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Evaluating Effects of Deposit Contracting on Oral Contraceptive Adherence

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Evaluating Effects of Deposit Contracting on Oral Contraceptive Adherence

by

Sandy Au Yeung

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts in Applied Behavior Analysis
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ABSTRACT

There is a high prevalence of nonuse and imperfect use of oral contraceptives (OCs) that can result in multiple consequences, one of which is unintended pregnancy. Deposit contracting may be promising for increasing OC adherence, however, there is little research testing deposit contracting on oral contraceptive adherence. In addition, studies have concluded that young women with elevated stress symptoms are at risk of contraceptive nonuse. Purposes of this thesis were to evaluate effects of deposit contracting on OC use for women, and the relation of stress to timely pill consumption. In addition, reliability was measured between the different measurements used to determine OC usage in the study. We recruited 10 college-aged female participants who were distributed into three cohorts. During baseline phase, participant’s deposit returns were based on submitting daily “selfies” (optional), weekly OC blister packs photos, weekly completed PSS-4 forms, and weekly completed pill diaries on time. During the deposit contracting phase, participants were to continue submitting all the weekly reports, but the deposit returns were contingent also upon submitting daily “selfies” on time. Results of latency of pill consumption and percentage of imperfect use showed that deposit contracting was effective in decreasing percentages of OC imperfect use, decreasing the latency in pill consumption, and increasing OC adherence for participants with stress. Results of the study also indicated that reliability was mixed between the different form of data collections on OC adherence.
CHAPTER ONE:
INTRODUCTION

Evaluating Effects of Deposit Contracting on Oral Contraceptive Adherence

Oral contraceptive (OC) use is a commonly used form of contraception in the United States (Daniels, Mosher, & Jones, 2013; Jones, Mosher, & Daniels, 2012). It is estimated that about four of every five women in the United States have used OCs (Daniels, Mosher, & Jones, 2013). OCs are prescribed to prevent pregnancy, treat acne, treat cysts/tumors, and relieve symptoms of premenstrual problems (Fletcher, Bryden, & Bonin, 2001).

However, there is a high prevalence of nonuse and imperfect use of OC, which are defined as missing pills, taking pills out of order, and starting an OC early or late (Rosenberg & Waugh, 1999). On average 4.7 OCs pills are missed per person, per cycle (Hou, Hurwitz, Kavanagh, Fortin & Goldberg, 2010). In the United States, it is estimated that less than one million unintended pregnancies are correlated to OC use, misuse, or discontinuation (Rosenberg, Waugh, & Long, 1995). Other consequences of nonuse and imperfect use of OC are bleeding irregularities (Rosenberg & Waugh, 1999), early cycle of menstruation (Rosenberg & Waugh, 1999), and estrogen-related side effects such as nausea, breast tenderness, weight gains, and headaches (Rosenberg & Waugh, 1999).

Economic cost of missing oral contraceptives can be related to medical risks such as unintended pregnancies. In a study by Trussell (2007), it was estimated that direct medical cost of an unintended pregnancy averages to $1609, which is calculated by the total costs of births,
induced abortions, and fetal losses divided by the total number of unintended pregnancies in the United States annually. In a study that evaluated the clinical and economic impact of 15 contraceptive methods, the cost effectiveness of oral contraceptives over five years was estimated to be a saving of $12,879 over no method of contraceptive use (Trussell et al., 1995).

In an article on health economics of contraception, Mavranezouli (2009) noted that inconsistent adherence of contraceptive usage reduces the effectiveness of the contraceptive compared with perfect usage, which consequently, reduces their cost effectiveness.

One known risk factor for imperfect use is stress (Hall, Moreau, Trussell, & Barber, 2013a). In a study by Hall et al. (2013a), the researchers examined the impact of depression and stress symptoms on contraceptive method use in women 18-20 years old. The researchers used the Center for Epidemiology Studies- Depression Scale- 5 (CES-D-5) to screen and assess depressive symptoms over the previous week, and the use of the Perceived Stress Scale (PSS-4) to screen and assess stress symptoms through the previous month. The researchers used the standardized cutoff of \( \geq 4 \) points and \( \geq 9 \) points to indicate moderate/severe depression and stress, respectively. Through the use of univariate and bivariate statistics, the researchers used it to compare weekly contraceptive methods among women with and without moderate/severe psychological conditions. The sample’s mean baseline for CES-D-5 depression and PSS-4 stress scores were 3 ± 3 points and 6 ± 3, respectively. When it pertained to women’s depression and stress symptoms, the researchers found that there was a 62% correlation of women with moderate/severe depression symptoms also had moderate/severe stress symptoms. In unadjusted analyses, the researchers found that women with moderate/severe depression and stress symptoms had higher proportions of weeks in which no contraceptive was used compared with those without depression and stress symptoms. Through statistical analyses, the researchers
found that women with moderate/severe stress had twice the odds of contraceptive nonuse than women without stress. Also, the relative risks for nearly all combinations of dual methods use were lower than for single methods use among women with moderate/severe stress symptoms. The researchers concluded that psychological stress symptoms predicted weekly nonuse of contraceptive methods, that stressed women at risk of pregnancy had more than twice the odds of not using contraception than women without elevated stress symptoms, and that stressed women had higher relative risks of using coital methods such as condoms and withdrawal. Therefore, the researchers in the study suggest young women with elevated stress symptoms are at risk of contraceptive nonuse.

Another study by Hall, Moreau, Trussell, and Barber (2013b) found through statistical analysis that stress was negatively associated with weekly contraceptive consistency for nearly all contraceptive methods. In addition, the researchers noted that though depression and stress in their sample were highly correlated, stress exhibited the most consistent negative association with contraceptive use, overall, and across method types.

Assessment of OC adherence has varied among different interventions. Past literature has reported the challenges of studying OC adherence due to the lack of a reliable well-defined measurement of OC use (Castaño & Westhoff, 2013; Hall, White, Reame, & Westhoff, 2010; Trussell & Portman, 2013). Castaño and Westhoff (2013) reasoned that the difficulty in measuring OC adherence could possibly be that the method used to calculate OC adherence must fulfill the needs of a certain study and the resources available. In addition to the challenges of assessment of OC adherence, assessments of reliability and validity are rarely described (Hall et al., 2010). Subjective forms of measurements such as surveys and interviews (Berenson & Rahman, 2012; Castaño, Bynum, Andrea, Lara, & Westhoff, 2012; Garbers, Meserve, Kottke,
Hatcher, & Chiasson, 2012; Hall et al., 2010; Hughey, Neustadt, Mistretta, Tilmon, & Gilliam, 2010; Rosenberg & Waugh, 1999), daily diaries (Hou et al., 2010; Huber et al., 2013; Woods et al., 2006), and postcards (Huber et al., 2013) have been common forms of data collection on nonuse and imperfect use.

There have been a few studies that have used more direct measurements of nonuse and imperfect OC use in the forms of pill counting (Lee et al., 2007; Rudd et al., 1989), electronic monitoring devices (Halls et al., 2010; Hou et al., 2010), and pharmacy claims data (Pittman et al., 2011). However, those forms of measurements mentioned have been noted as possibly being tedious, difficult to collect, expensive, and not providing information on when OCs are consumed, but rather only possessed (Halls et al., 2010; Lee et al., 2007; Rudd et al., 1989).

Recently, other medication adherence studies have used other direct forms of measurements such as directly observed therapy (DOT) (Au-Yeung & DiCarlo, 2012; Park et al., 2014), biomarkers (Castaño & Westhoff, 2012; Hall et al., 2010; Westhoff, Petrie, & Cremers, 2013), wireless observed therapy (WOT) (Au-Yeung & DiCarlo, 2012; DiCarlo, 2012), and video/photo-assisted observation (Galloway, Coyle, Guillen, Flower, & Mendelson, 2011; Hoffman et al., 2010) that may be promising for measurements of OC use. These measurements provide accurate accounts of consumption (i.e. via direct observation, urinary sample, and electronic sensor), patterns of use recorded, collection ease, convenience, and cost efficiency (Au-Yeung & DiCarlo, 2012; Castaño & Westhoff, 2013; Galloway et al., 2011; Hall et al., 2010; Hoffman et al., 2010; Park, Howie-Esquivel, & Dracup, 2014; Westhoff, 2013).

A number of studies have tested interventions to increase OC use. Knowledge-based and cue-based interventions have been used either alone or in combination with each other. Knowledge-based interventions include education, routine care, and educational text messages.
that involve providing OC counseling and educational information of OC use (Berenson & Rahman, 2012; Castaño et al., 2012; Garbers et al., 2012). Cue-based interventions used to increase OC adherence typically involve the use of face-to-face behavioral counseling and electronic reminders in the form of either text messages, pager messages, or other (Berenson & Rahman, 2012; Hou et al., 2010; Vervloet et al., 2012). However, both interventions have had multiple studies showing no significance in improving OC adherence compared to those in control groups or between knowledge-based and cue-based interventions (Berenson & Rahman, 2012; Hou et al., 2010; Rigsby et al., 2000).

A study by Castaño et al. (2012), compared participants who received routine care to participants who received routine care plus daily educational text messages on OC continuation. In the study, the routine care consisted of contraceptive counseling and educational information handouts explaining the use, effectiveness, benefits, and risks of using contraceptives. The daily educational text messages that were sent in the study consisted of an introductory message, a few reminders on how to edit contact information or message time, a few contents from the educational information handouts, some quality control messages, and a final message. Collected through telephone calls interviews, the researchers found that participants who received daily educational text messages had 10% more in continued users versus participants who only received routine care. However, in the study, the improved continuation in the participants who received daily educational text messages did not persist in continued use after the texts were discontinued at six months.

A study by Garbers et al. (2012), compared participants who received a module intervention that was a knowledge-based intervention to participants who received the module intervention plus tailored health messages. The results of the study showed a significant
improvement of OC continuation and adherence in the group that received a module intervention with tailored health messages based off self-reports collected. However, a limit of the study was its reliance on self-report, and noted that additional research is needed on the impact of the module intervention with tailored health messages on continuation and adherence over a longer time period.

Incentive-based interventions have been shown to be effective in medication adherence, such as naltrexone adherence by patients with heroin dependence (Preston et al., 1999) and antiretroviral adherence by patients who were HIV-infected (Rigsby et al., 2000).

One unique incentive-based intervention, behavioral contracting, has been shown to be an effective method in increasing behavior such as physical activity (Wysocki, Hall, Iwata, & Riordan, 1979) and supplement ingestion (Epstein & Masek, 1978).

One particular form of behavioral contracting is deposit contracting which involves participants depositing their own money in advance and receiving their deposit back if they adhere to the behavior change, but forfeit the money if they do not adhere (Halpern, Asch, & Volpp, 2012). Deposit contracting has been shown to be effective in abstinence for cigarette smoking (Dallery, Meredith, & Glenn, 2008), and disulfiram tablets ingestion (Bigelow, Strickler, Liebson, & Griffiths, 1976). In a study by Wysoki et al. (1979), participants deposited six items of personal value, one of which was money made out to a charitable organization. Participants in the study could earn part of their money or other personal items back each week if they met the weekly aerobic point criterion in the presence of other participants, recorded another participant engaging in an exercise, and submitted reliability data at least once each week. Results of Wysoki et al., (1979) study showed that for both groups of participants in a multiple baseline design, both groups increased their average number of aerobic points once the
behavioral contract was introduced, decreased to zero when there was a week break from the behavior contract, and increased when the behavior contract was reintroduced for both groups of participants.

When it comes to deposit contracts and behavioral change, there is little empirical evidence in examining the effectiveness of deposit contracts (Giles, Sniehotta, McColl, & Adams, 2015). However, corporations using deposit contracts which can also be known as commitment contracts are starting to emerge but further research is needed to assess the efficacy, acceptability, effectiveness, cost effectiveness, and targeting (Halpern et al., 2012). There is little research on deposit contracting on OC adherence. In addition, no interventions have been evaluated to address OC adherence in individuals with stress. Therefore, the purpose of this thesis was to evaluate effects of deposit contracting on OC use for women and the relation of stress to timely pill consumption. In addition, reliability will be measured between the different measurements used to determine OC usage in the study.
CHAPTER TWO:  
METHOD  

Note to Reader  
Portions of this chapter, specifically regarding the PSS-4 form, has been previously published in Cohen, S., Kamarck, T., and Merlstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*, 385-396, and have been reproduced with permission from Dr. Cohen. Please see Appendix F.  

Participants and Setting  
We recruited 10 participants. Each were assigned to one of three cohorts. Cohort A and B had 3 participants, while Cohort C had four participants. Participants were assigned to cohorts until they contained at least three participants and were available to begin. Cohort B started the study first, followed by Cohort A, and finally Cohort C.  

We recruited college-aged females that met the following inclusion criteria: aged 18 to 25, agreed that they were financially stable and could deposit $64 or more to be in the study, owned a usable smart phone, were prescribed to at least a 21 count OCs in blister pack form, and were instructed to consume OCs once a day daily (ex. 21 active OC + 7 placebo). Out of 10 participants, only seven participants had placebo days. Participants were able to participate in the study when they had already started the blister pack or were about to start on the blister pack contingent with the study.
Participants were given the monthly PSS-4 form to see where they scored as far as their stress level. Previous work found that women who had moderate/severe stress symptoms, as assessed by the PSS-4, had more than twice the odds of contraceptive nonuse than women without stress (Hall et al., 2013a). In addition, women with moderate/severe depression and stress symptoms were less likely to use long-acting methods than OCs, and women with stress symptoms were more likely to use condoms or withdrawal method than non-coital methods. The same authors in another study found that there was a negative correlation between women with moderate/severe depression and stress symptoms to weekly contraceptive consistency, especially among the usage of withdrawal methods, condoms, and OCs (Hall et al., 2013b). Detailed description of PSS-4 is provided in the material section below.

Recruitment consisted of distributing IRB-approved flyers at University of South Florida’s student union center, USF announcement boards, student health clinic, classrooms, and bathrooms. Facebook posts and e-mails were also used for recruitment. The principal investigator met with each participant individually to discuss the study and obtained consent.

Data collection took place wherever the participants planned to take their daily OC, and were comfortable in taking a picture of themselves taking the OC to submit to the researchers.

**Materials**

Pre- and post-intervention surveys were provided to the participants at the start and end of the study to evaluate social validity. Prior to the start of the study, participants received a survey asking how they view the study and their expectations of their success in intervention (see Appendix A). At the end of the study, participants received a similar survey asking how they viewed the study and its effects (see Appendix B).
Wickr by Wickr, LLC is a phone application that was available for iOS and Android devices, it was downloaded in the smart phones of the researchers and participants, and was used for photo submissions and text message exchanges.

A Venmo account was created for the purposes of privately receiving and distributing monetary participation incentives to participants.

Participants was advised to have a password protected smartphone to receive messages from the principal investigator.

The PSS-4 was used to measure experienced levels of stress (Cohen, Kamarck, & Mermelstein, 1983). This study administered the PSS-4 (as adapted by Hall et al., 2013a), to screen for stressful life situations over the previous week (see Appendix C). Questions were presented in a five-point Likert format from zero (never) to four (very often) with total scores ranging from zero to 16. Higher scores indicate higher perceived stress. Scores of 9 points or more were considered the standardized cutoff to determine moderate stress (Hall et al., 2013a). An electronic version of the PSS-4 form was distributed weekly to participants via Google Inc’s Form.

Wickr was used to send a text message containing the daily keyword that participants had to include in their photo submission of themselves either by displaying on a white board or piece of paper. This was to help ensure that participants did not forge the date their verification photos were taken. The daily keyword was sent to each participant before their two-hour time frame.

Google Inc.’s Form was used for participants to submit the weekly self-report pill diary that specifically asked from Monday-Sunday, how many pills were missed (i.e. not taken within a two-hour time frame or not taken at all that day) and the time of consumption for each day.
Data Collection

The primary dependent measure was the latency of OC consumption time as indicated by participants in a weekly pill diary. The latency of OC consumption time was calculated by subtracting the time the participant reported that she took her pill to the start time of her agreed two-hour time frame. Imperfect use or missed pill use was also evaluated and was defined as when a participant did not take her pill within the agreed two-hour time frame. The weekly pill diary was sent to participants at the beginning of the study. The weekly pill diary asked from Monday-Sunday, how many pills were missed and the times they consumed their pill. Participants were expected to send the completed weekly pill diary on the seventh day/Sunday by no later than 11:59 PM via electronic mail and continue completing the weekly pill diary until the end of the study.

In addition to the pill diary, participants also submitted photos of the OC blister pack on the seventh day (Sunday) of each week by no later than 11:59 PM. Participants were instructed to mark on blisters (i.e. placing an “X” using a marker) that were missed either not taken within the two-hour time frame or not consumed that day. The amount of marked blisters pills missing from the week on the blister pack served as a permanent product of pills missed to help provide some reliability for the weekly pill diaries.

Weekly submissions of completed PSS-4 forms were collected to monitor levels of perceived stress. Scores from the PSS-4 were examined and compared in relation to the total amount of missed OC and time latency of pill consumption of the entire study during baseline and deposit contracting phases. Participants were to complete and send on the seventh day/Sunday via Google Form each week.
In the deposit contracting phase, additional data on OC usage were collected by having participants send a “selfie” via text message to the experimenter once a day. According to this measure, Perfect OC Usage was defined as photos that met the following four criteria: a picture that (1) showed the participant’s face, (2) showed the prescribed OC on her tongue, (3) showed the assigned keyword, and (4) was sent within an agreed-upon two-hour time frame. The submission time of the photo was then used to calculate the latency of pill consumption by subtracting the submission time to the start time of the agreed two-hour time frame. Daily “selfies” were submitted via Wickr phone application from participants to the experimenters. Imperfect OC use was also considered when any of the four criteria mentioned were not met.

“Selfies” were collected via the experimenter’s and research assistant’s smart phones through the Wickr phone application on a daily basis during the deposit contracting phase of the study. The experimenter sent messages to the participant as a confirmation of receiving a photo from participants during the deposit contracting phase.

On Sunday afternoon around 5:00 PM, the experimenter sent text-message reminders to participants who had not sent in the weekly data (i.e. completed weekly pill diaries, PSS-4 forms, and photo of blister pack) to do so. Participants who had sent in their weekly data one day late (i.e. by 5:00 PM on Monday) were given half the money earned dependent on study phase.

**Interobserver Agreement**

Interobserver agreement of weekly reports (i.e. submissions of completed pill diaries, completed PSS-4 forms, and OC blister pack photos) were assessed by having a secondary observer independently having access to submissions of the weekly reports from participants. An agreement for pill diaries was defined as two observers calculating the same PSS-4 scores from the PSS-4 submissions, recording the same time submissions reported specified from the pill
diaries, and recording the same number of blisters marked with an “X” indicating that a pill was missed from the blister pack photos.

Interobserver agreement of “selfie” submissions were assessed by having a secondary observer independently receive photo submissions via smart phone from participants, and by recording the electronic timestamps that includes the date and time that the “selfies” were delivered and whether participants had perfect or imperfect use for each day. An agreement was defined as two observers (i.e. the primary and secondary observers) recording the timestamps labeled on the “selfies” and that the participant had perfect or imperfect use for that day.

Agreement data was collected during at least 30% of the data in each phase for each cohort. The secondary observer was trained on the study procedures and protocol for filling out the interobserver agreement form. Interobserver agreement was calculated by dividing the number of agreements on pill diary submissions, blister pack photos, PSS-4 forms, “selfie” submissions, and percentage of imperfect uses by the number of agreements plus disagreements and converting this ratio to a percentage by multiplying it to 100. The total average of agreement between the different modes of data collection for each week were then averaged across all the weeks of each phase to calculate baseline phase and deposit contracting phase IOA. Results of the IOA described below.

Procedure

Following the consent process, participants were oriented to the contract between participant and principal investigator (see Appendix D). The Principal investigator went over with each participant on how to create and use Venmo, Wicker, and Google Form. The principal investigator oriented participants to the social-validity questionnaire to fill out. At the beginning of the study, each participant was instructed through the creation of a Venmo account, where she
agreed to submit $64 or more to a designated Venmo account controlled by the principal investigator, and agreed to a two-hour time frame that she thinks she will be able to submit photos on a daily basis. The maximum a participant could deposit was $256. Please refer to Table 1 for how $64 was calculated. At the beginning of the study, participants could negotiate for a larger dollar deposit than $64 if they thought that $64 ($4 per week) was not enough for them to engage in perfect OC usage. Participants had the opportunity to earn back all of their money by having perfect OC use via daily “selfie” within the two-hour time frame, submission of weekly PSS-4 forms, submission of weekly pill diary, and photo submission of weekly OC blister packets over the baseline and deposit contracting phases.

In addition, at the beginning of the study, the principal investigator went over the baseline and deposit contracting phases. Participants were trained and provided examples of completing and submitting weekly completed pill diaries, daily “selfies,” weekly photo submission of blister packs and weekly completed PSS-4 forms.

**Baseline**

The baseline phase consisted of the participants submitting daily “selfies,” (optional) weekly OC blister packs photos, weekly completed PSS-4 forms, and weekly completed pill diaries, which are displayed in Table 1. Participants were told that they were expected to send a daily selfie if they take their OC but there were no differential consequences for sending the “selfies” or not. However, submission of the completed weekly PSS-4 form, completed weekly pill diary, and photo of the OC blister packet with markings on imperfect days earned the participant four dollars or lose four dollars if she did not submit on the seventh day (Sunday) by no later than 11:59 PM. The average latency across weeks via time submissions from weekly completed pill diaries were analyzed for when to start the deposit contracting phase.
Table 1. Submissions for Baseline vs. Deposit Contracting Phases

<table>
<thead>
<tr>
<th>Weekly/Sunday submission</th>
<th>Baseline</th>
<th>Deposit Contracting</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSS-4 form</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Pill diary</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Picture of blister pack</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Monetary amount received:</td>
<td>$4</td>
<td>$0.50</td>
</tr>
</tbody>
</table>

Daily submission

<table>
<thead>
<tr>
<th>Monetary contingent on daily selfie submission of OC on tongue and keyword</th>
<th>Baseline</th>
<th>Deposit Contracting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monetary amount received:</td>
<td>$0</td>
<td>$0.50</td>
</tr>
<tr>
<td>Total monetary amount received:</td>
<td>$4</td>
<td>$4</td>
</tr>
</tbody>
</table>

Note: Monetary amount is based on if participants agree to deposit $0.50 to therefore be able to earn back $4 a week over 16 weeks.

Deposit Contracting

The deposit contracting phase consisted of participants submitting daily “selfies,” weekly photos of OC blister packs, weekly completed pill diaries, and weekly completed PSS-4 forms, which are displayed in Table 1. During the deposit contracting phase, daily “selfie” submission in an agreed two-hour time frame earned the participant her 50 cents back or lose 50 cents if she did not submit the daily “selfies” in an agreed two-hour time frame. Submission of the completed weekly PSS-4 form, completed weekly pill diary, and photo of the OC blister packet with
markings on imperfect days earned the participant 50 cents back or lose 50 cents if she did not submit on the seventh day (Sunday) by no later than 11:59 PM.

During the deposit contracting phase, participants lost 50 cents for each day they had imperfect use. For example, if a participant was to have imperfect use for three days then she would lose $1.50 in total and receive at least $2 back at the end of the 7-day interval (Monday-Sunday). Conversely, those participants who had perfect use were be transferred a 0.50 plus an equally shared amount of money retained from those participants with imperfect use over those days. Earned money was be distributed back to participants every eighth day. Specifically, on the following Monday, the participants who had perfect use for seven days (Monday-Sunday) received $3.50 plus the split money that the participants who lost their X dollar amount for the week via Venmo.

In both baseline and deposit contracting phases, all money awarded to participants due to perfect use or success in submitting required weekly reports was distributed on the eighth days (Mondays) by no later than 11:59 PM. All money not awarded to participants due to imperfect use or failure to submit required weekly reports was forfeited to the principal investigator to be redistributed to other participants with perfect use. Participants who deposited above $64 and had imperfect use on some or all days during the study had the option of donating the money to a charity of choice. Only one participant chose to donate more than $64 and that individual did not elect to donate her losses to charity.

Treatment integrity

Treatment integrity of the primary experimenter’s implementation of baseline and deposit contracting phases was assessed by a secondary observer. The following categories of experimenter behavior were assessed by : (a) texting back a confirmation message to participants
who sent a “selfie” within the agreed two-hour time frame, (b) depositing the money earned by
the designated eighth days (Mondays) to participants who engaged in perfect use or submitted
weekly OC blister pack photos, weekly completed PSS-4 forms, and weekly completed pill
diaries by the designated seventh day (Sunday), and (c) splitting the money that was lost by
participants who had imperfect use, as evenly as possible to participants who had perfect use on
any given day for each cohort.

Designs

According to Hou et al. (2010), OC users typically missed around 1.2 pills per week. In
order to increase the chances of capturing an improvement in adherence while still leveraging the
strengths of single-subject design logic (e.g., repeated measures, replication), we assigned
participants to three cohorts, in a multiple-baseline-across-cohorts designs, and effectively
treated each cohort as a single organism. The study duration was determined in advance to be 16
weeks. This was done in order to provide participants clear expectations about how much they
needed to deposit during recruitment and informed consent, how much they could earn
throughout the duration of the study, and to make sure we only needed to collect deposits once at
the beginning of the study.

Percentage of Imperfect Use

The percentage of imperfect use across weeks was arranged in a non-concurrent
multiple-baseline-across cohort design. The conditions of the percentage of imperfect use was in
a AB design, with baseline first introduced and then the deposit contracting phase. Data on pills
missed were collected by pill diaries, blister pack photos, and “selfies.” Calculation of imperfect
use was calculated by adding the number of pills missed during a week reported by the three
forms of data collections and then divided by the number opportunities/days that participants in a
cohort were to consume their pills for that week. Although there were incentives for participants to submit selfies during the deposit-contracting phase, those were not present during baseline. Therefore, we chose to make the pill diaries the primary measure because it was available across all experimental phases and we used the selfie data to validate the pill diary and blister-pack photos during the deposit-contracting phase.

Percentages of imperfect use were also arranged in two bar graphs to show comparisons of percentage of imperfect between baseline and deposit contracting phases. One bar graph of percentages of imperfect use reported from pill diaries and another bar graph from blister packs. Percentage of imperfect use from each cohort and then all cohorts collectively, were graphed and compared.

**Average Latency of Pill Consumption**

The average latency of pill consumption across weeks was arranged in a non-concurrent multiple-baseline-across cohort design. The conditions of the average latency of pill consumption was in an AB design, with baseline first introduced and then the deposit contracting phase. Data on the average latency of pill consumption were collected by pill diaries and “selfies.” Through pill diary data collection, participants had recorded the time that they take their pills. Through “selfie” submissions, the timestamps were recorded of when the “selfie” were delivered. The average latency across weeks was calculated by calculating the average latency via pill diaries and “selfies” of all the participants of one cohort for each week. The researcher subtracted the times participants reported that they took their pill through pill diaries, or the timestamps through “selfie” submissions to the initial time they agreed that they would take their pill. The researcher then added the differences of all the participants in that cohort together and divided by the number of participants that decided to take their pills for the week.
For example, if a participant’s initial time frame was 7:00 AM and she reported that she consumed her pill at 8:30 AM then the participant’s latency would be one hour and 30 minutes.

**Stress and Missed Pill Consumption**

The proportion of missing pill consumption of all three cohorts compared to stress reported in baseline and deposit contracting phases were evaluated in a bar graph. Calculation for proportion of pills missed were calculated by the number of pills missed divided by the number of opportunities for pill consumption during baseline and deposit contracting phase.

**Stress and Average Latency**

Average latencies of pill consumption of all three cohorts in minutes were compared to stress scores in a scatter plot. Average latencies were calculated by data submitted from “selfie” submissions and pill diaries, and the stress scores were reported by the PSS-4 forms. Correspondence was evaluated using a best-fit line using Excel’s built-in trend line function, and the resulting slopes and r-squared values were examined to evaluate the relation of average latencies to stress scores.

**Average Latency of Each Day of the Week**

The average latency of pill consumption of each day of the week via pill diaries and “selfies” were evaluated in a bar graph design. The average latency of pill consumption included all three cohorts and were split into three categories: pill diaries during baseline, pill diaries during intervention, and “selfie” submissions during intervention. All three categories were compared in relation to the average latency and each day of the week.

**Reliability**

Reliability of the participants OC usage was measure by comparing the percentage of imperfect use reported from pill diaries, blister packs, and “selfies” submitted. Microsoft’s Excel
software was used to calculate the Pearson’s correlation coefficient between pill diaries and blister packs, between pill diaries and “selfies”, and between blister packs and “selfies”. The statistical package cor.test found in R was used to calculate Pearson’s product moment correlation on the percentage of imperfect use for each week for all the cohorts and the values were then placed in Table 2.

Reliability was also evaluated in a scatter plot on the percentage of missed pills between pill diaries and blister packs, between pill diaries and “selfies”, and between blister packs and “selfies.” Additionally, a scatter plot was used to evaluate the reliability of latency of OC consumption between pill diaries and “selfies” during deposit contracting phases.
CHAPTER THREE:

RESULTS

Percentage of Imperfect Use

Percentage of imperfect use results are showed for the three cohorts in a multiple-baseline-across cohorts design in Figure 1. For Cohorts A and C, the average percentage of imperfect use decreased during the deposit contracting phase compared to baseline phase. For Cohort B, there was no difference in the average percentage of imperfect use between baseline and deposit contracting phases.

Percentage of imperfect use results were also displayed in two bar graphs in Figure 2 and 3. During the baseline phase, Cohort A’s average percentage of imperfect use via pill diary was 45% and blister pack was 33%. During deposit contracting phase, Cohort A’s average percentage of imperfect use via pill diary and blister pack both decreased to 8% and 6% respectively.

During the baseline phase, Cohort B’s average percentage of imperfect use via pill diary was 2% and blister pack was 1%. During deposit contracting phase, Cohort B’s average percentage of imperfect use via pill diary and blister pack remained at 2% and 1%, respectively.

During the baseline phase, Cohort C’s average percentage of imperfect use via pill diary was 20% and blister pack was 15%. During deposit contracting phase, Cohort C’s average percentage of of imperfect use via pill diary and blister pack both decreased to 4% and 3%, respectively.
Figure 1. The percentage of imperfect OC use across baseline and deposit contracting phases for Cohort A, B, and C. Open squares indicate data from blister pack photo submissions. Closed circles indicate data from photo submissions or “selfies”. Closed triangle indicate data from pill diaries.

The percentage of imperfect use for all cohorts combined during baseline phases from pill diaries was 20% and from blister packs was 15%. During the deposit contracting phases for
all the cohorts combined, the percentage of imperfect use decreased from both pill diaries and blister packs to 4% and 3%, respectively.

**Figure 2.** The percentage of imperfect use reported from pill diaries across each cohort and then all collectively. The black bars indicate the percentage of imperfect use during baseline phases. The grey bars indicate the percentage of imperfect use during deposit contracting phases.

**Figure 3.** The percentage of imperfect use reported from blister packs across each cohort and then all collectively. The black bars indicate the percentage of imperfect use during baseline phases. The grey bars indicate the percentage of imperfect use during deposit contracting phases.
Average Latency of Pill Consumption

Average latency of pill consumption across weeks’ results are showed for the three cohorts in a multiple-baseline-across cohorts design as average latency of pill consumption across weeks in Figure 4. The deposit contracting phase was introduced to all three cohorts in a staggered fashion once there were a steady increasing trend (i.e. Cohort A and C) or a steady trend (i.e. Cohort B).

Through visual analysis, it appears that the range of the average latency of pill consumption via pill diaries and “selfies” decreased during deposit contracting phases across all three cohorts compared to the average latency of pill consumption via pill diaries baseline phases. In addition, the average latency of pill consumption across weeks via pill diaries and “selfies” appears to be less variable during the deposit contracting phases compared to average latency of pill consumptions via pill diaries during baseline phases across all cohorts.

Through calculations, the average latency of pill consumptions via pill diaries and “selfies” during deposit contracting phases decreased for all three cohorts compared to the average latency of pill consumptions via pill diaries during baseline phases.

During the baseline phase, Cohort A’s average latency of pill consumption use via pill diary was about 345 minutes, 125 minutes over the 120 minute (2 hour) time frame. During deposit contracting phase, Cohort A’s average latency of pill consumption uses via pill diary decreased to about 74 minutes. In addition, during the deposit contracting phase, the average latency of pill consumption uses via “selfie” for Cohort A was about 75 minutes.

During the baseline phase, Cohort B’s average latency of pill consumption use via pill diary was about 51 minutes. During deposit contracting phase, Cohort B’s average latency of pill consumption uses via pill diary decreased to about 37 minutes. In addition, during the deposit
Figure 4. The average latency of pill consumption in across baseline and deposit contracting phases for Cohort A, B, and C. Closed circles indicate data from “selfies”. Closed triangle indicate data from pill diaries.
contracting phase, the average latency of pill consumption via “selfie” for Cohort B was about 34 minutes.

During the baseline phase, Cohort C’s average latency of pill consumption via pill diary was about 71 minutes. During deposit contracting phase, Cohort C’s average latency of pill consumption via pill diary decreased to about 52 minutes. In addition, during the deposit contracting phase, the average latency of pill consumption via “selfie” for Cohort C was about 55 minutes.

**Stress and Missed Pill Consumption**

At the beginning of the study, only one out of ten participants scored as having moderate to severe stress (i.e. scoring 9 or higher) from the monthly PSS-4 form. Participants who score at moderate to severe stress on their weekly PSS-4 forms had a higher proportion of pills missed reported through their pill diaries than participants who score at none to mild stress (i.e. scoring less than 9) in the baseline phases by a 46% increase, but not during the deposit contracting phases (See Figure 5). During the deposit contracting phases, there was a higher proportion of pills missed for participants who scored at none to mild stress than participants who scored as moderate to severe stress by a 5% increase. However, the proportion of pills missed for participants who scored at none to mild stress during deposit contracting phases were lower than the proportion of pills missed for participants who scored at none to mild stress during baseline phases by a 5% decrease. The bar graph supports that deposit contracting may decrease the number of pills missed, even when scoring at moderate to severe stress.

**Stress and Average Latency**

Stress scores in relation to the average latency of pill consumption was also evaluated in a scatter plot (See Figure 6). The results showed an increasing trend line for stress scores and the
average latency of pill consumption. In addition, the trend line equation showed that as the stress score for a participant increases the average latency of pill consumption increases by about 15 minutes. The scatter plot supports that the higher the stress level a participant reported, the longer the time the participant waited to consume her pill.

![Stress and Missed OC](image)

**Figure 5.** Proportion of OCs missed during baseline (BL) and deposit contracting (DC) phases, specifically when participants score on the PSS-4 as having moderate/severe stress (Stress) or below (No Stress). “n” represented the number of opportunities (participant-days).

**Average Latency of Each Day of the Week**

The average latency of pill consumption for each day of the week for all cohorts were evaluated (See Figure 7). Based on pill diaries submitted during baseline phases, Thursday had the highest average latency of pill consumption at about 199 minutes, and Sunday had the lowest average latency pill consumption at about 76 minutes. Based on pill diaries submitted during deposit contracting phases, Wednesday had the highest average latency of pill consumption at
about 64 minutes, and Thursday had the lowest average latency pill consumption at about 52 minutes. Based on “selfies” submitted during deposit contracting phases, Friday had the highest average latency of pill consumption at about 93 minutes, and Tuesday had the lowest average latency pill consumption at about 50 minutes.

**Figure 6.** Average latency of pill consumption in minutes in relation to the stress scores. Open circles indicate data from photo submissions or “selfies”. Closed triangle indicate data from pill diaries.
Figure 7. Average latency of pill consumption in minutes in relation to each day of the week reported by pill diaries during baseline (P:BL), pill diaries during deposit contracting (P:BL), and “selfies” during deposit contracting (S:DC). The horizontal dotted line represents the two-hour or 120-minute time frame.

Based on visual analysis, it appears that across all cohorts and all days, there is a higher average latency in minutes reported by pill diaries during baseline phases compared to reports by pill diaries during deposit contracting phases and “selfie” submissions during deposit contracting phases. Through visual analysis, the bar graph further supports that the time of pill consumption decreases closer to the initial start time (0 minutes) of participants’ agreed two-hour time frame during the deposit contracting phase compared to baseline phase.

Reliability

The reliability between measurements use to determine OC consumption was calculated using the Pearson’s correlation coefficient function on Excel (See Table 2). There was a 78% reliability agreement between pill diary submissions and OC blister pack photo submissions.
About 73% reliability agreement between pill diary and “selfie” submissions of OC. Lastly, about 34% reliability agreement between OC blister pack photo submissions and “selfie” submissions. Based on the Pearson correlation coefficient calculations, there was a higher reliability of measurement between pill diary and blister pack, then it is pill diary and “selfies,” and then blister pack and “selfies”.

**Table 2. Pearson’s Correlation Coefficient Between Measurements**

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<tr>
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<th>Pill Diary</th>
<th>Blister Pack Photo</th>
<th>“Selfie”</th>
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</thead>
<tbody>
<tr>
<td>Pill Diary</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blister Pack Photo</td>
<td>78%*</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>“Selfie”</td>
<td>73%**</td>
<td>34%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Note: Pearson’s r tests for Pill Diary vs. Blister Pack Photo (*) and Selfie vs. Pill Diary (**) were statistically significant at (a < 0.01).

Reliability on the percentage of missed pills between pill diaries and blister packs, between pill diaries and “selfies”, and between blister packs and “selfies” are shown in Figures 8, 9, and 10. The slope and R-squared value of the linear relationship between the percentage of missed pills from blister packs and the percentage of missed pills from pill diaries were 0.61 and 0.723, respectively, when the y-intercept was forced to pass through the intercept (See Figure 8). Likewise, the slope and R-square value of the linear relationship between the percentage of missed pills from “selfies” and percentage of missed pills from pill diaries were 51% and 1.46 respectively, when the y-intercept was forced to pass through the intercept (See Figure 9). The slope and R-square value of the linear relationship between the percentage of missed pills from “selfies” and percentage of missed pills from blister packs photos were -10% and 1 respectively, when the y-intercept was forced to pass through the intercept (See Figure 10).
Figure 8. Reliability comparison of pills missed reported from pill diaries to blister packs. The 45-degree line indicates 100% in reliability. The markers on the 45-degree line means the percentage of missed pills reported from pill diaries matches the percentage of missed pills from blister packs.
Figure 9. Reliability comparison of pills missed reported from pill diaries to “selfies”. The 45-degree line indicates 100% in reliability. The markers on the 45-degree line means the percentage of missed pills reported from pill diaries matches the percentage of missed pills from “selfies”.

Figure 10. Reliability comparison of pills missed reported from blister packs to “selfies”. The 45-degree line indicates 100% in reliability. The markers on the 45-degree line means the percentage of missed pills reported from blister packs matches the percentage of missed pills from “selfies”.

The reliability of latency of OC consumption between pill diaries and “selfies” during deposit contracting phases was evaluated in Figure 11. There is an increasing trend line with a 61% correlation in latency of pill consumption reported from pill diaries to “selfies”. Based on visual analysis, a lot of data points were on or near the 45-degree line which represented 100% correlation between pill diaries and “selfies” submissions of the latency of pill consumption.
Figure 11. Reliability comparison of the latency of OC consumption during deposit contracting reported from pill diaries and selfies. The 45-degree line indicates 100% in reliability. The markers on the 45-degree line means the latency of pill consumption reported from pill diaries matches the latency of pill consumption from “selfies”.

Figures 12 and 13 shows two participants’ reliability in submitting the latency of OC consumption through pill diaries and “selfies”. When it comes to the reliability in the latency of OC consumption through pill diaries and “selfies”, Participant 1 from Cohort B had the highest reliability with 100% variance (See Figure 12). Participant 9 from Cohort C had the lowest reliability in the latency of OC consumption through pill diaries and “selfies” with a 7% variance.
Figure 12. Reliability measurement of latency between pill diaries and “selfies” for Participant 1.

Figure 13. Reliability measurement of latency between pill diaries and “selfies” for Participant 9.
**Interobserver Agreement**

For Cohort A, there was 100% interobserver agreement out of 43% of data from baseline and 33% of data from deposit contracting phase. For Cohort B, there was 100% interobserver agreement out of 33% of data from baseline and 57% of data from deposit contracting phase. For Cohort C, there was 100% interobserver agreement from 40% of data from baseline and 33% from deposit contracting phase.

**Treatment Integrity**

For Cohort A, there was 100% treatment integrity out of 33% of data from baseline and 33% of data from deposit contracting phase. For Cohort B, there was 100% treatment integrity out of 67% of data from baseline and 43% of data from deposit contracting phase. For Cohort C, there was 100% treatment integrity from 40% of data from baseline and 33% from deposit contracting phase. For splitting the weekly deposit returns as evenly as possible, at the end of the study, there were $0.10 left over from Cohort C, due to splitting money three ways because one participant had late submissions of weekly reports and missed “selfie” submissions. Because no participant indicated a preferred charity, the researcher chose a charity and donated the remaining funds along with a larger personal contribution.

**Social Validity**

**Pre-survey**

Overall, for the pre-survey, more participants agreed that they would have success in sending daily photos (“selfies”) and in the behavioral contract outlining their responsibilities as compared to any other outcome. More participants agreed that the daily photo submission and the behavioral contract would not be difficult. More participants agreed that their OC adherence should improve by participating in sending daily photos and the behavioral contract as compared
to any other outcome. More participants agreed they will be able to stick with sending daily photos. More participants agreed that sending daily photos and following the behavioral contract had reasonable expectations. For neutral responses, more participants believed that the behavioral contract would be good for them. There were mixed views on whether daily photo submission would be good for them.

**Post-survey**

For the post-survey, more participants agreed that the behavioral contract was not difficult. More participants agreed that their OC adherence improved by participating in sending daily photos, and participating in the behavioral contract. More participants agreed that the daily photo submission and the behavioral contract were good for them. More participants strongly agreed that they were able to stick with the behavioral contract, and that the behavioral contract had reasonable expectations. More participants strongly agreed that they believed they had success in sending daily photos and following the behavioral contract. More participants strongly agreed that sending the daily photos had reasonable expectations. Participants were split between neutral and agreed that the daily photo submission was not difficult. Participants were also split between agreed and strongly agreed that they were able to stick with sending daily photos.

**Changes from Pre- to Post-survey**

There were four questions that had interesting results from the pre-survey to the post survey. The first question was on the difficulty of the daily photo submission. For the pre-survey, More participants believed that the daily photo did not look too difficult to implement. After the study was implemented there were mixed views between neutral and strongly agreed on the difficulty of implementing daily photos. The second question was on the difficulty of the behavioral contract. In the pre-survey, more participants agreed that the behavioral contract did
not look difficult. After the study was implemented, more participants strongly agreed that the behavioral contract was not difficult. The third question was on whether the participant’s OC adherence should improve by participating in sending daily photos. In the pre-survey, the more participants agreed that their OC adherence should improve by participating in sending daily photos. After the study was implemented, more participants still agreed that their OC adherence did improve by participating in sending daily photos. The fourth question was on whether a participant’s OC adherence should improve by participating in the behavioral contract. Interestingly in the pre-survey, more participants agreed that the OC adherence should improve by participating in the behavioral contract. After the study was implemented more participants still agreed that the OC adherence did improve by participating in the behavioral contract.

Overall, there were positive views on responsibilities outlined in the behavioral contract and the use of sending “selfies” (daily photo submissions). There was a general consensus that the act of sending “selfies” and participating in a behavioral contract would improve a participants’ OC adherence.
CHAPTER FOUR: 
DISCUSSION

The purposes of this study were to evaluate effects of deposit contracting on OC use for women, the relation of stress to timely pill consumption, and the reliability between the different measurements used to determine OC usage in the study. The major findings of the study indicate that a) stress may be a risk factor in not taking OC on time, b) deposit contracting may be effective in increasing OC adherence even when females are stressed, c) deposit contracting may be a good intervention in increasing OC adherence within a two-hour time frame, and d) reliability was mixed between the different forms of data collections on OC adherence.

Stress

At the end of the study, participants who scored throughout the study as having severe stress were to be provided a list of community resources on stress management available in the Tampa Bay area. However, no participants in all the three cohorts scored as having severe stress throughout the study.

Based on the study findings, it replicated results of Hall et al. (2013a) showing that stress may be a risk factor in decreasing OC adherence. However, if the reason why females are missing their pills is because of stress, then deposit contracting could be an intervention to implement to prevent imperfect use. Deposit contracting has shown to be effective in increasing OC adherence, even when women are stressed, which is comparable to using a function-based
intervention. Based on the results, deposit contracting has shown to be effective in decreasing missed pill usage even when females report having moderate to severe stress.

**Reliability**

When it comes to the reliability between pill diaries and selfie submissions, participants were able to refer to their photo submissions (selfies) to fill out their pill diary. Therefore, the reliability between the two forms of data collection were predicted to be higher but based on results, it showed that “selfie” submissions compared to pill diaries and blister pack photos had a lower agreement. However, based on the Person correlation coefficients, there were high reliability between “selfies” and pill diaries, and between pill diaries and blister packs photos. Future forms of data collection on OC usage should be researched on testing the reliability of actual usage and also the ease of reporting OC usage. Based on the post-surveys about the study in relation to social validity, it appears that the majority of participants had neutral or strongly agreed that sending daily photos (submitting “selfies”) was not difficult. However, the majority of participants strongly agreed that the behavioral contract (submitting PSS-4 forms, blister pack photos, pill diaries, and “selfies”) was not difficult.

**Placebo Days**

Participants had the option of not taking their placebo pills. During the deposit contracting phase, there were no deduction of their deposit if they did not submit a “selfie” during a placebo day. There were some days where a participant could not take their pill and therefore the primary researcher decided to consider those days as placebo days. One participant was advised by a doctor to not consume anything hours before a surgery. Another participant had food poisoning and was then admitted to a hospital for a day. While another participant needed to pick up a new prescribed blister pack and could only get it after her two-hour time frame.
researcher did not deduct their deposit due to those reasons, and considered them as placebo days.

**Technological Implications**

There were some days where a participant could not submit a “selfie” due to limited access to cell reception because she was on a cruise trip. The participant informed the researcher before the trip, therefore the researcher did not deduction her deposit and considered those days as placebo days. There were a few occurrences when a “selfie” or a photo of a blister pack was not submitted in time due to lack of cell reception which resulted in a failed delivery. The primary researcher texted participants when a “selfie” submission or a blister pack photo was missed. If the photo submissions were missed due to a failed message delivery, the primary researcher informed participants to take a screenshot of the original failed Wickr text message that included the original time it was supposed to be sent. In addition, a redelivery of the photo message was also to be sent in order to consider that the photo was sent on time. Out of all three cohorts, there were in total, only three occurrences where participants had try to send their “selfie” or a photo of the blister pack, but were not successfully sent due to cell reception.

**Time Frames**

There were two participants that had changed from their original agreed two-hour time frame. Participant 7 from Cohort C had changed her time frame three times in the study. Rapunzel changed her time frame two times during baseline phase, and one time near the end of the deposit contracting phase. Participant 4 in Cohort A, changed her time frame one time in the study, and it was during the beginning of the deposit contracting phase. There were no monetary deposit deductions due to changing a time frame.
Feasibility in Single Subject Designs

There were some challenges in doing research on deposit contracting on oral contraceptive use using single subject design. On Figure 2, for Cohort B, the deposit contracting phase was introduced on week 10, even though there appeared to be a decreasing average latency trend for weeks seven to nine, during baseline. The reasons why deposit contracting was introduced in week 10 for Cohort B were because the study had a fixed duration of 16 weeks, and there was a need to have flexibility to be able to introduce phase changes with other cohorts before and after. Additionally, for Cohort B, weeks six to nine were far more stable than the previous weeks one to five. With week nine still within the the range of 20 to 60 average latency in minutes, deposit contracting phase was then introduced. Cohort B’s low percentage of imperfect use in baseline may have resulted in a floor effect. Recommendations for future studies to minimalize floor effect, would be to have an inclusion criteria of participants who report having a certain average amount of missed pills per week or to have more participants added each cohort.

For Figure 1, there was difficulty in using a single subject design for the percentage of imperfect use. The use of a multiple baseline across cohort design may have been inappropriate for the percentage of imperfect use, considering the number of participants that were recruited for each cohort. It is recommended that more participants should be recruited when using a multiple baseline across cohort design to evaluate the percentage of imperfect use.

“Selfies” Submissions

Criteria to submit “selfies” was not contingent to monetary deposit returns during baseline phases which resulted in no submissions of selfies during that phase. Recommendations for future studies should require “selfie” submissions during baseline in order to compare the
percentages of imperfect use and the average latencies of pill consumption reported from “selfie” submissions between baseline and intervention. Another recommendation would be evaluating the behavior of sending “selfies” as an intervention and comparing baseline and intervention percentages of imperfect use and average latencies of pill consumption reported from pill diaries.

**Monetary Contingency**

A strength in the study was letting participants earn the same weekly deposit in baseline and deposit contracting phases. The reason earning the same weekly deposit was a strength was because it controlled for the money earned in both phases, and the only difference was what it was earned for (i.e. money earned for “selfies” versus no money earned for “selfies”). Based on the average latencies of pill consumption for Cohorts A and C in Figure 2, there appears to be an effect in having money be earned based on “selfie” submissions during deposit contracting phases and lowering the average latency. There had to be a monetary contingency to some type of data reporting during baseline in order to receive data. There were instances where a participant did not submit the weekly reports during baseline, which resulted in lost data. It would be interesting to do further research on OC usage if no monetary contingencies were in place to sending reports of OC use during baseline, and then compare it to when monetary contingencies are in place.

**Recommendations**

Based on this study, future recommendations on evaluating effects of deposit contracting on oral contraceptive adherence includes, recruiting more participants to minimize floor effect, recruiting participants who score at moderate to severe stress in the PSS-4 monthly form, requiring participants to send “selfie” submissions during baseline, and setting a low monetary
contingency in sending “selfies” during baseline phase and a high monetary contingency during deposit contracting phase.
REFERENCES


Appendix A: Pre-Survey

We are really interested in how you view this study and how your expectations are related to your success in this study. Please be honest in answering these statements. Your answers will not be used against you.

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<thead>
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<td>Daily photo submission does not look too difficult.</td>
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<td>The behavioral contract does not look difficult</td>
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<td>My OC adherence should improve by participating in sending daily photos.</td>
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<td>My OC adherence should improve by participating in the behavioral contract.</td>
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<td>I think this daily photo submission will be good for me.</td>
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<td>I think this behavioral contract will be good for me.</td>
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<td>I think I will be able to stick with sending daily photos.</td>
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<td>I think I will be able to stick with the behavioral contract.</td>
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<td>I think sending daily photos have reasonable expectations.</td>
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<td>I think the behavioral contract has reasonable expectations.</td>
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Appendix B: Post-Survey

We are really interested in how you viewed this study after going through the study and if your expectations are related to your success in this study. Please be honest in answering these statements. Your answers will not be used against you.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
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<tbody>
<tr>
<td>I believed I had success in sending daily photos.</td>
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<td>I believed I had success in the behavioral contract.</td>
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<td>Daily photo submission was not difficult.</td>
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<td>The behavioral contract was not difficult</td>
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<tr>
<td>My OC adherence improved by participating in sending daily photos.</td>
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<td>My OC adherence improved by participating in the behavioral contract.</td>
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<td>I think this daily photo submission was good for me.</td>
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<td>I think this behavioral contract was good for me.</td>
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<tr>
<td>I was able to stick with sending daily photos.</td>
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<tr>
<td>I was able to stick with the behavioral contract.</td>
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<td>I think sending daily photos had reasonable expectations.</td>
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<tr>
<td>I think the behavioral contract had reasonable expectations.</td>
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</table>
Appendix C: Perceived Stress Scale  4

Instructions: The questions in this scale ask you about your feelings and thoughts during the last month. In each case, please indicate with a check how often you felt or thought a certain way.

1. In the last month, how often have you felt that you were unable to control the important things in your life?

   ___0=never  ___1=almost never  ___2=sometimes  ___3=fairly often  ___4=very often

2. In the last month, how often have you felt confident about your ability to handle your personal problems?

   ___0=never  ___1=almost never  ___2=sometimes  ___3=fairly often  ___4=very often

3. In the last month, how often have you felt that things were going your way?

   ___0=never  ___1=almost never  ___2=sometimes  ___3=fairly often  ___4=very often

4. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

   ___0=never  ___1=almost never  ___2=sometimes  ___3=fairly often  ___4=very often
Appendix D: Contract

I, __________________________, hereby declare on this date, ________________,
that I, the participant, agree to the following:

Beginning of the study the participant is to:

Beginning of the study
1. Download Venmo application and create an account on their personal smart phone if they do not have one already.
2. Download Wickr application and create an account on their personal smart phone if they do not have one already
3. Create a Google account if they do not have one already or prefer a new one
4. Deposit $64 or ____________ (insert higher amount) depending on negotiation with the principal investigator via Venmo account. Maximum amount one can deposit is $256.
5. Agree that _______________ is the two-hour time frame that the participant will be able to submit “selfies” on a daily basis
6. Agree that no later than 11:59 PM is the time on Sundays that the participant will submit filled out pill diaries, OC blister pack photos, and filled out PSS-4 forms
7. Understand that the participant will receive a text message reminder around 5:00 PM to turn in their completed weekly reports

8. Weekly reports
   a. Understands how to complete and submit weekly filled out pill diaries via Google Inc.’s Form
      i. Filled out all questions in form
   b. Understands how to complete and submit clear weekly OC blister pack photos with marking on blisters on days OC were missed via Wickr
   c. Understands how to complete and submit clear weekly filled out PSS-4 forms via Google Inc.’s Form
      i. Answer all questions in form
   d. Report if consuming active or placebo pills
   e. Report if it is placebo pills week and choosing to consume or skip that week

9. Daily Reports
   a. Understands how to complete and submit daily clear “selfies” via Wickr showing photographic proof:
      i. the participant’s face
      ii. the prescribed OC on her tongue
      iii. the assigned keyword

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During phase one, the participant will receive the following payments on a weekly basis for each of the following activities:

A. $0 – The participant has submitted “selfies” (defined above) of taking your OC for each of the previous 7 days during the designated time (specified above)
B. At least $4 or ______ - The participant has submitted your completed PSS-4 form, a clear photo of your OC blister pack, and a completed pill diary on Sunday by no later than 11:59 PM

During the deposit contracting phase, the participant will receive the following payments on a weekly basis for each of the following activities:

A. At least $0.50 or ______ - The participant has submitted photographic proof (defined above) of taking your OC for each of the previous 7 days during the designated time (specified above)
B. At least $0.50 or ______ - The participant has submitted your completed PSS-4 form, a clear photo of your OC blister pack, and a completed pill diary on Sunday by no later than 11:59 PM

All money awarded to participants due to perfect use or success in submitting required weekly reports will be distributed on the eighth days (Monday) by no later than 11:59 PM.

All money not awarded to participants due to imperfect use or failure to submit required weekly reports will be forfeited to the principal investigator to be redistributed to other participants with perfect use.

Any participants that turn in their completed weekly reports by 5:00 PM Monday will receive half of their money that was earned.

_________________________________________  _____________________________
Print Participant’s Name                       Print Principal Investigator’s Name

_________________________________________
Participant’s Signature                        Principal Investigator’s Signature

_________________________________________
Date                                          Date
Appendix E: IRB Approval

4/12/2016

Sandy Au Yeung
ABA-Applied Behavior Analysis
13301 Bruce B. Downs Blvd
Tampa FL  33612

RE:  Full Board Approval for Initial Review
IRB#:  Pro00023812
Title:  Evaluating Effects of Deposit Contracting on Oral Contraceptive Adherence

Study Approval Period:  2/19/2016 to 2/19/2017

Dear Ms. Au Yeung:

On 2/19/2016, the Institutional Review Board (IRB) reviewed and APPROVED the above application and all documents contained within, including those outlined below.

Approved Item(s):
Protocol Document(s):
Sauyeung_IRB_Protocol.03.10.16

Consent/Assent Document(s)*:
Sauyeung-informed Consent.pdf

*Please use only the official IRB stamped informed consent/assent document(s) found under the "Attachments" tab. Please note, these consent/assent document(s) are only valid during the approval period indicated at the top of the form(s).

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval via an amendment. Additionally, all unanticipated problems must be reported to the USF IRB within five (5) calendar days.
We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

[Signature]

Kristen Salomon, Ph.D., Vice Chairperson
USF Institutional Review Board
Appendix F: PSS-4 Permission

Dr. Cohen’s Scales:

We welcome copies (small or large) of any or all of these PSS’s to use in research or educational purposes without permission. Permission is not necessary when using the scale for non-profit educational purposes. Please contact Dr. Sheldon Cohen.

<table>
<thead>
<tr>
<th>PAPERS ON PSS</th>
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<tbody>
<tr>
<td>(7) Coyle, R. R. (1989). <em>Assessment of a depression</em> <em>inventory</em> <em>among the Perceived Stress Scale (PSS)</em>. <em>Journal of Consultation and Community Psychology</em>, 57(2), 325.</td>
</tr>
</tbody>
</table>

**PERCEIVED STRESS SCALE (PSS)**

**PLEASE NOTE:** The Perceived Stress Scale is not a diagnostic instrument; there are no score cut-offs. There are only comparisons within your own group.