (25.2%)
Channelopathy/Arrhythmia	0 (0%)	8 (3.3%)
Cardiomyopathy	106 (100%)	117 (48.3%)
Aortopathy	0 (0%)	50 (20.7%)
Sudden Death	0 (0%)	2 (0.8%)
Missing	0 (0%)	4 (1.7%)

Timeframe

Days between genetic counseling and participant responses to the post-session survey ranged between four and 39 days for Group 1 and between zero and 39 days for Group 2 (Figures 1 and 2). To account for the different distributions of time between the two groups for follow-up survey participation, the time between genetic counseling and post-session survey completion for each group was divided into quartiles (Table 3). The first quartile in each group was used as the reference quartile in analysis.

Table 3: Days between Genetic Counseling and Post-Session Survey Completion by Group and Quartile

Days between Genetic Counseling and Post-Session Survey Completion by Group and Quartile				
	Group 1		Group 2	
Time Quartile	N	Days	N	Days
Quartile 1	27	4-9	61	0-3
Quartile 2	27	9-12	61	3-5
Quartile 3	26	12-19	60	5-8
Quartile 4	26	19-39	60	8-39

Figure 1: Group 1: Participants Responding to Post-Session Survey by Day

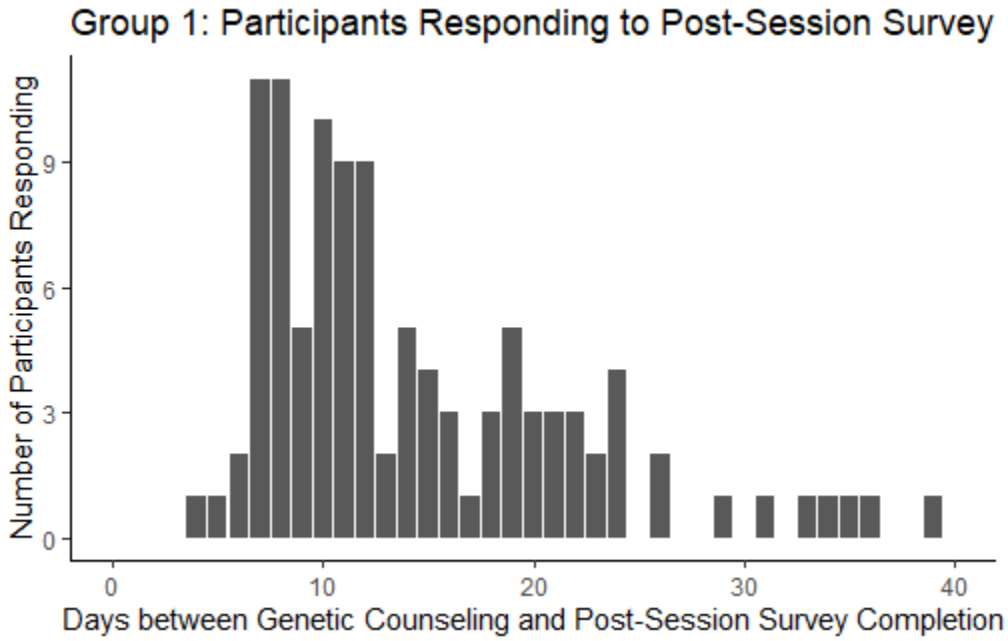
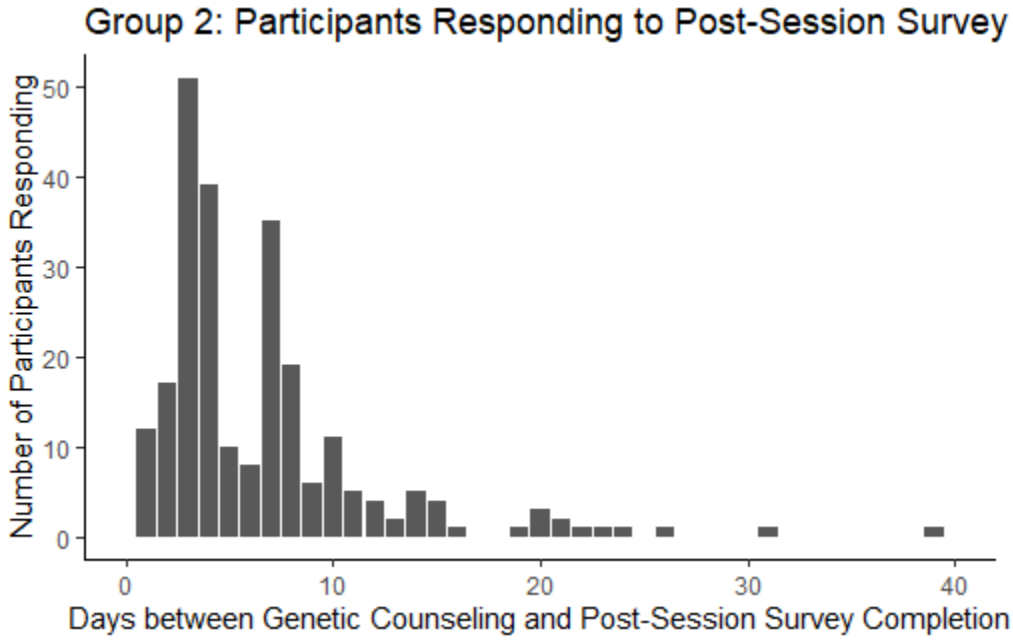


Figure 2: Group 2: Participants Responding to Post-Session Survey by Day



Group 1 Analysis

The first aim of this analysis was to assess the relationship between WAI-SR scores and time between genetic counseling and post-session survey completion, hypothesizing that the working alliance

would be rated as weaker as time between appointment and survey completion increased. A box plot showing Group 1 scores by quartile is presented in Figure 3. T-values from Student's t-test revealed that unadjusted working alliance scores completed in the second time quartile were statistically significantly lower than those completed in the first time quartile; that is, responses from participants completing surveys between days nine and twelve after their appointment were lower than responses from participants completing surveys between days four and nine after genetic counseling (t-value = -2.872, p = 0.0051). Unadjusted means, medians, standard deviation, and t-test p-values are reported by Quartile for Group 1 in Table 4. No other time quartiles were found to have a statistically significant difference in WAI-SR scores. This relationship was maintained when controlling for confounders that were found to be relevant for Group 1, where mean WAI-SR scores were found to be 8.13 points lower for participants completing post-session surveys in the second time quartile compared to the first (t-value = -3.09, p-value = 0.003). Relevant confounders for Group 1 included the age category of the participant, whether they came to their appointment with previous genetic testing results, and whether the participant's session was conducted in-person or virtually. Estimates of adjusted regression coefficients can be found in Table 5.

The second aim of this analysis was to assess the relationship of the working alliance (WAI-SR) to two patient-reported measures, cardiac anxiety (CAQ) and empowerment (GCOS-24), and determine whether these relationships differed by time quartile for Group 1, with the hypothesis the time between appointment and survey completion would moderate the relationship between working alliance, CAQ, and the GCOS-24. Working alliance scores were not found to have a statistically significant relationship with CAQ scores during any time quartile for Group 1 (Table 6). However, the working alliance was found to be correlated to change in patient empowerment as measured by the difference in GCOS-24 scores before and after genetic counseling, and this relationship showed a statistically significant interaction with time. This statistically significant interaction effect held when controlling for the

confounders relevant in the first aim (age, prior genetic testing results, and mode of visit). For each point of increase in empowerment from before to after genetic counseling, the working alliance score increased by almost half a point more for those responding in time quartile 2 as compared to those responding in time quartile 1 (t-value = 2.91, p = 0.005) (Table 6). No other quartiles had a statistically significant interaction effect with empowerment on WAI-SR scores.

The final aim of this analysis was to compare how the working alliance subscales of Bonds, Goals, and Tasks changed by time quartile, where a deterioration was expected in the internal consistency of the subscales for the working alliance. In keeping with prior aims, for each of the three subscales, there was a statistically significant difference in scores between the first and second time quartiles for Group 1, but no other time quartiles were significantly different from the initial time quartile. Mean, median, standard deviation, and p-values for the Group 1 WAI-SR subscale scores are listed in Table 7. None of the relationships between the three working alliance subscales were moderated by time (Appendix 1). To check for changes in internal consistency of the working alliance subscales by time quartile in Group 1, Cronbach's alpha was calculated comparing responses to each of the subscale items in each time quartile. Results, as reported in Table 8, show moderate to good internal consistency for the Bond, Goal, and Task subscales, with no apparent trends by time quartile.

Figure 3: Group 1: Box Plot of WAI-SR Score by Time Quartiles

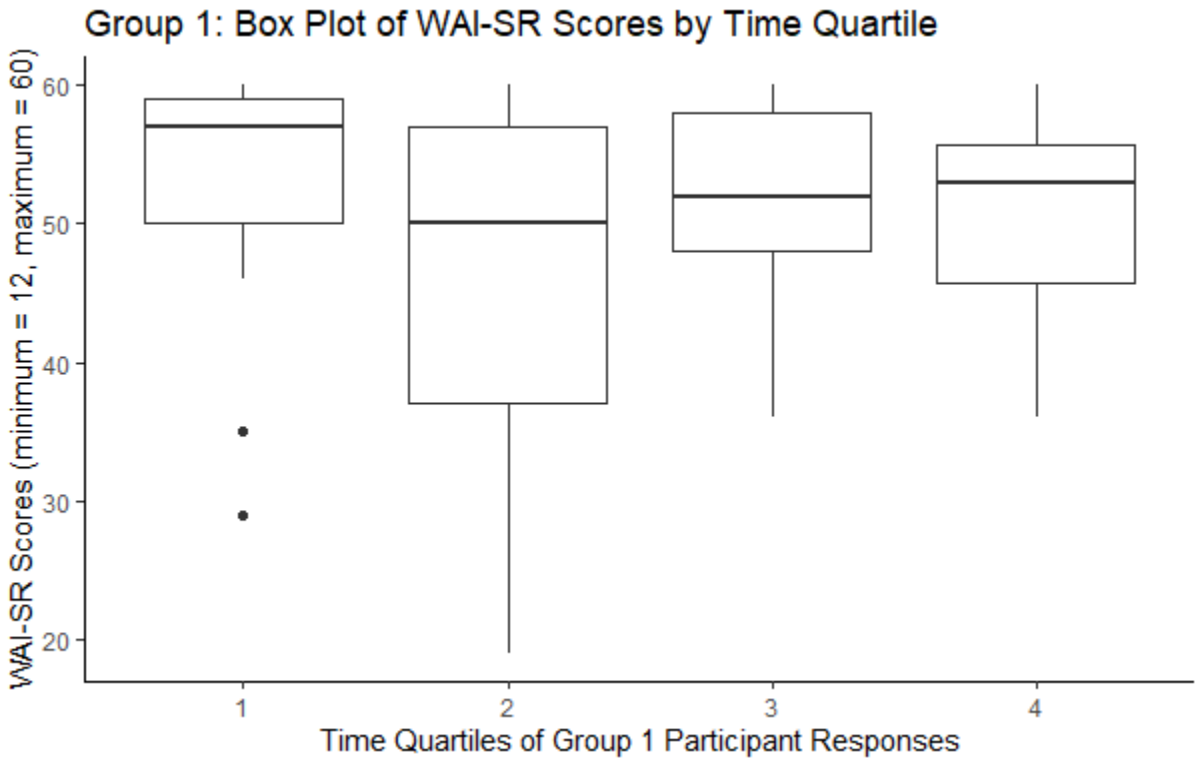


Table 4: Unadjusted WAI-SR Total Score by Time Quartile

Unadjusted WAI-SR Total Scores by Time Quartile					
Group	Time Quartile	Mean	Median	Standard Deviation	p-value[1]
Group 1	Quartile 1 (4-9 days)	53.63	57.00	7.786	-
	Quartile 2 (9-12 days)	46.12	50.00	13.062	**0.005**
	Quartile 3 (12-19 days)	51.39	52.00	8.096	0.436
	Quartile 4 (19-39 days)	51.73	53.00	6.977	0.484
Group 2	Quartile 1 (0-3 days)	48.51	50.00	10.245	-
	Quartile 2 (3-5 days)	50.41	52.50	8.447	0.315
	Quartile 3 (5-8 days)	47.44	50.33	11.535	0.573
	Quartile 4 (8-39 days)	48.70	51.00	10.280	0.924
1. P-values for t-value comparing means of reference Quartile 1 to other quartiles					

Table 5: Effect of Time Quartile and Relevant Confounders on Total WAI-SR Score for Group 1 and Group 2

Effect of Time Quartile and Relevant Confounders on Total WAI-SR Scores for Group 1 and Group 2								
	Group 1				**Group 2**			
Coefficients	*Estimates*	*Standard Error*	*T-Statistic*	*P-Value*	*Estimates*	*Standard Error*	*T-Statistic*	*P-Value*
Intercept	57.47	4.51	12.75	**<0.001**	54.41	5.75	9.46	**<0.001**
Quartile 2	-8.13	2.63	-3.09	**0.003**	0.81	1.96	0.42	0.678
Quartile 3	-3.41	2.67	-1.28	0.206	-1.30	1.93	-0.67	0.501
Quartile 4	-2.74	2.51	-1.09	0.279	-0.82	1.94	-0.42	0.673
Ages 21-29	-2.59	4.42	-0.59	0.559	-6.14	5.10	-1.21	0.229
Ages 30-39	-0.97	4.29	-0.23	0.821	-6.38	4.77	-1.34	0.182
Ages 40-49	1.58	4.50	0.35	0.727	-0.19	4.72	-0.04	0.968
Ages 50-59	-5.78	4.39	-1.32	0.192	-4.84	4.73	-1.02	0.307
Ages 60-69	-13.24	4.79	-2.77	**0.007**	-2.66	4.83	-0.55	0.582
Ages 70 and Older	-12.78	7.47	-1.71	0.091	-3.00	4.92	-0.61	0.543
No Previous Genetic Testing Results Available	-1.11	1.83	-0.61	0.545	-5.47	2.37	-2.31	**0.022**
Appointment Not In-Person	7.57	4.18	1.81	0.074				
Identified as Female					1.03	1.39	0.74	0.459

Genetic Counselor 2					2.14	2.57	0.83	0.406
Genetic Counselor 3					1.01	2.49	0.40	0.686
Genetic Counselor 4					5.23	2.67	1.96	0.051
Observations	90				227			
R^2 / R^2 adjusted	0.357 / 0.266				0.110 / 0.051			

Table 6: Group 1: Effect of Time Quartile Interaction with Cardiac Anxiety and Empowerment on WAI-SR Scores

Group 1: Effect of Time Quartile Interaction with Cardiac Anxiety and Empowerment on WAI-SR Scores								
	Group 1: Working Alliance and Cardiac Anxiety				**Group 1: Working Alliance and Empowerment**			
Coefficients	*Estimates*	*Standard Error*	*T-Statistic*	*P-Value*	*Estimates*	*Standard Error*	*T-Statistic*	*P-Value*
Intercept	55.41	6.21	8.93	**<0.001**	54.20	5.03	10.79	**<0.001**
Quartile 2	0.35	6.72	0.05	0.958	-13.75	3.94	-3.49	**0.001**
Quartile 3	-6.11	7.00	-0.87	0.385	0.31	3.81	0.08	0.935
Quartile 4	2.30	7.30	0.32	0.753	-2.88	3.30	-0.87	0.386
Pre-Session Cardiac Anxiety Score	1.92	2.34	0.82	0.415				
Ages 21-29	-3.21	4.54	-0.71	0.482	-1.52	4.31	-0.35	0.726
Ages 30-39	-2.06	4.43	-0.46	0.644	0.20	4.22	0.05	0.962
Ages 40-49	0.74	4.61	0.16	0.872	0.97	4.33	0.22	0.824

Ages 50-59	-5.85	4.52	-1.29	0.200	-0.84	4.29	-0.20	0.846
Ages 60-69	-14.07	4.92	-2.86	**0.005**	-13.41	4.61	-2.91	**0.005**
Ages 70 and Older	-13.31	7.60	-1.75	0.084	-9.23	7.01	-1.32	0.192
No Previous Genetic Testing Results Available	-1.99	1.96	-1.02	0.312	-2.27	1.78	-1.28	0.205
Appointment Not In-Person	7.45	4.94	1.51	0.136	9.65	3.85	2.50	**0.015**
Interaction: Quartile 2 and Pre-Session Cardiac Anxiety Score	-5.33	3.81	-1.40	0.166				
Interaction: Quartile 3 and Pre-Session Cardiac Anxiety Score	1.33	3.57	0.37	0.711				
Interaction: Quartile 4 and Pre-Session Cardiac Anxiety Score	-3.04	3.94	-0.77	0.442				
Pre-to-Post Session Change in Empowerment Score					0.09	0.09	0.98	0.332
Interaction: Quartile 2 and Change in Empowerment Score					0.48	0.17	2.91	**0.005**
Interaction: Quartile 3 and Change in Empowerment Score					-0.18	0.16	-1.12	0.267

Interaction: Quartile 4 and Change in Empowerment Score					0.09	0.13	0.72	0.471
Observations	89				88			
R^2 / R^2 adjusted	0.383 / 0.257				0.511 / 0.409			

Table 7: Unadjusted WAI-SR Subscale Scores by Time Quartile

Unadjusted WAI-SR Subscale Scores by Time Quartile						
Group	Subscale	Time Quartile	Mean	Median	Standard Deviation	p-value[1]
Group 1	Bond	Quartile 1	18.52	20.00	2.24	-
		Quartile 2	15.80	16.00	4.53	**0.00226**
		Quartile 3	17.84	20.00	2.83	0.47027
		Quartile 4	18.27	19.00	2.14	0.78417
	Goal	Quartile 1	17.48	18.00	3.24	-
		Quartile 2	15.00	16.00	5.20	**0.0288**
		Quartile 3	16.25	16.00	3.39	0.3079
		Quartile 4	16.41	18.00	3.86	0.3560
	Task	Quartile 1	17.63	18.00	3.16	-
		Quartile 2	15.32	16.00	4.26	**0.0144**
		Quartile 3	16.68	17.00	2.98	0.3465
		Quartile 4	17.29	17.00	2.61	0.7189
Group 2	Bond	Quartile 1	17.12	18.00	3.30	-
		Quartile 2	17.58	18.33	2.97	0.451
		Quartile 3	16.89	18.00	3.88	0.710
		Quartile 4	17.32	19.00	3.15	0.751
	Goal	Quartile 1	16.12	17.00	4.01	-
		Quartile 2	16.54	17.00	3.65	0.580
		Quartile 3	15.66	17.00	4.58	0.557
		Quartile 4	15.75	17.00	4.35	0.637
	Task	Quartile 1	15.29	16.00	3.69	-
		Quartile 2	16.34	16.00	2.80	0.116
		Quartile 3	14.90	16.00	3.94	0.555
		Quartile 4	15.63	16.00	3.93	0.616
1. P-values for t-value comparing means of reference Quartile 1 to other quartiles						

Table 8: Calculation of Cronbach's alpha for WAI Bond, Goal, and Task Subscales by Time Quartile

Calculation of Cronbach's alpha for WAI Bond, Goal, and Task Subscales by Time Quartile				
Group	Time Quartile	Bond	Goal	Task

Group 1	Quartile 1	0.832	0.829	0.895
	Quartile 2	0.978	0.942	0.863
	Quartile 3	0.849	0.858	0.797
	Quartile 4	0.874	0.890	0.847
Group 2	Quartile 1	0.874	0.923	0.804
	Quartile 2	0.933	0.894	0.814
	Quartile 3	0.925	0.932	0.858
	Quartile 4	0.861	0.915	0.889

Group 2 Analysis

For the assessment of the relationship between working alliance and time for Group 2 where nearly all sessions were conducted virtually, scores were expected to be higher when post-session survey completion occurred closer to genetic counseling, just as was hypothesized for Group 1. Unlike Group 1, working alliance scores completed in the first quartile were not found to be statistically significantly different from scores in other quartiles. A box plot of working alliance scores by quartile for Group 2 can be found in Figure 5, with details presented in Table 4. No statistically significant relationships between working alliance scores and time quartile were uncovered when controlling for relevant confounders for Group 2, including the participants' age, gender, whether they had results available from a previous genetic test, and which genetic counselor the patient saw (Table 5).

Like Group 1, it was anticipated that time would moderate the relationship between the working alliance (WAI-SR) and patient reported variables of cardiac anxiety (CAQ) and empowerment (GCOS-24) for Group 2. For Group 2, the relationship between unadjusted working alliance scores and cardiac anxiety differed for participants who completed their post-session survey in Quartile 3 as compared to those who completed it in Quartile 1 (t-value = 2.529, p-value = 0.0121). This moderating effect, detailed in Table 9, did not maintain its significance when controlling for participants' age, gender, availability of prior genetic testing results, and genetic counselor (t-value = 1.869, p-value = 0.0630). Time quartile was

not found to have a moderating effect on the relationship of working alliance and empowerment as measured by GCOS-24 scores, even when adjusting for confounding effects (Table 9).

In assessing changes in the relationships of the Working Alliance's Bonds, Goals, and Tasks subscales to each other by time quartile for Group 2, internal consistency of the subscales was expected to deteriorate as time between genetic counseling and post-session survey completion increased. Like total Working Alliance scores, none of the subscales in Group 2 showed a statistically significant relationship to time quartile, and none of the relationships between the three Working Alliance subscales were moderated by time (Appendix 1). Means, medians, standard deviation, and associated p-values for WAI-SR subscales are shown in are shown in Table 7. Internal consistency, as measured by Cronbach's alpha, did not demonstrate consistent deterioration by time quartile, and subscale scores were moderate to good (Table 8).

Figure 4: Group 2: Box Plot of WAI-SR Score by Time Quartile

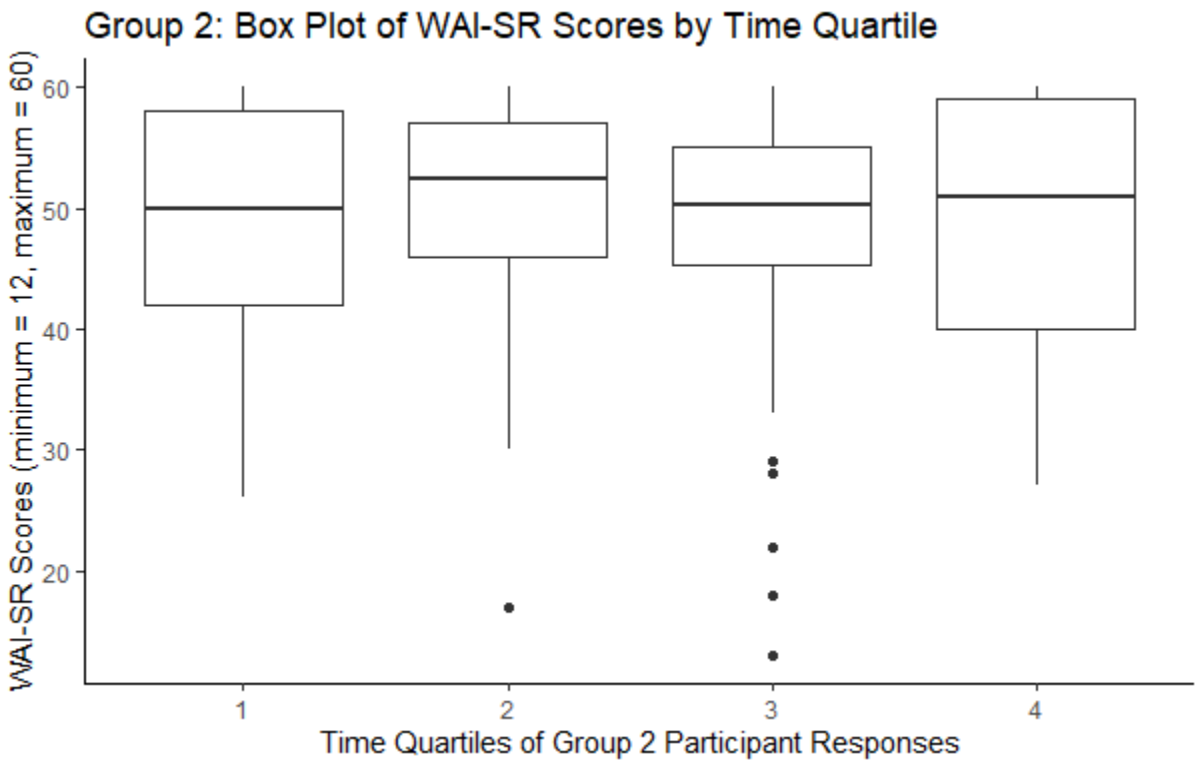


Table 9: Group 2: Effect of Time Quartile Interaction with Cardiac Anxiety and Empowerment on WAI-SR Scores

Group 2: Effect of Time Quartile Interaction with Cardiac Anxiety and Empowerment on WAI-SR Scores								
	Group 2: Working Alliance and Cardiac Anxiety				**Group 2: Working Alliance and Empowerment**			
Coefficients	*Estimates*	*Standard Error*	*T-Statistic*	*P-Value*	*Estimates*	*Standard Error*	*T-Statistic*	*P-Value*
Intercept	57.81	6.33	9.13	**<0.001**	55.28	5.81	9.52	**<0.001**
Quartile 2	-6.80	4.72	-1.44	0.151	0.83	2.02	0.41	0.682
Quartile 3	-8.66	4.31	-2.01	**0.046**	-1.61	2.01	-0.80	0.423
Quartile 4	-1.48	4.52	-0.33	0.743	-0.94	2.01	-0.47	0.641

Pre-Session Cardiac Anxiety Score	-2.54	2.10	-1.20	0.230				
Ages 21-29	-5.70	5.13	-1.11	0.268	-5.47	5.17	-1.06	0.291
Ages 30-39	-6.40	4.79	-1.34	0.183	-6.06	4.82	-1.26	0.210
Ages 40-49	-0.46	4.75	-0.10	0.922	0.23	4.79	0.05	0.962
Ages 50-59	-5.19	4.75	-1.09	0.276	-4.95	4.80	-1.03	0.304
Ages 60-69	-2.50	4.84	-0.52	0.606	-2.06	4.89	-0.42	0.674
Ages 70 and Older	-3.05	4.96	-0.61	0.539	-2.71	5.00	-0.54	0.589
Identified as Female	0.86	1.43	0.61	0.545	1.01	1.42	0.71	0.478
No Previous Genetic Testing Results Available	-5.22	2.41	-2.17	**0.031**	-6.24	2.47	-2.53	**0.012**
Genetic Counselor 2	2.33	2.58	0.90	0.368	1.44	2.62	0.55	0.584
Genetic Counselor 3	0.98	2.52	0.39	0.696	0.57	2.53	0.22	0.824
Genetic Counselor 4	5.08	2.71	1.88	0.062	5.21	2.78	1.88	0.062
Interaction: Quartile 2 and Pre-Session Cardiac Anxiety Score	4.85	2.80	1.73	0.085				
Interaction: Quartile 3 and Pre-Session Cardiac Anxiety Score	5.46	2.92	1.87	0.063				
Interaction: Quartile 4 and Pre-Session Cardiac Anxiety Score	0.56	2.91	0.19	0.847				

Pre-to-Post Session Change in Empowerment Score					-0.11	0.14	-0.74	0.458
Interaction: Quartile 2 and Change in Empowerment Score					0.19	0.20	0.95	0.342
Interaction: Quartile 3 and Change in Empowerment Score					0.40	0.22	1.85	0.066
Interaction: Quartile 4 and Change in Empowerment Score					0.18	0.21	0.88	0.381
Observations	223				221			
R^2 / R^2 adjusted	0.134 / 0.057				0.129 / 0.051			

Discussion

Healthcare research continues to investigate the working alliance as a mediator for patient outcomes, and genetic counseling research increasingly uses the WAI to assess the working alliance. When conducting healthcare outcomes research, study designs face limitations in research staff and clinic workflow and changes in the provider-patient relationship that are guided by isolation procedures and the rise of telehealth. It is not always possible for all research participants to complete measures of patient outcomes at the exact same time intervals. Ensuring that collected data is comparable across the study, or multiple studies, is a critical part of healthcare research that will help providers better understand the role of working alliance in patient outcomes. This study sought to contribute to the gaps in research of WAI instrumentation and methodology (Paap et al., 2022) by exploring whether there is

observational evidence of differences in WAI scores related to the time after an appointment in which a participant completed the measure.

Previous research has demonstrated that there may be a decrease in patient satisfaction over time when surveys are administered further away from the date of a medical encounter (Jensen et al., 2010; Taylor et al., 2017; Setodji et al., 2019), and other literature has stated that this relationship is both unclear and understudied (Crow et al., 2002). Given the inclinations of recent research, this study hypothesized that there would a deterioration in reported working alliance scores over time.

Contrary to the study's hypotheses, the results of this observational study show that there is not consistent evidence that WAI-SR responses differ when assessed further out from a genetic counseling session rather than closer to a session. Group 1 data, which were collected from participants seen mostly in-person by one genetic counselor for arrhythmogenic cardiomyopathy, showed a small dip in working alliance scores from participants who completed post-session surveys in days nine to 12 after their genetic counseling appointment, compared to participants completing surveys in days four to nine. This small dip did not persist when comparing respondents between days four and nine to respondents completing the WAI after day 12. However, this difference was not replicated in an analysis of Group 2, which included participants who were seen mostly by telehealth by four different genetic counselors for a variety of cardiovascular indications, where the majority of participants completed their post-session survey by day 8. The previously described differences between the protocols for Group 1 and 2 make a direct comparison limited and led the authors to explore ways in which to model differences in time for both groups.

Differences between the two groups in participant response times, were particularly challenging to account for, especially that Group 1 post-session surveys were completed beginning four days after genetic counseling and Group 2 post-session surveys were completed beginning less than one day after genetic counseling. Not presented in this study were the variations in time that were used to explore

where differences may exist in patient-reported outcomes. Time periods of days, half-weeks, and weeks between a participant's genetic counseling appointment and post-survey completion were explored as more intuitive, but still arbitrary, time points in which to compare scores of the WAI-SR for each group. This data exploration masked differences in groups that were better represented when time quartiles were applied separately to each group. Future studies with a larger sample size may consider additional within-group analysis to discover and describe inflection points in therapeutic alliance scores over time.

Previous studies have indicated that ratings of working alliance within a session are associated with changes in patient empowerment following a genetic counseling session (Murray et al., 2021). To further investigate ways in which time may affect performance of WAI-SR scores, this study examined the interaction of time in the relationship between other patient-reported outcomes and WAI-SR scores. This study hypothesized that the relationship between working alliance and empowerment, and working alliance and cardiac anxiety, would be moderated by time. Limited evidence of a moderation effect was found in this analysis. When controlling for potential confounding variables, time quartile did not moderate the relationship between cardiac anxiety and working alliance scores. In addition, the only interaction effect of time in Group 1 occurred in comparing differences in the relationship between empowerment and working alliance scores between those completing the post-session survey in Quartile 2 (nine to 12 days) in comparison to those completing in Quartile 1 (four to nine days). An interaction effect between time and empowerment was not shown to affect working alliance in Group 2, but the slightly stronger relationship between empowerment score change and working alliance in Quartile 2 compared to Quartile 1 for Group 1 may be evidence of convergence of the concepts of empowerment and working alliance for participants, or slippage in the participants' ability to distinguish between empowerment and working alliance over time. Further studies may be able to examine this finding more closely. Finally, this study anticipated that internal consistency of the WAI-SR subscales would deteriorate as time from appointment increased, but again, this observational study found

limited evidence of a deterioration. Cronbach's alpha remained moderate to strong in all time quartiles for both groups. There was no clear deterioration of internal consistency over time, and no differences in internal consistency between the Bonds, Goals, and Tasks subscales.

As this is an observational study, there are limitations that may affect the conclusions that can be drawn from these analyses. There could be multiple reasons that this study did not uncover the hypothesized differences. First, the ceiling effects of the WAI-SR need to be strongly considered: The prevalence of top-box scoring of the WAI-SR may be masking smaller differences in WAI-SR by time since genetic counseling. In addition, as participants were able to choose the timeframe for completing the post-session survey, unmeasured aspects of the participant personality and/or experience may have affected both the chosen survey completion time and the ratings of the session. For instance, perhaps only people who had warm, productive, or satisfying experiences with genetic counseling may have felt committed enough to complete the post-session surveys further out from their appointment. Regardless, these results provide initial reassurance to the field of genetic counseling research that measures of the working alliance will maintain their integrity even if patient surveys are not completed immediately after a genetic counseling encounter. In the absence of more robust data, following best practices of administering the WAI as close to an appointment as possible is recommended, preferably within eight days per the findings of this analysis. However, data need not necessarily be excluded if collected within approximately four weeks from a genetic counseling appointment.

Limitations

The limitations of this study can be addressed in four categories: instrumentation and design, historic effects, statistical limitations, and participation. First, several aspects of instrumentation and design limit the power of conclusions that can be drawn from the results. This was an exploratory, observational study, and findings cannot be implied to have a causative relationship as each participant only completed one assessment of the WAI and was not randomly assigned to a completion time. As

with many other survey-based studies of patient outcomes, ceiling effects and limited variability of survey-responses play a significant role with regard to whether differences can be detected between groups. Future studies may consider removing top box responses in analyses including the WAI. The WAI itself is limited as an instrument, as researchers have pointed out its Western focus (Takasaki et al., 2017). This limits the instrument's sensitivity to responses from participants who are outside the dominant Western culture.

Historic effects significantly limit the generalizability of this study's findings. Group 1 data were collected in 2017 and 2018, prior to the COVID-19 pandemic, and participants were seen for genetic counseling mostly in-person. Comparatively, Group 2 data were collected between April 2020 and December 2021, and visits were conducted via telemedicine by necessity. These major differences in study protocols limit their comparability, and the differences in the effects of time for each Group could be attributed to historic effects and unassessed session variables.

As these two Groups' protocols were different enough to exclude the performance of a combined analysis, the current study was not sufficiently powered to determine the effects of days or weeks on WAI scores, one of the studies statistical limitations. Second, no study participants in Group 1 completed the post-session survey within the first two days of their genetic counseling appointment, and very few members of Group 2 completed their post-session survey within the first two days. Third, imputation was used to increase the number of participants who had complete survey responses, where an average of the participants' related responses were taken to calculate a value for the missing response. Although less than 5% of items included in this analysis were imputed, future analyses should use more robust imputation techniques, such as multiple imputation. Fourth, a linear model was used for regression analysis, but non-normality of participant survey responses and non-independence of the data in Group 2 (nested by genetic counselor) violate this model's assumptions. A fixed-effects model

may be more appropriate for the very low number of clusters in this data and the non-normality of especially WAI-SR responses.

Finally, the study population, both of patient participants and genetic counselor participants, limits the generalizability of findings. Participants were highly educated, with over 70% having earned a bachelor's degree or higher, which is not representative of the years of education for the United States population. It is possible that education may correlate to or affect the priorities of patient participants, and therefore may prompt differences in recall for the study population as compared to a generalized population receiving genetic counseling. In addition, the homogeneity of the genetic counseling field may interact with the patient participants recall of genetic counseling appointments. Socioeconomic status was not assessed for this study but could have had an unobserved influence on cardiac anxiety, empowerment, and working alliance. Additionally, only four genetic counselors participated as providers. More genetic counselors would be needed for a more robust analysis.

Practical Implications

This study offers initial reassurance to genetic counseling researchers that measures of the working alliance will maintain their integrity even if patient surveys are not completed immediately after genetic counseling. The results show limited evidence that time between genetic counseling and post-session survey completion correlates to differences in WAI total and subscale scores. Future studies could consider multiple assessments of the WAI at different points in time following a genetic counseling session and could consider having additional incentives to complete the post-session surveys within one day of a participant's genetic counseling appointment. Researchers should be aware that variations in survey administration and participant completion times may be a source of bias in their studies and should consider accounting for this in their study procedures.

Conclusion

Genetic counseling research has increasingly included measures of the therapeutic alliance, often assessed with the WAI-SR, as a variable through which genetic counseling outcomes may be mediated. In psychological research the WAI-SR is typically measured immediately following a therapeutic encounter to maximize participant recall. However, the increase in telemedicine encounters and social distancing during the pandemic have changed how and when patient surveys can be administered. This exploratory analysis of secondary data from two separate groups of participants seen for cardiovascular genetic counseling aimed to identify how time between genetic counseling and post-session survey completion may affect patient reports of the working alliance. Group 1 consisted of 106 participants seen for the first time by one genetic counselor, mostly in person, for an indication of arrhythmogenic cardiomyopathy. Group 2 consisted of 242 participants seen for the first time by one of four genetic counselors, mostly by telemedicine, for a variety of cardiovascular indications.

Overall, the study found limited evidence that time was related to differences in the working alliance, or that time was related to a deterioration in the internal consistency of the WAI subscales. Differences in working alliance scores were observed in Group 1 where participants who completed their post-session surveys between days nine and 12 (Quartile 2) had a small but statistically significantly lower scores than participants who completed post-session surveys between days four and nine (Group 1) when controlling for relevant confounders. An interaction affect was also found for Group 1 between Quartile 2 and empowerment scores, perhaps indicating slippage in the participants' recall of the session. These trends were not replicated in Group 2. These results provide initial reassurance to the field of genetic counseling research that measures of the therapeutic alliance will maintain their integrity even if patient surveys are not completed immediately after a genetic counseling encounter, however, it is important to continue to consider that time can affect patient recall when completing post-session follow-up surveys.

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Appendix

Table 10: Effect of Time Quartile Interaction on Relationship between WAI Bond subscale and WAI Goal Subscale

Effect of Time Quartile Interaction on Relationship between WAI Bond subscale and WAI Goal Subscale								
	Group 1				**Group 2**			
Coefficients	*Estimates*	*Standard Error*	*T-Statistic*	*P-Value*	*Estimates*	*Standard Error*	*T-Statistic*	*P-Value*
Intercept	10.4900	2.366	4.433	-	6.27837	1.16155	5.405	-
Quartile 2	-5.1992	2.7336	-1.902	0.060562	1.89962	1.71327	1.109	0.2687
Quartile 3	-2.0837	3.4659	-0.601	0.549316	-0.45949	1.52675	-0.301	0.7637
Quartile 4	5.3451	3.1585	1.692	0.094257	2.81432	1.56823	1.795	0.0741
WAI Goal Scores	0.4593	0.1332	3.449	**0.000879**	0.67250	0.06997	9.611	**< 2e-16**
Interaction: Quartile 2 and Change in WAI Goal Scores	0.2414	0.1587	1.520	0.132131	-0.10247	0.10223	-1.002	0.3172
Interaction: Quartile 3 and Change in WAI Goal Scores	0.1216	0.2027	0.600	0.550218	0.03412	0.09267	0.368	0.7131
Interaction: Quartile 4 and	-0.3107	0.1821	1.706	-0.091688	-0.15035	0.09518	-1.580	0.1156

Change in WAI Goal Scores								
Observations	86				225			
R^2 / R^2 adjusted	0.5798/ 0.5452				0.6132 / 0.6011			

Table 11: Effect of Time Quartile Interaction on Relationship between WAI Goal subscale and WAI Task Subscale

Effect of Time Quartile Interaction on Relationship between WAI Goal subscale and WAI Task Subscale								
	Group 1				**Group 2**			
Coefficients	*Estimates*	*Standard Error*	*T-Statistic*	*P-Value*	*Estimates*	*Standard Error*	*T-Statistic*	*P-Value*
Intercept	3.33865	2.80555	1.190	-	2.29528	1.37588	1.668	-
Quartile 2	-4.94493	3.40192	-1.454	0.150	-1.99050	2.31503	-0.860	0.3908
Quartile 3	-0.37972	4.40770	-0.086	0.932	-1.16519	1.86047	-0.626	0.5318
Quartile 4	-0.30317	4.61963	-0.066	0.948	-0.28364	1.91703	-0.148	0.8825
WAI Task Scores	0.80222	0.15673	5.119	**1.92e-06**	0.90452	0.08753	10.334	**<2e-16**
Interaction: Quartile 2 and Change in WAI Task Scores	1.92e-06	0.19811	1.422	0.159	0.08920	0.14241	0.626	0.5317
Interaction: Quartile 3 and Change in WAI Task Scores	0.01087	0.25421	0.043	0.966	0.07093	0.11944	0.594	0.5532

Interaction: Quartile 4 and Change in WAI Task Scores	-0.01763	0.26443	-0.067	0.947	-0.02573	0.12053	-0.213	0.8312
Observations	85				226			
R^2 / R^2 adjusted	0.6394/ 0.6094				0.6649 / 0.6545			

Table 12: Effect of Time Quartile Interaction on Relationship between WAI Task subscale and WAI Bond Subscale

Effect of Time Quartile Interaction on Relationship between WAI Task subscale and WAI Bond Subscale								
	Group 1				**Group 2**			
Coefficients	*Estimates*	*Standard Error*	*T-Statistic*	*P-Value*	*Estimates*	*Standard Error*	*T-Statistic*	*P-Value*
Intercept	0.32295	3.95205	0.082	-	1.60905	1.97280	0.816	-
Quartile 2	4.28388	4.33968	0.987	0.326	4.86633	2.94214	1.654	0.0995
Quartile 3	-0.01497	5.65900	-0.003	0.998	1.58228	2.57466	0.615	0.5395
Quartile 4	1.79403	6.01915	0.298	0.766	1.38259	2.87347	0.481	0.6309
WAI Bond Scores	0.93456	0.21192	4.410	**3.04e-05**	0.79872	0.11321	7.055	**2.12e-11**
Interaction: Quartile 2 and Change in WAI Bond Scores	-0.25651	0.23842	-1.076	0.285	-0.23839	0.16674	-1.430	0.1542
Interaction: Quartile 3 and Change in WAI Bond Scores	-0.02825	0.30648	-0.092	0.927	-0.10549	0.14813	-0.712	0.4771

Interaction: Quartile 4 and Change in WAI Bond Scores	-0.11758	0.32533	-0.361	0.719	-0.06875	0.16406	-0.419	0.6756
Observations	85				225			
R^2 / R^2 adjusted	0.539/ 0.5006				0.4308/ 0.413			