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# Caregiver Treatment Consumption in an Experimental Treatment Marketplace

Delaney J. Darragh
*Louisiana State University and Agricultural and Mechanical College*

# TREATMENT CONSUMPTION IN AN EXPERIMENTAL TREATMENT MARKETPLACE

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# Abstract

Behavioral economics is an approach to understanding consumer behavior by integrating behavioral science with economic principles. Behavioral economics incorporates traditional economic principles with operant learning approaches. There is limited research examining how individuals consume psychological and behavioral treatments. This is especially the case for treatments designed for children. The current study used data from a previously collected sample to explore gender differences in an experimental treatment marketplace (ETM). Experimental treatment marketplaces are generally used to evaluate choices between goods and services (e.g., types of behavior interventions). An ETM was developed to evaluate treatment consumption when levels of evidence differed between prospects. Results indicated that parents substituted an evidence-based treatment with an alternative treatment when associated costs and effort increased, regardless of evidence of the alternative treatment. Further analyses revealed that the rate of substitution did not differ significantly between mothers and fathers. These findings are discussed and reviewed in the context of advocating for treatments with documented efficacy.

Keywords: evidence-based treatment, behavioral economics, caregiver decision-making, experimental marketplace, experimental treatment marketplace

# Introduction

Operant Behavior Economics is an approach to understanding consumer behavior by integrating behavioral science with economic principles (Reed, Niileksela, & Kaplan, 2013; Camerer, Lowenstein, & Rabin, 2004). Traditional economic approaches (Persky, 1995) assume that the typical consumer is rational (i.e., fully aware of relevant costs and benefits) and make decisions that maximize their long-term benefit (Allen, 1938). For example, a rational individual, such as a parent, in a traditional economic approach should make treatment choices that maximize child outcomes regardless of delays and effort. However, the assumption of rationality in humans rarely holds true in everyday life (Ainslie, 1992). That is, parents may choose treatments with more immediate, but lesser benefit over treatments with greater benefits that involve greater commitment (i.e., effort, delays).

Research in behavioral economics has found that humans and nonhumans regularly deviate from rational patterns of behavior (i.e., irrational choices; Ainslie, 1992) Rather than assuming rationality, a behavioral economic perspective assumes *irrationality* (e.g., an individual would likely choose $100 dollars today over $101 dollars 50 years from now). Behavioral economists have since developed methods and procedures for elucidating patterns of suboptimal choice. In contrast to mainstream behavioral economics, which emphasizes cognitive biases, an operant behavioral economic perspective focuses on the importance of environmental factors (i.e., a reinforcer pathology; Bickel et al., 2011). An operant behavior economic approach was suggested by Hursh (1980), who advocated for the use of economic concepts and methods to help advance the science of human behavior. Hursh (1984) discussed and applied various economic concepts such as demand, open vs. closed economies, and substitution. These terms are discussed in greater detail below.

When we speak of demand, we are referring to the degree to which someone will defend their baseline consumption of a reinforcer (Hursh, 1980; 1984). For instance, a child might consume a particular reinforcer (e.g., candy) at a high rate when the cost (i.e., schedule of reinforcement) remains constant; however, the consumption of this reinforcer would likely decrease as the cost to produce it steadily increases (Bickel et al. 2011; Green & Freed, 1993). The economic concept of demand holds that the reinforcer consumption will decrease as the price increases (Allen, 1938). A demand function (i.e., model) is employed to estimate the level of demand for a reinforcer as a function of different factors of interest, such as price or the availability of alternatives (Gilroy, Kaplan, & Reed, 2020). A demand function used in the operant behavioral economic framework typically uses a nonlinear model to represent this pattern of consumption (Hursh and Silberberg, 2008).

In order to consume a good or reinforcer, an individual must put forth some pre-determined degree of responding, i.e., schedule of reinforcement (Reed, Niileksela, & Kaplan, 2013). In operant behavior economics, price is often thought of as the schedule of reinforcement (Hursh, Madden, Spiga, DeLeon, & Francisco, 2013). For instance, a child is required to perform 10 math problems for 10 minutes of access to video games. The price here is considered the number of math problems, while access to video games is considered the good/reinforcer.

The operant behavioral economic perspective emphasizes the context of consumption. For example, consumption varies when the context of the economy is open versus when it is closed (Hursh, 1984, 2013). That is, economies exist on a continuum that ranges from open to closed and these are distinguished by the consumer's ability to access the reinforcer at either a free or lower price (Hursh, 1984; Imam, 1993). For instance, a purely closed economy is one in which the individual has only one way to access a reinforcer, and they must expend the entire cost (price) in order to consume the reinforcer (Reed, Kaplan, & Becirevic, 2015). In contrast, an open economy is characterized by a situation wherein an individual may not have to put forth the entire cost (or any at all) in order to consume the reinforcer (Gilroy et al., 2018). The context of an economy is important because the context influences both the efficacy and demand for reinforcers. Closed economies result in higher levels of demand than open economies since the individual cannot access the commodity elsewhere. For example, when training an animal on a new behavior, a trainer would use a reinforcer which the animal has no access to outside of the training situation. This arrangement is more likely to maintain a high level of demand and the animal will continue to work at high rates (price) to produce the reinforcer (commodity).

In addition to the type of economy, the availability of specific alternatives is relevant. Oftentimes, there are multiple choices available, which may vary in terms of preference. For example, a child in a token economy may spend their tokens amongst multiple items. However, preference for items is influenced by the cost or price used to produce them. As such, when the price of a preferred item is increased, a different, lower preferred item may then become more preferred now that the previously preferred item now is available at a higher price (Hursh et al., 2013; Tustin, 1994; Salvy, Nitecki, and Epstein, 2009). In this example, the relationship observed between these items relates to the substitutability of reinforcers. That is, as the consumption of one reinforcer decreases another rises in conjunction. Alternatively, the relationship could be complementary. Complementary relationships are demonstrated when the consumption of different reinforcers rise and fall together. For instance, a child may work to produce access to both a train toy and train tracks and subsequent increases in price are likely to affect the consumption of each in similar ways. Lastly, the consumption of alternative reinforcers may occur independently of changes in price for the reinforcer that was originally highlypreferred. For example, a child’s work to produce access to stickers in a classroom token economy is less likely to have an effect on how many pencils they would work to access.

Cross price analyses are performed to evaluate relationships between reinforcer consumption (Bickel et al., 2000; Johnson & Bickel, 2008). In these analyses, there is usually an alternative commodity which is available at a fixed price (e.g., price of traditional cigarettes increases while the ‘vape pen’ alternative remains at a fixed price). Given that the alternative is available at a fixed price, these methods reveal patterns of consumption in the alternative when the price for the main good increases from low-to-high. This methodology elucidates relationships between reinforcers and allows researchers to evaluate how changes in price influences the consumption of alternatives (i.e., an experimental marketplace).

An experimental marketplace (ETM) is an online “store” in which researchers manipulate variables related to consumption (e.g., price, availability of alternatives) in a context that resembles real-world situations (Epstein et al., 2010, 2012). ETMs have been used to study a variety of phenomena including drug and alcohol use, healthy eating choices, and reinforcer efficacy for children with developmental disabilities (Quisenberry, Koffarnus, Epstein, Bickel, 2017; Quisenberry, Koffarnus, Hatz, Epstein, Bickel, 2015; DeHart, Kaplan, Pope, Mellis, Bickel; 2019; Yang & Chiou, 2010;). For example, Quisenberry and colleagues (2017) designed an experimental tobacco marketplace for the consumer to find suitable alternatives to a particular good, cigarettes and e-cigs. This study used a cross price analysis to gauge substitution of nicotine replacement products in the smoking population as a harm reduction strategy. In this analysis, the price of conventional cigarettes rises as the cost of the alternative nicotine products remains constant. Quisenberry and colleagues (2017) found that purchasing of conventional cigarettes decreased while purchasing of alternative products increased. Additionally, they found that the consumption patterns of cigarette smokers are associated with behavioral economic measures of product substitution, warranting more consideration for nicotine replacement products.

The consumption of a good is most often influenced by the cost or price to produce it. Economists use the term elasticity of demand to index how relative changes in price (i.e., increasing costs) relate to relative changes in demand (i.e., decreasing demand; Gilroy et al., 2020). Broadly speaking, elasticity represents how strongly a change in the price of a commodity influences the demand for that good. Demand curves have the ability to be either elastic or inelastic. A good is considered inelastic when changes in the price of that good do not strongly affect the consumption of that good. For example, gasoline is a good which is generally considered inelastic, even at high prices, meaning that individuals continue to purchase gas even when the price increases. Conversely, a good is considered elastic when consumption of the good is very sensitive to changes in price (Gilroy et. al., 2018). For example, luxury goods such as televisions have consumption patterns which are very sensitive to price changes. Putting this in operant behavioral economic terms, demand elasticity informs researchers when a reinforcer is no longer likely to maintain behaviors at the desired rate.

**Caregiver Treatment Consumption**

‘‘When there is no cure, there are 1000 treatments.’’ –Donald Cohen

The above quotation from Donald Cohen, former director of the *Yale Child Study Center*, highlights the abundance of available treatments for parents to consider when it comes to their child’s behavioral and mental health. Parents, in general, have been found to have ambivalent attitudes about potential behavioral interventions (Lui, Robin, Brenner, & Eastman, 1991). Ambivalent attitudes towards treatment coupled with the vast number of available treatments can make it difficult for parents to choose the “best fit” treatment. Therefore, it is necessary for professionals to contribute less to the confusion, and rather offer well-intentioned and evidence-based recommendations.

Research has shown that certain factors influence parents’ decision-making and treatment choices for their child over other factors (Bennet, 1996; Cunningham et al., 2013; 2015; Call et al., 2015). Common factors that affect parental decision-making include delays in treatment or behavioral improvement. Researchers have assumed that professionally accepted treatments would have a higher rate of caregivers who choose that treatment; however, research has revealed that is not the case (Johnston & Fine, 1993; Reimers et al., 1992, 1987). This, in turn, indicates that there are additional predictive factors, necessitating further research in this area (Bennet, 1996).

**Caregiver Level Factors**

Psychological research has traditionally been conducted with mothers instead of fathers to inform their child’s evaluation, diagnosis, treatment, and all other things associated with mental health services (Keen, Couzen, Muspratt, & Rodger, 2010; Cepanec, Lice, Simlesa, 2012). Father participation in their children’s mental health services tend to be low (Panter-Brick et al., 2014), further, their participation patterns can sometimes differ from mothers (Mauricio et al., 2017). This has caused a gap in caregiver research, necessitating greater inclusion of fathers in psychological research (Fitzgerald, Zucker, & Maguin, 1994; Kerr, Lunkenheimer, & Olson, 2007). More importantly, evidence suggests that both parents’ involvement in their children’s mental health services leads to more favorable and effective outcomes (Piotrowska et al., 2017; Fabiano, 2007; Lundahl, Tollefson, Risser, & Lovejoy, 2008).

Some research suggests mothers and fathers tend to show moderate levels of agreement when it comes to diagnosis and decision-making for their child (Gray, Tonge, Sweeney, & Einfeld, 2008; Gudmundsson & Gretarsson, 2009; Johnson, Wolke, & Marlow, 2008; Matson, Hess, Kozlowski, & Neal, 2011). However, other studies elucidate the opposite, where parents show incongruence on psychological assessments and questionnaires (Ivens & Rehm, 1988; Moreno, Silverman, Saavedra, & Phares, 2008; Gudmundsson & Gretarsson, 2009). Gudmundsson and Gretarsson (2009) suggest that psychological research should shift its focus to developing differential criteria and norms for mothers and fathers. Differences in mother and father opinions complicate both diagnostic and treatment-related decision-making, particularly in the case of children whose parents show low levels of congruence (Matson et al. 2011).

In the current state of research, there is relatively little evidence to show systematic differences in mother and father decision-making, as it is an under-explored subject. One of the barriers to conducting this research is the difficulty of having a comparable distribution of both mother and father participation. For instance, research conducted to standardize psychological inventories found that mothers filled out 90% of all checklists (Kovacevic´, Jelaska, Kuvac, & Cepanec, 2007). Therefore, one of the goals of the present study is to expand the literature on differences in mother and father treatment-related decision-making.

**Evidence-Based Treatments**

Years of clinical research has generated a growing list of evidence-based treatments for child behavior problems (Kazdin & Weisz, 2003; Gresham & Watson, 2013). While exact figures are unknown, research gathered by the Data Resource Center for Child & Adolescent Data by using the National Child Health Survey estimates that there are over 4.2 million children with a mental health or behavior condition/disorder who currently receive or have received treatment or counseling. This statistic was pulled from a national survey which revealed that 53% percent of children have a mental health or behavioral diagnosis (Child and Adolescent Health Initiative, 2018-2019). The sheer number of children involved in the mental health field has resulted in a growth in available treatments, varying in terms of evidence and clinical research.

Upon identification, parents of children with behavioral issues are put into a decision-making position on behalf of their child. This can be difficult for parents to navigate, particularly when there is a wide variety of choices of treatment, both good and bad, with varying levels of evidentiary support (Green et al., 2006; Miller, 2012). Autism research has revealed that many parents choose ineffective therapies which lack strong empirical support (Smith, 2005). This is problematic because treatment efficacy, as well as proper implementation, is necessary to get a positive response in the treatment of clients (Allen and Warzak, 2000; MacNaughton and Rodrigue, 2001).

Efficacy of a behavioral treatment is considered the ethical bare minimum when treating clients in a clinical setting. In fact, *The Right to Effective Behavioral Treatment*, a text used to guide the ethical practice of applied behavior analysts, states that clients in behavior therapy have a right to the most effective treatment available to them (Van Houten et al., 1988). Ineffective or unsupported treatments sometimes evade trained professionals by using common scientific vocabulary; however, these treatments do not have strong evidence to back up many of their claims of effective treatment. These treatments are referred to as pseudoscience, fad treatments, and questionable treatments. They appeal to the general public because the treatments often promise quick fixes or innovative ways to solve problem behaviors (Green, 1999). Examples of common pseudoscience treatments often referred to in pop culture include music therapy, scared straight programs, and memory-recovery techniques (Foxx & Mulick, 2016; Lilienfeld, 2007). In the past, pseudoscientific treatment practices have led to both harmful and ineffective consequences for a multitude of children and families (Sturmey, 2015).

There are multiple thresholds used to differentiate the efficacy of behavioral treatments (Kaminski & Claussen, 2017). Kaminski and Claussen (2017) distinguished five categories differentiated by evidence criteria. For the purposes of the present study, researchers selected three levels from the five to form a high, moderate, and low hierarchy to better compare the treatments. Treatments are considered "Level 1" if they were superior to a placebo group or another active treatment group, or equivalent to an already efficacious treatment in at least two different teams in two different settings. Level 1 treatments are considered to be well-established treatments. Level 3 is used to describe treatments which are possibly efficacious, because the treatment only has one good randomized controlled trial showing the treatment to be better to a no-treatment control group for reducing problem behavior. This means that there is evidence to its effectiveness, but there has not been enough research conducted in different settings to establish the treatment as well-evidenced. The last level, Level 4, is used to describe purely experimental treatments which have little to no evidentiary support. Level 4 treatments are an example of pseudoscience, wherein they are accessible to consumers, but have not yet been proven to be effective in their intended purpose. These treatments have not been tested in a randomized controlled trial or have not yet been evaluated with methodologically rigorous designs. The present study utilizes these thresholds to present treatments with varying levels of evidence to parents. The treatments which were chosen are presented below.

Table 1. Levels of Evidence. This table lists the criteria researchers used to describe the levels of evidence of the selected treatments. The three levels selected from this list were levels 1, 3, and 4.

| | |
|---|---|
| Level 1: Well-established | Efficacy demonstrated for the treatment in at least two (2) independent research settings and by two (2) independent investigatory teams demonstrating efficacy by showing the treatment to be either:<br>• Statistically significantly superior to pill or psychological placebo or to another active treatment, OR<br>• Equivalent (or not significantly different) to an already well-established treatment in experiments |
| Level 2: Probably Efficacious | There must be at least two good experiments showing the treatment is superior (statistically significantly so) to a waitlist control group, OR One or more good experiments meeting the well-established treatment level with the one exception of having been conducted in at least two independent research settings and by independent investigatory teams |
| Level 3: Possibly Efficacious | At least one good randomized controlled trial showing the treatment to be superior to a waitlist or no-treatment control group |
| Level 4: Experimental | Not yet tested in a randomized controlled trial, OR<br>Tested in 1 or more clinical studies but not sufficient to meet Level 3 criteria. |

*Source*: Kaminski and Claussen (2017) Levels of Evidence Hierarchy

**Problem Behaviors in Children**

Developmental behaviors and learning challenges are common occurrences, but extreme and persistent disruptive behaviors put kids at a high risk of childhood impairment, as well as possible negative outcomes later in life. Children with disruptive problem behaviors tend to engage in behavior which puts them at a disadvantage for academic success, early substance abuse problems, and struggles with peer and family relationships (Scholtens et al. 2012; Wehmeier et al. 2010; Pardini & Fite, 2010; Foster & Jones, 2005). Further, caregivers often experience significant stress and strain as a result of their child's behavior problems (Deater-Deckard, Dodge, Bates, & Pettit, 1998; Dumas, Wolf, Fisman, & Culligan, 1991; Nock &

Kazdin, 2002). Nock and Kazdin (2002) delve further and examine how caregiver strain, in turn, negatively affects the rest of the family.

These negative impacts highlight the importance of measurable treatments to improve long-term functioning for both the client and their family. However, problem behaviors in children present serious treatment challenges unique from other childhood disorders due to their disruptive nature. As such, the American Academy of Child and Adolescent Psychiatry (AACAP, 2018) put forth recommendations to treat disruptive problem behaviors which include interventions such as parent guidance, training, and family therapy (Steiner, 1997). Further, the practice parameter supported by the AACAP guides clinicians to utilize parent interventions by selecting a treatment package from seven empirically tested behavioral parent therapies.

Currently, parent management training (through a variety of treatment packages) with young children is the most thoroughly researched and validated intervention to treat disruptive behavior problems in children (Kazdin, 1998; Lavigne et al., 2010). Parent management training has been shown to improve disruptive behaviors, oppositional problems, conduct problems, and the associated impairments and negative outcomes in children (Eyberg et al. 2008; Pelham and Fabiano 2008). Further, parent management training has been shown to improve aspects of parent and family functioning such as caregiver stress and perceived parental competence (Chacko et al. 2009; Daley et al. 2014). Parent management training teaches behavior principles along with social learning theory and parenting skills to improve the parent and child relationship, increase compliance, and decrease disruptive behaviors. The present study examined four different parent management training packages with varying levels of evidence, discussed in greater detail below.

### Parent Child Interaction Therapy

Parent Child Interaction Therapy (PCIT; Berkovits, O'Brien, Carter, & Eyberg, 2010) is a treatment package which is well-established in terms of efficacy. Further, it is often recommended by professionals to treat childhood challenging behavior. PCIT is considered a Level 1 (well-established) evidence-based treatment, meaning that it has proven to be comparable to alternative treatments which are efficacious. PCIT takes on an approach to encourage and reinforce positive interactions between parents and their child who is experiencing behavior problems. For example, parents are first taught skills to utilize during play with their child to promote prosocial behavior and strengthen attachment. Parents are then taught useful discipline skills to reinforce compliant behavior, such as praising good behavior. Further, parents are coached on how to use rewards and consequences to increase positive behavior.

### Incredible Years Preschool Basic Parenting Program

The Incredible Years Preschool Basic Parenting Program is also considered a well-established, evidence-based treatment to treat childhood challenging behavior. The Incredible Years program is a group-based, Level 1 treatment proven to be efficacious across a variety of contexts and individuals (Axberg & Broberg, 2012; Hommen, Gaspar, Seabra-Santos, & Canavarro, 2014). The program sets out to strengthen parent-child interactions and attachments, reduce harsh discipline, and teach parents skills to foster their child's potential. Incredible Years utilizes video modelling, roleplaying, discussion, collaboration, and self-reflection to teach parents about child development and effective parenting skills.

### Rational Positive Parenting Program

The Rational Positive Parenting program (RPPP) is a group-based treatment that is not currently considered well-established in terms of efficacy. It is considered a Level 3 (i.e., possibly efficacious) treatment because it has just one good randomized controlled trial showing the treatment to be superior to a no-treatment control group in terms of improving problem behavior. RPPP teaches emotion-regulation strategies to parents, focusing on improving their own emotional problems and building positive emotions. Reportedly, parents are then better able to understand their child's problem behaviors and learn discipline strategies to better manage those specific behaviors. RPPP utilizes coaching, modelling, and consequences to build effective communication, social skills, and problem-solving skills between parents and their child (David, David, & Dobrean 2014).

### Collaborative and Proactive Solutions

Collaborative and Proactive Solutions (CPS) is considered a Level 4 (i.e., experimental) treatment because it has not yet been tested in a randomized controlled trial to prove its efficacy in treating children with behavior problems. CPS is not supported by experts in the field. The intervention is based on the notion that children with challenging behaviors have skill deficits that can be taught and, in turn, improve. CPS focuses on teaching parents and children to collaboratively solve problems together in a proactive manner. For example, parents and children are taught to work together in prioritizing problems and creating plans to solve those problems a priori (Ollendick et al., 2016).

## Source work

The present study utilizes a previously collected data set from another study. The source work which initially collected the data is entitled "Caregiver Consumption of Therapies as a Function of Evidence: A Treatment Marketplace Approach." The study set out to evaluate the substitutability and elasticity of differentially evidence-based treatments. The participants underwent four consecutive hypothetical purchasing trials which are described in more detail below in the methods section. Study results indicated that caregivers tend to consume a variety of treatments in a similar pattern, regardless of if those treatments are considered efficacious or not.

### Study Aims

The purpose of the present study was to better understand caregivers' consumption of differentially evidenced-based treatments for their child exhibiting behavior problems. Researchers were interested in answering the following questions:

**RQ1**: To what degree does the price of treatments influence consumption?

**RQ2**: Does the degree of evidence influence how parents decide between treatment alternatives?

**RQ3**: Are mothers and fathers differentially influenced by the degree of evidence in the available treatments?

# Methods

## Participants

Participants were recruited for the original source study using mTurk, the Amazon Mechanical Turk Platform.  On the platform, workers (i.e., caregivers) were able to engage with the posted survey only if they met certain prerequisite qualifications. Once participants were deemed eligible for the study, workers were then able to complete the survey designed using Qualtrics software (Qualtrics, Provo, UT). The Institutional Review Board at Louisiana State University approved the survey as well as all other associated procedures and materials.

Participants for the study included parents/caregivers with at least one child exhibiting problem behavior (i.e., parents must have endorsed problem behaviors for one or more child). Inclusionary criteria included English language proficiency, US citizenship, parent/caregiver age of at least 18 years, and at least one child within the age range of 2-18 and living in their home under their care. In addition, parents and caregivers must report a desire to seek treatment for their child's behavior problems. Exclusionary criteria included no desire to seek treatment. The total sample size of participants who completed the survey was 107, 95 participants were included in the final analysis.

## Experimental Treatment Marketplace

Participants who qualified for the survey were presented with a hypothetical prompt detailing the constraints which the researchers placed on the marketplace (i.e., time and budget restrictions). Participants were limited to allocating 16 hours a week total towards treatment for their child, although it was up to participants to choose how many of those hours to allocate to each treatment (they were allowed to choose a combination of treatments), or even whether or not to utilize the full number of hours allotted per week. In addition, caregivers were given a budget of $4,000 to spend per week on the different behavior therapies. It should be noted that caregivers were not allowed to "bank" leftover money from their budget, if they didn't spend the full amount, they lost the remaining money. The selected therapies cost an average of $200 with a standard deviation of $50 and costs ranged from three standard deviations above and below the mean (i.e., primary behavior treatment available at the following prices: $50, $100, $150, $200, $250, $300, $350).

Participants were then presented with the first vignette detailing a strong evidence-based treatment and asked to indicate however many hours they would purchase to allocate their time for the treatment. This first task was used to elucidate demand for treatment in a purely closed economy (i.e., only a strong, evidence-based treatment was available for consumption). Researchers evaluated the consumption of the treatment as the price of the treatment increased. This task gives researchers a picture of the demand for evidence-based treatment when there is no competition.

**Substitution Task**

Next in the ETM, clinicians presented three separate vignettes. In each vignette, the strong, evidence-based option from the earlier task was available, while there was a fixed-price alternative concurrently available. All of the treatments presented in the study are utilized to improve child problem behavior; however, the concurrently available treatments in the ETM varied in terms of evidence. Efficacy of the alternatives in the ETM ranged from strongly efficacious (Level 1) to possibly efficacious (Level 3) to experimental treatments with a significant lack of evidence (Level 4; Kaminski & Claussen, 2017). The first vignette provided a comparison of treatment choices between two Level 1 treatments. Next, a vignette presented the choice between a Level 1 treatment and a Level 3 treatment. Lastly, a third vignette presented the choice of a Level 1 treatment and a Level 4 treatment.

Within these vignettes, price was manipulated in order to elucidate patterns of consumption when more than one choice of treatment is available to the consumer, also known as a cross-price analysis. The level of evidence was the independent variable in this study. The following treatments for problem behaviors were described to participants, including their level of evidence: Parent Child Interaction Therapy (PCIT; Level 1; strong evidence support), Incredible Years Preschool Basic Parenting Program (Incredible Years; Level 1; strong evidence support), Rational Positive Parenting Program (RPPP; Level 3; Moderate evidence support), Collaborative and Proactive Solutions (CPS; Level 4; Low evidence support).

To examine consumption in a cross-price analysis, the Level 1 treatment presented to participants increased in price, while the alternative treatment stayed at a fixed price of $100. For example, participants may be told that the cost of PCIT (i.e., the main treatment; Level 1) is $200 an hour, and the cost of RPPP (i.e., the alternative treatment; Level 3) is $100. Participants were then prompted to indicate how much time they would allocate to each of these treatments (i.e., in behavioral economic terms, how many units of each commodity they would like to purchase). Participants could elect to consume treatment in the following increments: whole, half, and quarter hours.

**Data Screening Measures and Inspection**

In order to ensure reliable and systematic data, researchers embedded attention checks within the survey and conducted a systematic check of the data prior to running analyses. In the attention check items, participants were given the choice of treatments that were well out of the assigned budget (i.e., a therapy which costs $150,000) in order to ensure participants were responding in a systematic and reliable manner. The total sample size of participants who completed the survey was 107, but only 95 (88%) participants were included in the statistical analysis due to the check for unsystematic data. Three criteria were used to identify unsystematic data using the *beezdemand* function in R (Kaplan et al, 2019). Within *beezdemand* (i.e., behavioral economic easy demand), the *CheckUnsystematic* function applies the three criteria proposed by Stein, Koffarnus, Snider, Quisenberry, and Bickel (2015) to screen for unsystematic data. The three criteria include trend criterion (also known as $\Delta Q$), bounce criterion, and reversals from zero. Trend Criterion ($\Delta Q$) can be thought of as a global reduction in consumption and requires at least a 0.025 log-unit reduction in consumption per log-unit range in price. Bounce can also be thought of as price-to-price increases in consumption. Lastly, reversals from zero requires there be no instances of two consecutive zeros followed by a value that isn't zero. Participants were required to meet at least two of those checks to be included in the final statistical analysis.

**Analytical plan**

The present study utilized existing data from the original source study to conduct tertiary data analyses using the statistical program R (R Core Team, 2014). The analytical plan included the equation modeled by Hursh and Silberberg (2008) in order to model the relationship between purchasing and the price of treatments. This demand equation is a well-accepted model among behavioral economics researchers and has been validated in various studies using demand for physical reinforcements such as food, as well as hypothetical demand for things such as cigarettes (Hursh and Silberberg, 2008; Bentzley et al., 2013; Higgins et al., 2017). The equation is as follows:

$$\log_{10} Q = \log_{10} Q_0 + k\ (e^{-\alpha\, Q0\, C}\ - 1)$$

In this equation, the rate constant, α, reflects logarithmic changes in $Q$ (treatment consumption) along with the intercept ($Q_0$) and the span parameter ($k$). The parameter $Q_0$ refers to the predicted consumption of a reinforcer when the price is zero. The parameter $k$ is a constant which is shared across all participants and represents the range of consumption. The quantity $P_{MAX}$ represents the price at which the consumer spends the most of their budget towards evidence-based treatments. Cost ($C$, sometimes referred to as price) is the amount of work required to receive a fixed unit of the service.

$$Q_{Alt} = \log_{10} Q_{Alone} + I * e^{bC}$$

The above cross-price analysis equation is included for the purposes of discussing the specific variables used for the analysis. the cross-price equation is used to model the relationship between two different types of consumption and how they interact. The parameter $Q_{ALT}$ is the consumption of the alternative and is operationally defined as the number of hours allocated towards the alternative treatment. The model yields several parameters, but parameter $I$ is the primary parameter of interest. The parameter $I$ reflects the relationship between the fixed-price commodity and the primary commodity (i.e., is it a complement, substitute, or independent relationship).

The primary goal of this work was to explore the relationship between consumption of evidence-based treatments and reported gender. The R statistical program was used to evaluate the effects of gender. Specifically, the cross-price models were fitted using gender-specific $Q_{Alone}$ and $\beta$ parameters (full model) and a nested version with shared $Q_{Alone}$ and $\beta$ parameters (restricted model). The two models were compared using an Extra Sum of Squares Test to determine which better characterized the observed data.

## Results

Most participants included in the study were female with an average age of 39 years. Additionally, most of the participants were college educated (67%) and had an average income of $68,307. For more sociodemographic information on the sample, see Table 2.

**RQ1** – Researchers aggregated consumption across different prices to evaluate treatment consumption as a function of price. This is illustrated in Figure 1, which displays the variability and consumption for the alone-price condition. Figure 1 includes a box plot which illustrates a common trend where the distribution of treatment consumption trended downwards as a function of price. An empirical demand curve is also provided to illustrate mean levels of consumption across prices overall. The statistical model revealed a downward trend in consumption.

Table 2. Sociodemographic Characteristics of ETM Sample

| Sample Characteristics | *n* | % | *M* | *SD* |
| --- | --- | --- | --- | --- |
| Gender | | | | |
| Male | 41 | 38 | | |
| Female | 65 | 61 | | |
| Age | | | 39.15 | 8.7 |
| Education Level | | | | |
| Less than high school | 3 | 3 | | |
| High school | 4 | 4 | | |
| Some college | 18 | 17 | | |
| Associate degree | 9 | 8 | | |
| Undergraduate degree | 59 | 55 | | |
| Graduate degree | 13 | 12 | | |
| Income | | | 68,307.55 | 33,692.03 |
| Number of children | | | | |
| One | 26 | 24 | | |
| Two | 54 | 51 | | |
| Three | 16 | 14 | | |
| Four | 6 | 6 | | |
| Five | 5 | 5 | | |
| Amount of Problem Behavior | | | | |
| A great deal (e.g., my child engages in harmful behaviors such as hitting or kicking) | 10 | 9 | | |
| A lot (e.g., my child throws tantrums when I ask them to follow instructions) | 29 | 27 | | |
| A moderate amount (e.g., my child does not listen to instructions) | 45 | 42 | | |
| A little (e.g., I have to repeat myself for my child to follow instructions) | 23 | 22 | | |

Note: sociodemographic data includes participants (approximately 12% of the sample) who were not included in the final statistical analysis.

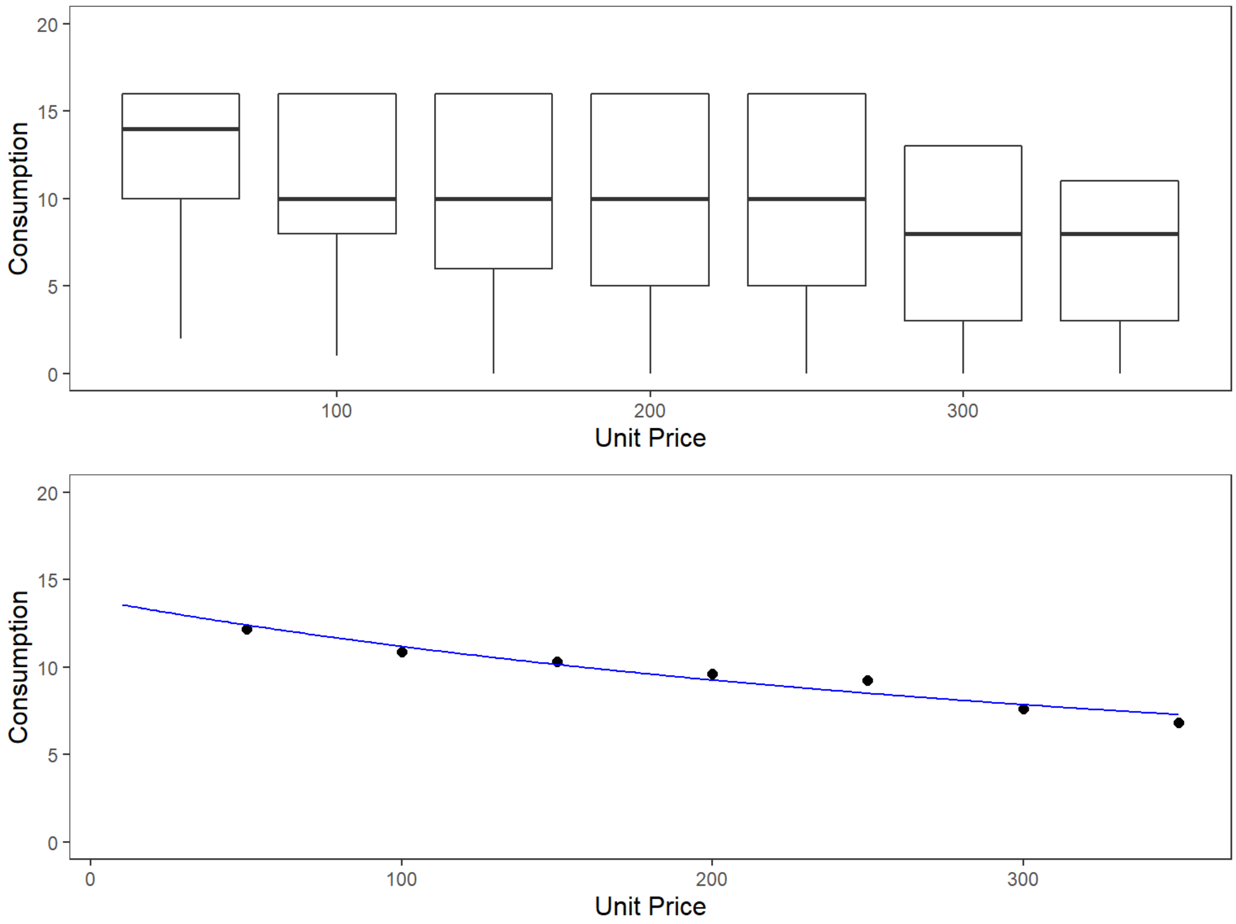


Figure 1. Aggregate Treatment Consumption Variability

**RQ2** – Researchers used the *wrapnls* package in R to perform cross price analyses as a function of evidence. Three different substitution tasks were evaluated whereby each alternative treatment was present alongside the main treatment: Strong-Strong, Strong-Moderate, and Strong-Low. The results for each experimental condition are displayed in Figure 2. The trends in modeled consumption of the treatment alternatives indicated that caregivers pursued the alternative treatment as a substitute for the well-established treatment when the price of the higher-evidenced treatment increased. As noted earlier, the *I* parameter reflects the direction and magnitude of the changes in the consumption in the alternative (e.g., does consumption of the alternative follow or diverge from the consumption of the primary good). Fitted *I* values for the strong-strong, strong-moderate, and strong-weak tasks were - .6149, - .819, and -.901, respectively. The *I* parameters indicated that as the price increased on the main treatment, the alternative treatment was pursued as a functional substitute to EBPs. Therefore, the nature of consumption between the main good and the alternative good is reciprocal, meaning substitutional.

**RQ3** – The third research question evaluated demand for treatments using a model with gender-specific $Q_0$ and α parameters (i.e., full model). The full model was then compared to a restricted form, whereby singular $Q_0$ and α parameters were shared across the sexes. The full model was compared to the restricted model using an Extra Sum of Squares F-Test (ESS-FT). Based on traditional statistical hypothesis testing, the ESS-FT can be used to determine the model with which the data were most likely to emerge from. Model selection in the strong-moderate condition indicated that there was insufficient evidence to reject the simpler model, $F$ $(2,10) = 2.35$, $p = .146$. Figure 3. illustrates the demand for the strong-moderate condition and the strong-weak condition. Similarly, model selection in the strong-low condition indicated insufficient evidence to reject the simpler model as well, $F$ (2,10) = 0.69, $p = .524$).

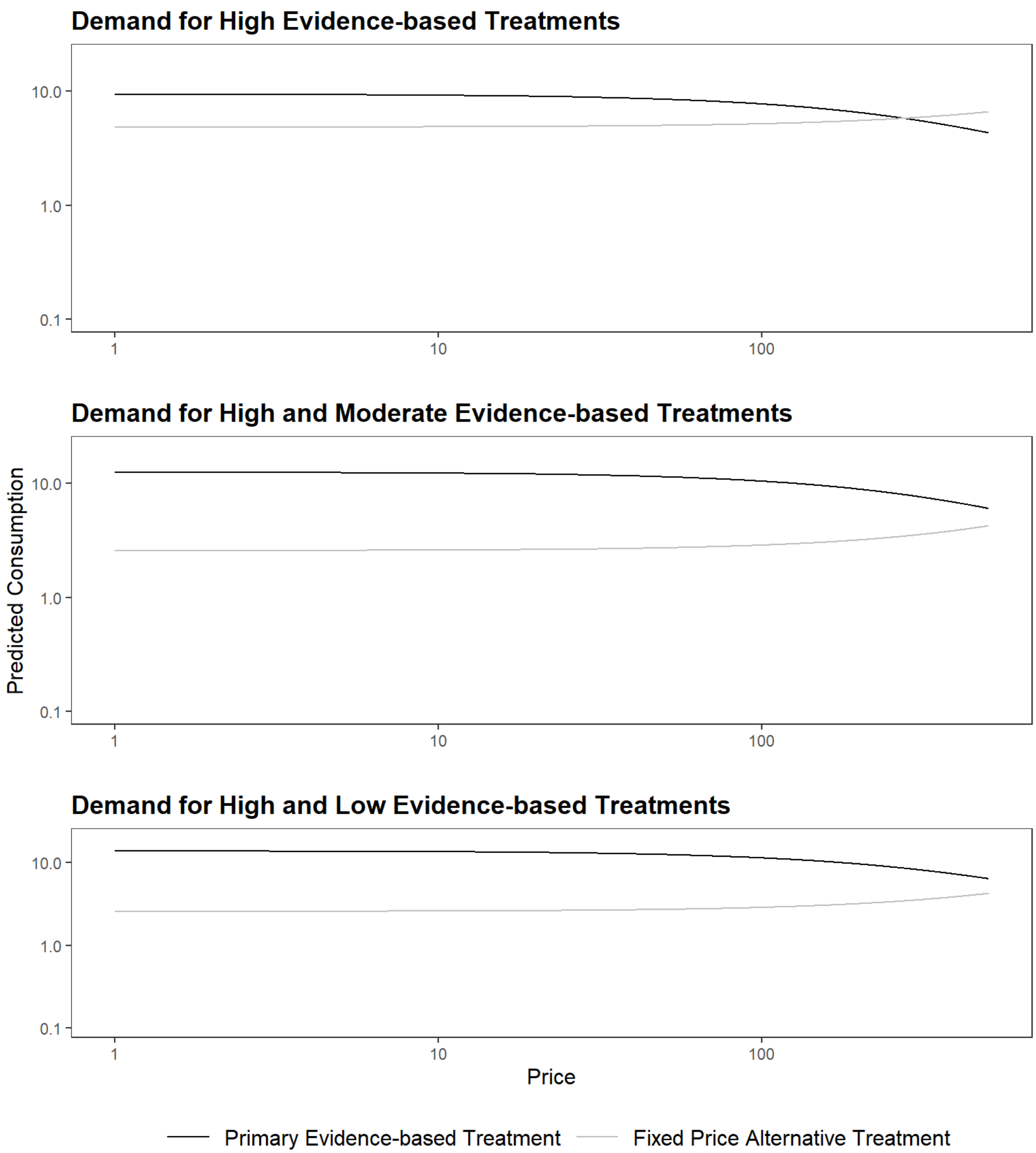


Figure 2. Demand Curves: Level of Treatment Evidence

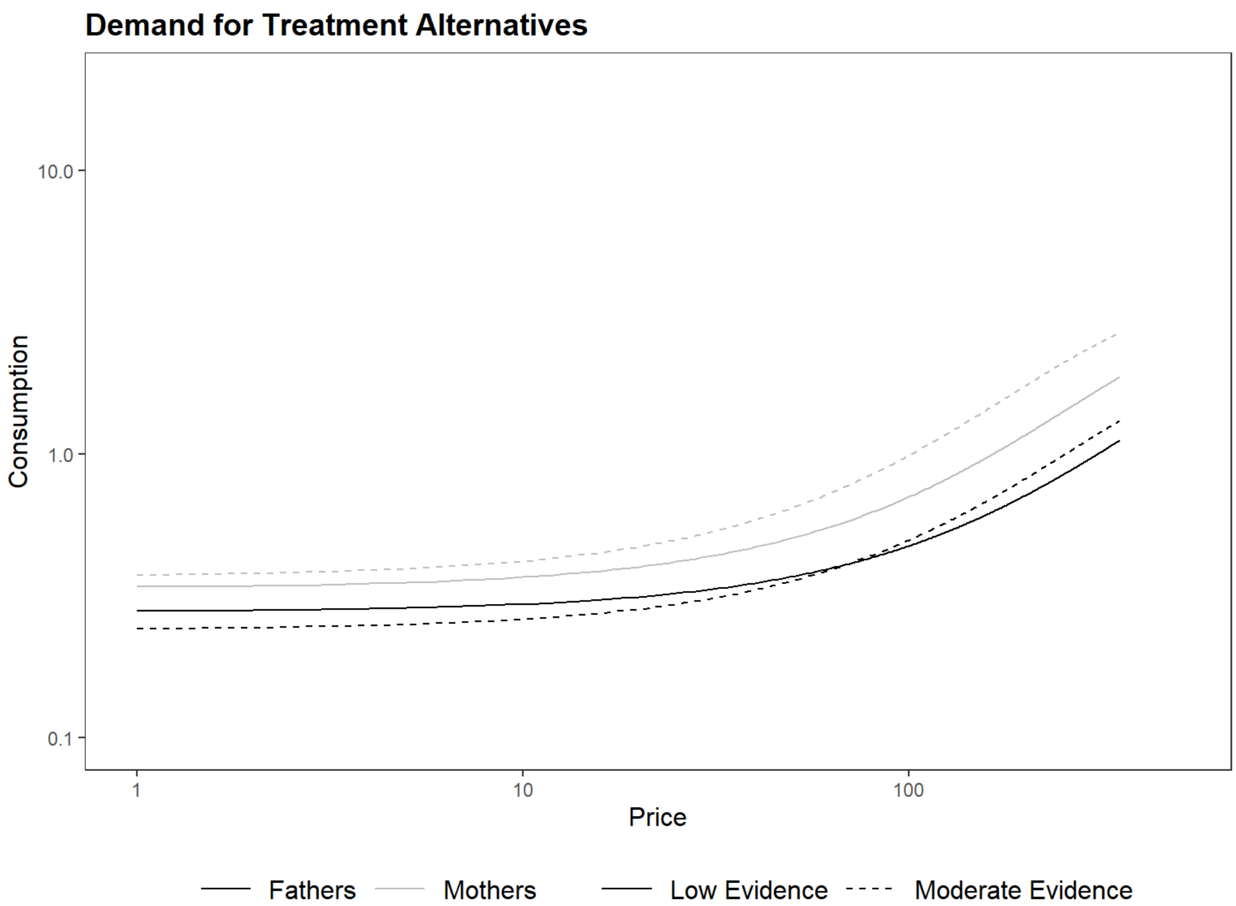


Figure 3. Demand Curve for Treatment Alternatives

# Discussion

The purpose of this study was to extend the literature for caregiver decision-making by applying behavioral economic methods to examine the roles that gender and evidence play in choices made by caregivers. Specifically, researchers posed three questions. First, to what degree is the consumption of evidence-based practices influenced by price? Second, are caregivers influenced by the degree of evidence when differentially evidenced treatments are concurrently available? Lasty, do caregivers vary, in terms of gender, in how they're influenced by the degree of evidence in available treatments?

Regarding the first research question, the consumption of evidence-based practices was found to be sensitive to price. As researchers expected, consumers are less likely to purchase an evidence-based treatment when the price increases. Figure 3 reveals the demand curve for average levels of treatment consumption in a closed economy. The downward sloping trend of the curve revealed that consumption decreased as the price of the treatment increases. Regarding the second research question, the consumption of evidence-based practices was manipulated, and an alternative treatment was kept available at a lower, fixed price. Cross-price analyses of demand for the alternative treatments revealed that all three alternatives functioned as was substitutes. That is, caregivers pursued generally less evidence-based alternatives when the prices of an evidence-based alternative increased. This finding suggests that caregiver choice was not strongly influence by the level (or lack) of available evidence. Regarding the last research question, caregiver-reported gender not helpful in characterizing how caregivers make choices as a function of evidence.

Although the methods and results of this work are consistent with earlier works in this area (Gilroy & Kaplan, 2020), several limitations warrant noting. First, the present study asked caregivers to complete hypothetical purchasing tasks rather than make actual treatment-related decisions. Previous research has also discussed these limitations (Reed et al., 2020) when using virtual marketplaces and have found that demand for real and potentially real outcomes can differ. However, the two have been determined to be strongly correlated (Wilson, Franck, Koffarnus, & Bickel, 2016).

Another limitation for the present study is a lack of diversity among participants. This is likely due to the overall limitation of collecting data through the MTurk program in that the sample of participants obtained may not accurately reflect the general population. For instance, there are disparities among race/ethnicity for participants, wherein the majority of participants self-identified as white/Caucasian. In addition, the sample consisted predominately of individuals who reported at least some education post high school as well as a mean income well above poverty level. This led researchers to believe that the sample obtained for the purposes of this study may not be fully representative of the general population of caregivers.

Other limitations to the present study include the post hoc nature of the analyses as well as relatively low power. Post hoc analyses have been historically criticized in the literature due to the fear that readers may ascribe more value to the unplanned outcome than is warranted (Curran-Everett & Milgram, 2013). In addition, group difference analyses without purposeful statistical and randomization planning could possibly lead to differences in the data that are little more than a coincidence. However, this was not an issue for the present study as the post hoc analysis for gender was not statistically significant.

The present study utilized analytical strategies which had low statistical power, meaning that researchers would have had to find a relatively large effect size in order to detect group differences. Low statistical power can also lead to a smaller number of choices in terms of statistical procedures; however, this did not prove to be an issue for the present study. In addition, low statistical power can affect certain assumptions needed to use certain procedures, such as assumptions like normality.

In conclusion, the results of the study suggest that demand of treatment varies based on other factors and constraints placed on the consumer in a virtual marketplace. The present study further demonstrates both the feasibility and importance of predicting behavior in an economic marketplace by applying behavior analytic terms and concepts. It demonstrates that choice is, at least in part, affected by the presence of substitutable alternatives. The virtual marketplace is a valuable tool which can be used to explore not only more treatment-related decisions and behaviors, but also a wide variety of behaviors in order to better predict future directions and behavior.

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# Vita

Delaney Darragh was born in Kaufman, Texas and attended Texas A&M University in College Station, Texas from August 2014 to December 2016 where she earned a Bachelor of Science in psychology. Delaney is a fourth-year graduate student in school psychology at Louisiana State University under the supervision of Dr. Frank M. Gresham, and plans to receive her Masters in Psychology in May 2022. Delaney's clinical and research interests include behavioral interventions for students with emotional and behavioral disorders, Autism Spectrum Disorder and related disorders, as well as mental health awareness.