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Full Report: Participation Dosage in *Key to Kāne*: A Pilot Text-Messaging Intervention for Fathers

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Executive Summary

Unlike in previous generations, fathers today want to be more actively engaged in their children's lives, but their involvement may be constrained by myriad factors. Given the extensive evidence that involved fatherhood benefits children, fatherhood interventions have been designed to encourage men to take a positive and active role in their children's lives and help increase quantity and quality of involvement.

Key to Kāne is a pilot, technology-assisted, text-messaging intervention for fathers of children aged 0 to 12, delivered in Hawai'i that focuses on three topics having the potential of supporting father involvement: information about normative child development, concrete and simple ideas for fathers on ways to become engaged with their children, and encouragement of men in their role as *Nā Mākua Kāne* (fathers).

Using data collected from the 120 participants in this intervention, analyses assessed both the determinants of the extent to which fathers read text messages (i.e., reading dosage) and whether different reading dosages differentially affect intervention outcomes. A few key findings emerged from the present study:

- Reading dosage is bimodal: many fathers do not read any messages, while many others read most or all messages.
- Native Hawaiian/Pacific Islander fathers are more likely than non-Native Hawaiian/Pacific Islander fathers to be in the no-dosage group; fathers with more children are more likely than fathers with a smaller number of children to be in the no-dosage group; and fathers who experience no economic, behavioral, or legal challenges are more likely than men who experience these personal challenges to be in the high-dosage group.
- Quantitative analysis suggests that higher reading dosage does not encourage fathers' engagement with their children. However, initial analysis of qualitative data obtained through focus groups suggests that intervention participants perceived positive changes in their involvement with their children.

Contrary to previous research findings, the quantitative findings presented here do not provide evidence that higher participation dosage encourages fathers' engagement with their children. This may be explained by limitations of our study:

- It is possible that we had a "ceiling effect" from recruiting mostly low-risk participants, as we would expect stronger effects with high-risk participants. Similarly, fathers with individual needs not covered in our text messages may not have benefited from the intervention, even if they had faithfully read texts and registered a high reading dosage. As such, we have two recommendations: recruitment efforts should continue targeting the vulnerable fathers who are less engaged with their children, and new curricula should be developed considering the importance of tailored approaches.
- Initial qualitative analysis indicates that fathers would like to meet other fathers, either face-to-face or through an online forum. We recommend that the effectiveness of *Key to Kāne* as an enhancement to an interactive intervention be evaluated. We also recommend continuing to collect qualitative data, as these data are essential for determining the kind of help fathers want, and for determining the mechanisms by which such interventions are most effective.

Introduction

The last 40-plus years have seen a sharp increase in research on fatherhood, including cultural changes in the definition of the role of the father (LaRossa, 1988; LaRossa, Gordon, Wilson, Bairan, & Jaret, 1991), the parenting behavior of men, and its effects on the well-being of children (Amato, 1998; Amato & Gilbreth, 1999; Lamb & Lewis, 2010; Marsiglio, Amato, Day, & Lamb, 2000; Tamis-LeMonda & Cabrera, 2002). Findings suggest that fathers—regardless of whether they live in the same household as their children—affect their children's development from childhood to adulthood, contributing to better socioemotional development (Flouri, 2008; Flouri, & Buchanan, 2003a, 2003b) as well as cognitive and academic outcomes (Bronte-Tinkew, Carrano, Horowitz, & Kinukawa, 2008; Coley, 1998; Coley, Lewin-Bizan, & Carrano, 2011; Fagan & Iglesias, 1999; Fagan & Lee, 2012a; Flouri & Buchanan, 2004; Jeynes, 2015; Sims & Coley, 2016; Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004), and to fewer problem behaviors (Amato & Rivera, 1999; Bronte-Tinkew, Moore, & Carrano, 2006; Carlson, 2006; Coley, 1998; Coley, Carrano, & Lewin-Bizan, 2011; Coley & Medeiros, 2007; Fagan & Iglesias, 1999; Flouri & Buchanan, 2002; Goncy & van Dulmen, 2010). Unlike in previous generations, fathers today want to be more actively engaged in their children's lives (Marsiglio & Roy, 2012; Petts, Shafer, & Essig, 2018), but their involvement is influenced, and may be limited, by myriad factors. Fatherhood interventions have been designed to encourage and support men in their positive and active role in their children's lives and to help increase their quantity and quality of involvement.

Barriers to Father Involvement

Fathers who want to be more engaged with their children can face barriers to their involvement, such as socioeconomic, interpersonal, and psychological. Fathers with low socioeconomic resources face a host of obstacles to becoming and staying involved in the lives of their children, such as unemployment or underemployment, low educational attainment, involvement in problem and illegal behaviors, fathering children across multiple households, and geographical distance between fathers and children that may require additional time and money necessary to maintain frequent involvement (Berger & Langton, 2011; Cheadle, Amato, & King, 2010; Fagan & Lee, 2012b; Jaffee, Caspi, Moffitt, Taylor, & Dickson, 2001; Johnson, 2001; Tamis-LeMonda & McFadden, 2010).

Fathers' poor interpersonal relationships, such as a conflictual relationship with the child's mother or an antagonistic coparenting relationship, are also associated with fathering difficulties, including lower warmth and cognitive stimulation of children and higher psychological control (Cabrera, Fagan, Wight, & Schadler, 2011; Coley & Hernandez, 2006; Davies, Sturge-Apple, Woitach, & Cummings, 2009; Schofield et al., 2009). Conversely, a strong parenting alliance—how parents acknowledge, respect, and value the parenting roles and tasks of the other (Cohen & Weissman, 1984)—positively affects father involvement (Futris & Schoppe-Sullivan, 2007; McBride & Rane, 1998; Rienks, Wadsworth, Markman, Einhorn, & Etter, 2011), and these associations are consistent across family structure (Fagan & Palkovitz, 2011).

Men's negative perception of their own performance in parenting tasks is an example of a psychological barrier to involvement. In general for parents, self-perceived low levels of parental self-efficacy are associated with poor parenting techniques (Sanders & Woolley, 2005), while high levels are associated with parental competence that includes warmth, encouragement, and monitoring (Ardelt & Eccles, 2001; Bogenschneider, Small, & Tsay, 1997; de Haan, Prinzie, & Dekovic, 2009; Glatz & Buchanan, 2015; Gondoli & Silverberg, 1997; Izzo, Weiss, Shanahan, & Rodriguez-Brown, 2000; Jones & Prinz, 2005). These associations are present also in research that focuses especially on fathers (Bogenschneider et al., 1997; Jacobs & Kelley, 2006; Sanderson & Thompson, 2002; Trahan, 2018).

Interventions Designed for Fathers

Fatherhood interventions may positively impact the lives of families (Bronte-Tinkew, Burkhauser, & Metz, 2012). Men who participate in such interventions tend to become more involved in their children's lives by increasing their interaction with them, expressing more support, and becoming more available to them (Doherty, Erickson, & LaRossa, 2006; Fagan & Iglesias, 1999). They also tend to increase their parenting competence by becoming more skilled in fostering their children's growth (Magill-Evans, Harrison, Benzies, Gierl, & Kimak, 2007), and to experience decreased conflict with the child's mother (Cookston, Braver, Griffin, Deluse, & Miles, 2006). But despite the benefits of participating in fatherhood interventions, not all men can participate and the most frequently reported barriers to participation include scheduling conflicts and time demands (see Fagan & Pearson, 2018; Heinrichs, Bertram, Kuschel, & Hahlweg 2005; see Spoth & Redmond, 2000). Thus, with this understanding, alternatives to face-to-face interventions for parents have been developed, including technology-assisted interventions using mobile phones or the internet (see Breitenstein, Gross, & Christophersen, 2014; see Hall & Biernan, 2015).

These new technologies offer opportunities for sharing social support, consulting with professionals, and teaching parental skills (Baggett et al., 2010; Jabaley, Lutzker, Whitaker, & Self-Brown, 2011; see Jones et al., 2013; Nieuwboer, Fukkink, & Hermanns, 2013) by either enhancing or replacing face-to-face interventions. Technology-assisted interventions for parents range from the delivery of information about children's health (Bar-Shain, Stager, Runkle, Leon, & Kaelber, 2015; Evans, Abroms, Poropatich, Nielsen, & Wallace, 2012; Evans, Wallace, & Snider, 2012; Hofstetter et al., 2015a; Hofstetter et al., 2015b; Militello, Melnyk, Hekler, Small, & Jacobson, 2016) to the enhancement of parenting skills and practices (Bigelow, Carta, & Lefever, 2008; Carta, Lefever, Bigelow, Borkowski, & Warren, 2013; Kraft & Monti-Nussbaum, 2018). Findings from evaluation research on the use of these technologies indicate that they improve parenting practices among participants (Enebrink, Högström, Forster, & Ghaderi, 2012; Rusell & Lincoln, 2017; Sanders, Baker, & Turner, 2012), and specifically for fathers, lead to more engagement in activities with their children (Hurwitz, Lauricella, Hanson, Raden, & Wartella, 2015).

Gaps in the Literature and Goals of this Study

Despite the increased interest in interventions that promote responsible fatherhood, information on their effectiveness is relatively new (Bronte-Tinkew et al., 2012; Bronte-Tinkew et al., 2007). In addition to describing the characteristics of participants enrolled in *Key to Kāne*, a pilot, technology-assisted, text-messaging intervention for fathers conducted in Hawai'i, this exploratory/descriptive study has two goals.

The first goal is to examine whether demographics and personal characteristics of fathers predict the extent to which fathers read *Key to Kāne* text messages, herein termed "reading dosage." The existing literature includes very few evaluation reports with data on fathers' participation dosage in interventions (Fagan & Pearson, 2018). No studies have rigorously examined influences on fathers' participation dosage, and most of the information is anecdotal, ranging from programmatic variables (e.g., flexible scheduling, monetary incentives) to fathers' personal characteristics (e.g., age, race, education, marital status) (see Fagan & Pearson, 2018). By systematically examining influences on fathers' participation dosage in interventions, we seek to inform recruitment method, such as targeted recruitment of specific groups.

The second goal of this study is to assess whether different dosages of participation in *Key to Kāne* differentially affect levels of our outcomes of interest. There are very few studies that looked at the effects of participation on the desired outcomes, and most measured participation as the mean level of sessions or hours attended. However, it has been suggested that most fathers either attend very few sessions or most or all sessions (see Fagan & Pearson, 2018). In this case, using the mean may produce an inaccurate link between participation and outcome, and therefore it has been suggested that the best way to explore this link is through the creation of categories of participation (see

Fagan & Pearson, 2018). Indeed, studies that focused on dosage categories found a positive association between high participation dosage, measured as hours of intervention attendance grouped by low, adequate, or high dosage, and increased father involvement with children (Fagan & Iglesias, 1999) and increased parenting satisfaction (Kim & Jang, 2018), both at post-treatment. Some studies also included a no-dosage group, meaning zero sessions (Kim & Jang, 2018). Therefore, there is clearly a need to examine whether greater intervention dosage leads to better outcomes, taking into consideration that the success of a fatherhood intervention can only be assessed in comparison to the goals of the intervention. Interventions like ours that have the limited scope of increasing fathers' engagement with children (versus interventions that also seek to improve father-mother coparenting relationships, for example) generally measure changes in a father's engagement with his children (Fagan & Iglesias, 1999). Consistent with this, our outcome of interest is father engagement. Given the positive associations between high parental self-efficacy levels and father engagement (Ardelt & Eccles, 2001; Bogenschneider et al., 1997; de Haan et al., 2009; Glatz & Buchanan, 2015; Gondoli & Silverberg, 1997; Izzo et al., 2000; Jacobs & Kelley, 2006; Jones & Prinz, 2005; Sanders & Woolley, 2005; Sanderson & Thompson, 2002; Trahan, 2018), we also measured paternal self-efficacy as an outcome. By systematically examining whether participation dosage affects these outcomes we seek to inform intervention planning and retention methods. Although not our focus, we also measured parenting alliance as a secondary outcome.

Method

The Intervention

Key to Kāne is a pilot, technology-assisted, text-messaging intervention for fathers delivered in Hawai'i that aims to help men become more involved in their children's lives. *Kāne* is the father of living creatures in Hawaiian mythology and represents the god of procreation. The *Key to Kāne* intervention was created through an interdisciplinary collaboration among Dr. Selva Lewin-Bizan, Mr. David "Kawika" Mattos, and Mrs. Victoria Bence. Dr. Lewin-Bizan, from the University of Hawai'i, is a researcher in the field of fatherhood. Mr. Mattos is the lead practitioner of the father engagement team at Maui Family Support Services, Inc., a social services agency that provides individual and group services to children, youth, and parents. Mrs. Bence is a teacher and phone application programmer at iOS Maui. For a project like ours, which combines intervention and technology, we cultivated this partnership following Jones's (2014) recommendations for "a collaborative development, testing, and deployment process" (p. 128). We also had the support of Edeluisa M. Baguio-Larena, CEO of Maui Family Support Services, Inc.

From March to May 2017, the content of the text messages was developed by the team's researcher and revised by the team's practitioner to make sure the content, language and tone, and length of each message was appropriate, clear, and engaging. Given the positive associations between high parental self-efficacy levels and father involvement, and that parents reported increased self-efficacy in their roles as parents resulting from receiving text-based support (Evans et al., 2012; see Gazmararian, Elon, Yang, Graham, & Parker, 2014), we considered self-efficacy important when working with fathers. Accordingly, we focused on three topics with the potential of supporting both father involvement and self-efficacy: information about normative child development, concrete and simple ideas for fathers on ways to become engaged with their children, and encouragement of men in their role as *Nā Mākua Kāne* (fathers).

To develop the content, we relied on theoretical sources such as child development textbooks and fatherhood handbooks, and on current research on parenting, fatherhood, child development, and pediatrics. For example, research shows that when parents use rich vocabulary, take the child's perspective, and ask questions either in conversations or when reading a book together, children develop a better receptive and expressive vocabulary (Bojczyka, Davis, & Rana, 2016; Mol & Neuman 2014). Specifically for fathers, those who used more diverse vocabulary in interactions with their children and more clarification requests had children who had a more advanced expressive

language, using more words and more diverse speech (Leech, Salo, Rowe, & Cabrera, 2013; Pancsofar, Vernon-Feagans, & The Family Life Project Investigators, 2010). Therefore, considering how quantity and quality of parent speech affects children's language skills, language was one of the topics we chose to focus on (Table 1).

Key to Kāne delivered three weekly text messages with a different topical focus to parents of children aged 0 to 12. On Mondays, the messages had information about child development. On Wednesdays, they dealt with engagement ideas. On Fridays, they highlighted the use of encouragement words. Messages were delivered during the evening hours for a period of 12 weeks. Messages were automated; fathers could not interact with the text service. Research has shown that when messages combine personalization and content matching strategies, the messages increase attention, enhance processing, and influence behavior (Hawkins, Kreuter, Resnicow, Fishbein, & Dijkstra, 2008). Consequently, message personalization was implemented to enhance the relevance of the content to individual fathers. Specifically, messages were delivered based on the age of the focal child, language was tailored to the sex of the focal child, and we referred to each participant by his name and included his focal child's name. In addition, we tailored the messages to the unique Hawaiian culture, using Hawaiian language and proverbs, based on the knowledge of team members and books.

Table 1. Language-related texts sent on a specific week for fathers of children ages 3–5

Information about normative child development	Concrete and simple ideas for fathers on ways to become engaged with their children	Encouragement of men in their role as Nā Mākua Kāne (fathers)

Did you know . . . ?
 	
Your child's brain grows rapidly and absorbs information from all around:
 	
• Your 3-year-olds correctly names some colors, may know a few numbers, recalls parts of a story, and engages in make-believe or fantasy play.
 	
• Your 4- and 5-year-olds counts 10 or more objects, correctly names at least 4 colors, and knows about things used every day in the home (money, food, appliances).
	Hello [name of participant].
	
	Here are some ideas about how to talk with [name of focal child] to encourage [his/her] language development.
	
	Talk to [him/her] as often as you can, ask questions and wait for responses. If you don't live with your child, you can do this on the phone or with any form of video chat.
	
	• If your child is 3 years old:
	
	  • Provide words that [he/she] did not request. Here is an example: When your child points to a car and says, "big car," answer "Yes, that is a big grey car. Look how shiny the surface is."
	
	  • Help [him/her] use words to describe things and ideas [he/she] cannot see. Here is an example: When [he/she] talks about the monster under the bed, ask "Is the monster friendly or angry?"
	
	• If your child is 4 or 5 years old:
	
	  • Reinforce the use of "please" and "thank you."
	
	  • Pay attention to the way you talk to your child and other family members. Try not to use bad words even when you are stressed.
		"More father involvement" means . . . more affection, touch, smiles, and warmth.
		
		Children with involved fathers are more likely to have better reading skills. Be involved with your *keiki* (children) in positive ways, even if you don't live with them. *Mālama* (take care of) them.
		
		Ka ʻike a ka mākua he hei no ke keiki (the knowledge of the parent is absorbed by the child).

From May to July 2017, the smartphone application was developed, followed by a period of testing. We conducted several rounds of testing, including design, delivery, and opening of texts, until we were comfortable with the use of this technology and felt ready to explain it to participants in our project. The first group of participants started receiving text messages at the end of August 2017, and the last group of participants in June 2018.

Sample and Procedures

Our goal was to recruit 120 participants for this study. The team's practitioner also served in the recruiter capacity. Recruitment efforts started in July 2017 and continued until April 2018, and included personally reaching out to families known at Maui Family Support Services, Inc., spreading the word through community organizations and non-profit agencies (e.g., Family and Child Services, Goodwill, the Salvation Army), government agencies (e.g., Maui County Business Development Office, Water Department, Waste Office), posting flyers throughout the city (e.g., churches, pizzerias, billboards), and posting in social media. Table 2 summarizes how participants heard about the intervention.

Table 2. Recruitment avenues (120 participants)

How did you hear about the program?	Enrollees
Program staff, team's practitioner	33
Community organizations	14
Flyers	12
Word of mouth	11
Wife or girlfriend	3
Social media	2
Government agency	1
Child's school	1
Combinations of all the above	43

Fathers who expressed interest in the intervention were invited to a group meeting at Maui Family Support Services, Inc. led by the practitioner that included a presentation of the intervention, a question-and-answer session, and dinner. These group meetings were held on a rolling basis, depending on the interest of potential participants. Prior findings suggested that the promotion of text-messaging interventions may be more successful if individuals are encouraged to sign up on the spot (Gazmararian et al., 2014). Therefore, interested men who attended the group meeting were enrolled in the project at the meeting by signing the consent form and downloading the phone application (app). After enrollment, participants received a demonstration on how to use all the functions of the phone app to ensure they were comfortable with using the technology. A total of 120 participants enrolled in *Key to Kāne*, and all enrollees received a program t-shirt.

There were two quantitative data collection points: baseline (paper-and-pencil at time of study enrollment) and 12 weeks later (over the phone at intervention completion). One hundred nineteen participants completed the baseline questionnaire, and 87 participants completed the post-intervention questionnaire. All participants who completed questionnaires were provided with Walmart gift cards for their time and effort: $25 for the baseline questionnaire, $35 for the 12-week questionnaire, and a bonus gift card ($30) for completing both questionnaires.

Hoping to gain an in-depth understanding of the likability of *Key to Kāne* and its effectiveness in promoting father involvement, we conducted three focus groups with intervention participants, led by the team's researcher and practitioner. In November 2017, all the men enrolled in *Key to Kāne* who completed the intervention received phone calls from the team's practitioner inviting them to participate in a focus group in December 2017, with the goal of

recruiting six to seven men. Six men agreed to participate. A similar procedure took place in June 2018, with the goal of recruiting 12 to 14 men for two separate groups. Twelve men agreed to participate, and two focus groups were conducted in July 2018 (seven and five participants, respectively). All those who participated in a focus group were provided with dinner and additional Walmart gift cards for their time and effort ($40).

Measures

Quantitative data were collected using self-report surveys. Data gathered included father engagement, parental self-efficacy, parenting alliance, father's personal challenges, whether participants have participated in another fatherhood intervention, and demographic information. Participants who had more than one child were asked to respond to surveys thinking of the child they wanted to focus on during this intervention (i.e., the focal child). Parents were also asked to report on the focal child's age and gender. Measures are discussed below. Most measures showed high reliability for our sample and are consistent with what the Fatherhood Research and Practice Network (FRPN) has reported in the available published literature (Dyer, Fagan, Kaufman, Pearson, & Cabrera, 2017a; Dyer, Kaufman, & Fagan, 2017b; Dyer, Kaufman, Fagan, Pearson, & Cabrera, 2018). Additionally, we collected data about the participation dosage in *Key to Kāne* by directly tracking the reading dosage of the fatherhood text messages for each participant.

Father engagement. Participants reported on their own parenting behaviors with the focal child using the Father Engagement Scale, a measure developed by the FRPN (Dyer et al., 2017a; Dyer et al., 2018). Items assessed the frequency with which fathers engaged in caregiving and play, and the frequency of engaging in cognitively stimulating behaviors with their infants or emotionally supportive behaviors with their young and older children (1 = *never* to 5 = *every day or almost every day*). Three sub-scales were developed: one for infants ages 0 to 1 (11 items, α = .96; e.g., "During the last month, how often have you . . . fed or given a bottle to this child?; put this child to sleep?; sung to this child?"), another for toddler and preschoolers ages 1 to 6 (10 items, α = .98; e.g., "During the last month, how often have you . . . played toys with this child?; had meals with this child?; read with this child?"), and another for children in middle-childhood, ages 6 to 12 (9 items, α = .96; "During the last month, how often have you . . . played toys with this child?; had meals with this child?; read with this child?"). For this study, all items were averaged to create a father engagement score. Reliability was calculated for each sub-scale: infants (α = .85), young children (α = .93), and older children (α = .96). Note that while this scale was developed to use with nonresident fathers, in this study it has been used with resident fathers as well.

Parental self-efficacy. Participants reported on their belief that they can perform parenting tasks successfully with the focal child using the Parenting Self-Efficacy Scale, a measure developed by the FRPN (Dyer et al., 2017a; Dyer et al., 2017b; Dyer et al., 2018). The scale (six items, α = .90; e.g., "I am good at . . . helping this child when he/she is upset or distressed; knowing what activities this child enjoys; providing for this child's financial needs") assessed belief in the ability to perform the parenting role successfully (1 = *strongly agree* to 5 = *strongly disagree*). For this study, all items were averaged to create a self-efficacy score and reliability was calculated (α = .83). Note that while this scale was developed to use with nonresident fathers, in this study it has been used with resident fathers as well.

Parenting alliance. Participants reported on their co-parenting relationship with the mother of the focal child using the parenting alliance sub-scale of the Co-Parenting Relationship Scale, a measure developed by the FRPN (Dyer et al., 2017a). The scale (five items, α = .94; e.g., "The mother of this child and I . . . discuss the best way to meet the child's needs; share information about the child with each other; make joint decisions about the child") assessed fathers' views of how they share the duties of parenting a child (1 = *strongly disagree* to 5 = *strongly agree*). For this study, all items were averaged to create an alliance score and reliability was calculated (α = .97). Note that while this scale was developed to use with nonresident fathers, in this study it has been used with resident fathers as well.

Father's personal challenges. Participants reported on their own personal challenges using the Measure of Fathers' Challenges, a measure developed by the FRPN (Fagan & Kaufman, 2015). The measure (30 items, α = .87; e.g., "In the past month, did you have problems with . . . unemployment?; not having enough money to buy things for your children?; physical health?") assessed the intensity with which fathers experience a range of economic, family, health, and legal challenges (1 = *not at all* to 4 = *yes, a great deal*). For this study, we treated personal challenges in two ways: first, all items were averaged to create a challenges score and reliability was calculated (α = .86), and second, we used individual items in analyses. Note that while this measure was developed to use with nonresident fathers, in this study it has been used with resident fathers as well.

Demographic variables. These variables included child and father age; child sex; how many children the father has; and father race/ethnicity, coded as Native Hawaiian/Pacific Islander, White, Asian, Hispanic/Latino, African American, and multiracial. Fathers' residence status (a dummy variable indicating whether the father lives with the focal child) and status of relationship with child's mother, coded as married, separated, divorced, cohabit, romantically involved but living apart, just friends, not in any type of relationship, and widower, are included as well. Finally, economic and human capital were measured as father's educational attainment (1 = *elementary school* to 7 = *graduate degree*), employment status (1 = *works full time* to 5 = *unemployed*), and income in the past 30 days before taxes and deductions (1 = *less than $500* to 7 = *more than $5,000*).

Participation in another fatherhood intervention. Participants reported on whether they participated in other fatherhood interventions (e.g., group programs at Maui Family Support Services, Inc. or at Neighborhood Place of Wailuku, programs at Child Protection Services, etc.) and, if so, how frequently, ranging from 1 = *once a week or more* to 5 = *not at all.*

Participation dosage in Key to Kāne. Intervention participation has been measured as reading dosage, that is, how many text messages participants read during their time in the intervention. As a team, we did a weekly direct tracking of the text messages read by each participant, using relevant information on the *Key to Kāne* phone app. As in prior studies (Fagan & Iglesias, 1999; Kim & Jang, 2018), we created four reading dosage groups, and followed Fagan and Pearson's (2018) recommendation for cutoffs: A no-dosage (zero texts read), a low dosage (read less than 40% of the texts, between one and 14 texts), a moderate dosage (read 40% to 69% of the texts, between 15 and 25 texts), and a high dosage (read 70% of the texts or more, between 26 and 36 texts) groups.

Analytic Technique

After describing the characteristics of participants enrolled in *Key to Kāne*, the main goals of this study were to examine whether demographic and personal characteristics of fathers predict their reading dosage and to assess whether different reading dosages differentially affect levels of father engagement, paternal self-efficacy, and parenting alliance.

Examination of the relationship between reading dosage and father characteristics began with a chi-squared test that was conducted to test whether there is a relationship between each potential predictor and reading dosage (0 = *no dosage*, 1 = *low dosage*, 2 = *moderate dosage*, and 3 = *high dosage*). When results of the chi-squared test indicated a significant association an ordered logistic regression model was used to link the choice of dosage level to each predictor. The results of the ordered logistic regression model yield the probability of choosing each dosage level conditional on levels of the predictor variable.

To assess whether different dosages of participation in *Key to Kāne* differentially affect outcomes, a one-way repeated-measure ANOVA was run to determine if there were differences in father engagement with his focal child, father's self-efficacy as a parent, and parenting alliance with the focal child's mother, based on reading dosage. For statistically significant outcomes, this was followed by post hoc analyses using the Scheffé post hoc criterion for significance to determine which means are significantly different from one another.

Results

This section summarizes the study results. First, a summary of participant characteristics is presented. Second, the results pertinent to the study aims are presented.

Characteristics of Participants Enrolled in *Key to Kāne*

Demographics. Depending on the variable, between one and five participants have missing data (that is, no one variable has more than five missing participants, but every participant might have missed at least one variable). Nearly 70% of the participants lived with the mother of the focal child (of all participants, 41.4% were married and 28.4% were cohabiting), and nearly four-fifths (79%) of the participants lived with the focal child. The average age of the focal child was four years and four months (*SD* = 41.1), and less than half (43%) of the focal children were girls. In terms of educational attainment, slightly over 40% of the participants obtained a high school diploma or a GED as a terminal degree, and almost three-fifths (57%) of the sample had attended at least some college. In terms of employment, slightly under 64% of the participants were employed full time and slightly over 14% were unemployed. In terms of race/ethnicity, slightly over one-third (35%) of the sample was multiracial and, among the single-race participants, the largest group was the Native Hawaiian/Pacific Islander (27.7%), followed by white (19.3%) and Asian (10.1%) (Table 3).

Engagement with focal child. Four participants have missing data. On a 1–5 scale, with 5 representing the highest level of engagement, the sample reported high levels of engagement with their children (*M* = 4.3, *SD* = 1.0) (Table 3).

Parental self-efficacy. Parental self-efficacy items were not included in the version of the questionnaire distributed to the first group recruited for the intervention, and therefore slightly over 34% of the participants have missing data for these questions. On a 1–5 scale, with 1 representing the highest level of self-efficacy, the remainder of the sample (*n* = 79) reported high levels of self-efficacy as fathers (*M* = 1.8, *SD* = 0.6) (Table 3).

Parenting alliance. Parenting alliance items were not included in the version of the questionnaire distributed to the first group recruited for the intervention, and therefore almost 36% of the participants have missing data for these questions. On a 1–5 scale, with 5 representing the highest level of alliance, the remainder of the sample (*n* = 77) reported high levels of alliance with the mother of the focal child (*M* = 3.6, *SD* = 1.4) (Table 3).

Personal challenges. Five participants have missing data. On a 1–4 scale, with 4 representing the highest level of challenges, the sample reported low levels of personal challenges (*M* = 1.3, *SD* = 0.3) (Table 3). In terms of specific personal challenges, the most commonly reported were related to economic barriers. Nearly half of the sample (48.7%) reported being unable to pay bills, followed by not having enough money to buy things for the children (43.9%), living in an overcrowded home (27%), and not having enough money for food (21.4%) (Table 4).

Participation in another fatherhood intervention. Most (70.4%) participants have not participated at all in other fatherhood interventions, while slightly over one-fifth (22.0%) have participated in other fatherhood interventions once a week or more (Table 3).

Participation dosage in Key to Kāne. Nearly one-fifth (19%) of the participants did not read any text message (23 participants) and were in the no-dosage group. Thirteen participants (11% of the sample) read between one and 14 text messages and were in the low-dose group. Sixteen participants (13% of the participants) read between 15 and 25 text messages and were in the medium-dose group. Sixty-eight participants (57% of the sample) read between 26 and 36 text messages and were in the high-dose group. Also, nearly one-quarter (23%) of the participants read all the text messages (27 participants), but they were included in the high-dose group (Table 5 and Figure 1).

Table 3. Sample characteristics (119 participants)

Variable	M or % (SD)	Range
Father age (n = 115)	35.5 (8.6)	20–57
Status of relationship with child's mother (n = 116)		
Married	41.4%	
Separated	2.6%	
Divorced	4.3%	
Cohabit	28.4%	
Romantically involved but living apart	4.3%	
Just friends	4.3%	
Not in a relationship	13.8%	
Mother is deceased	0.9%	
Educational attainment (n = 119)	3.9 (1.1)	2–7
Elementary school	0.0%	
Middle school	1.7%	
High school/GED	40.4%	
Some college but no degree	31.1%	
College	21.0%	
Some graduate but no degree	0.8%	
Graduate	5.0%	
Employed (n = 118)		
Full time (35+ hours per week)	63.6%	
Part time (1-34 hours per week)	10.2%	
Number of hours changes from week to week	7.6%	
Temporary/occasional/seasonal/odd jobs	4.2%	
Unemployed	14.4%	
Income (n = 116)	3.4 (1.8)	1–7
Less than 500	19.0%	
500–1,000	18.1%	
1,001–2,000	17.2%	
2,001–3,000	18.1%	
3,001–4,000	12.9%	
4,001–5,000	6.9%	
More than 5,000	7.8%	
Race (n = 119)		
One race	65.5%	
Native Hawaiian/Pacific Islander	27.7%	
White	19.3%	
Asian	10.1%	
Hispanic/Latino	5.0%	
African American	3.4%	
Multirace	34.5%	
Personal challenges (n = 115)	1.3 (0.3)	1–4
Parenting alliance (n = 77)	3.6 (1.4)	1–5
Father engagement (n = 116)	4.3 (1.0)	1–5
Father parenting self-efficacy (n = 79)	1.8 (0.6)	1–5
Participated in other programs (n = 118)		
Once a week or more	22.0%	
Several times a month	4.2%	
Several times a year	1.7%	
Hardly ever	1.7%	
Not at all	70.4%	
Children		
How many children (n = 119)	2.4 (1.6)	1–9
Focal child's age (in months) (n = 119)	52.3 (41.1)	1–144
Focal child is a girl (n = 118)	43.0%	
Live with focal child (n = 119)	79.0%	

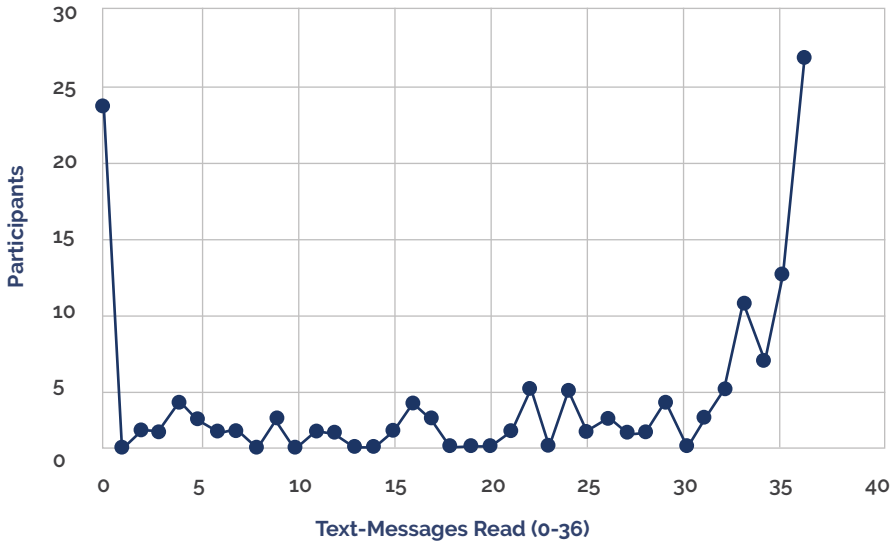
Table 4. Sample characteristics for personal challenges (119 participants)

Variable (range 1–4)	M (SD)	% of participants reporting having the challenge
Being unable to pay bills (n = 115)	1.7 (0.9)	48.7
Not having enough money to buy things for the children (n = 114)	1.7 (1.0)	43.9
Living in an overcrowded home (n = 115)	1.3 (0.6)	27.0
Not having enough money for food (n = 112)	1.3 (0.7)	21.4
Difficulties keeping a job when he has one (n = 114)	1.2 (0.3)	12.3
Accused of being violent towards partner (n = 114)	1.2 (0.6)	9.7
Not having health insurance for him/the children (n = 112)	1.3 (0.5)	9.0
Having a protection order against him (n = 114)	1.1 (0.4)	3.5

Table 5. Number of text messages read by participants (N = 120)

Dosage	Participants	Dosage	Participants	Dosage	Participants
0	23	13	0	25	1
1	0	14	0	26	2
2	1	15	1	27	1
3	1	16	3	28	1
4	3	17	2	29	3
5	2	18	0	30	0
6	1	19	0	31	2
7	1	20	0	32	4
8	0	21	1	33	10
9	2	22	4	34	6
10	0	23	0	35	12
11	1	24	4	36	27
12	1				

Figure 1. Number of text messages read (dosage) by participants (n = 120)



Note: 23 participants read 0 messages, 0 participants read 1 message, 1 participant read 2 messages . . . 27 participants read 36 messages

Fathers' Characteristics as Predictors of Reading Dosage

Chi-squared test was conducted to test whether there is a relationship between reading dosage (0 = *no dosage*, 1 = *low dosage*, 2 = *moderate dosage*, and 3 = *high dosage*) and a series of predictors (father's demographic characteristics and personal challenges). For father's personal challenges, we tested not only the composite measure but also individual items. We used an alpha level of .10 as a threshold for all chi-squared tests.

In terms of demographic characteristics, chi-squared test results indicated that being Native Hawaiian/Pacific Islander is associated with reading dosage levels, χ^2 (3, n = 119) = 6.8, p = 0.08, and that the number of children the father has is also associated with reading dosage levels, χ^2 (24, n = 119) = 35.8, p = 0.06. No other significant associations were found.

In terms of personal challenges as a composite measure, chi-squared test results indicated no association with text-message reading dosage levels, and therefore we tested individual items.

In terms of economic challenges, chi-squared test results indicated that not having enough money to buy things for the child is associated with reading dosage levels, χ^2 (9, n = 114) = 15.1, p = 0.09. In terms of behavioral and legal challenges, chi-squared test results indicated that being accused of being violent towards a partner, χ^2 (9, n = 114) = 19.8, p = 0.02, having a protection order against him, χ^2 (9, n = 114) = 20.3, p = 0.02, and having difficulties keeping a job, χ^2 (9, n = 114) = 21.1, p = 0.01, are all associated with reading dosage levels.

Tables 6 and 7 present results from the ordered logistic regression model that were used to model the probability of choosing each dosage level conditional on levels of the predictor variable, without controlling for contextual factors. Because the number of children the father has is associated with reading dosage levels, we looked more closely at the number of children as a predictor. Based on the ordered logistic regression, the predicted probabilities of choosing no-dosage by fathers that have one child = .15 and by fathers who have nine children = .42. Conversely, the predicted probabilities of choosing high dosage by fathers that have one child = .63 and by fathers who have nine children = .29. Fathers who have more children are more likely to choose no-dosage, and fathers who have fewer children are more likely to choose the high dosage. The predicted probabilities of choosing either low dosage or moderate dosage do not vary significantly by the number of children, except for the choice of low dosage which is slightly reduced for fathers with one or two children. (See Table 6 for full results.)

Given that specific personal challenges are associated with reading dosage levels, we looked more closely at the degree of economic challenges faced by the fathers as a predictor. Based on the ordered logistic regression of dosage level conditional on the degree of economic challenges faced by the fathers, the predicted probability of choosing no-dosage by fathers that experience no economic challenges = .14 as opposed to .64 for choosing high dosage. By contrast, for fathers that experience a great deal of economic challenges, the probability of choosing no dosage is .34 and for choosing high dosage is .36. The same trend appears for fathers who experience a few economic challenges or a somewhat higher degree of economic challenges. Overall, fathers that experience more economic challenges tend to be less active participants.

Table 6. Ordered Logit – Prediction of reading dosage by demographic characteristics

Dosage	Number of children (n = 119) χ^2 (24, n = 119) = 35.8, p = 0.06								
	1 (n=38)	2 (n= 41)	3 (n=18)	4 (n=9)	5 (n=6)	6 (n=3)	7 (n=1)	8 (n=2)	9 (n=1)
No	.15	.18	.20	.23	.27	.30	.34	.38	.42
Low	.09	.10	.12	.12	.13	.14	.15	.15	.15
Moderate	.13	.14	.14	.15	.15	.15	.14	.14	.14
High	.63	.58	.54	.50	.45	.41	.37	.33	.29
	Native Hawaiian/Pacific Islander[1] (n = 119) χ^2 (3, n = 119) = 6.8, p = 0.08								
	Yes (n=65)				No (n=54)				
No	.24				.13				
Low	.13				.08				
Moderate	.15				.12				
High	.48				.67				

[1]*Single race or part of multi races.*

Table 7. Ordered Logit – Prediction of reading dosage by father's personal challenges

Dosage	Economic challenges			
	Not having enough money to buy things for the child (n = 114) χ^2 (9, n = 114) = 15.1, p = 0.09			
	Not at all (n=64)	A little (n=29)	Somewhat (n=11)	A great deal (n=10)
No	.14	.19	.26	.34
Low	.10	.12	.14	.16
Moderate	.12	.14	.15	.14
High	.64	.55	.45	.36
	Behavioral and legal challenges			
	Being accused of being violent towards partner (n = 114) χ^2 (9, n = 114) = 19.8, p = 0.02			
	Not at all (n=103)	A little (n=5)	Somewhat (n=3)	A great deal (n=3)
No	.17	.28	.43	.58
Low	.11	.14	.16	.14
Moderate	.13	.15	.13	.10
High	.59	.43	.28	.17
	Having a protection order against him (n = 114) χ^2 (9, n = 114) = 20.3, p = 0.02			
	Not at all (n=110)	A little (n=1)	Somewhat (n=1)	A great deal (n=2)
No	.17	.39	.68	.87
Low	.11	.16	.13	.06
Moderate	.13	.14	.08	.03
High	.59	.30	.12	.04
	Having difficulties keeping a job (n = 114) χ^2 (9, n = 114) = 21.1, p = 0.01			
	Not at all (n=100)	A little (n=7)	Somewhat (n=4)	A great deal (n=3)
No	.16	.25	.38	.53
Low	.11	.14	.16	.15
Moderate	.13	.15	.14	.11
High	.60	.46	.32	.21

Reading Dosage as Predictors of Fathers' Engagement, Self-Efficacy, and Parenting Alliance[1]

Table 8 presents results from the one-way repeated measured ANOVA that was run to determine if there were differences in a series of outcomes, based on reading dosage. We used an alpha level of .10 for all statistical tests.

Table 8. One-way repeated measured ANOVA – Predicted outcomes pre- and post-participation by reading dosage group

	Dosage Group					
Outcome	None (n=23)	Low (n=13)	Moderate (n=16)	High (n=68)	*F*	Scheffé
	M (SD)	M (SD)	M (SD)	M (SD)		
Engagement						
Pre	4.3 (1.0)	4.3 (1.0)	4.3 (1.0)	4.3 (1.0)		
Post	4.4 (1.0)	4.7 (0.3)	4.5 (0.9)	4.4 (1.0)	3.29*	ns
Self-efficacy						
Pre	1.8 (0.6)	1.8 (0.6)	1.8 (0.6)	1.8 (0.6)		
Post	1.6 (0.4)	1.7 (0.5)	1.5 (0.5)	1.5 (0.5)	4.22**	ns
Alliance						
Pre	3.6 (1.4)	3.6 (1.4)	3.6 (1.4)	3.6 (1.4)		
Post	3.8 (1.1)	4.3 (0.5)	4.3 (0.7)	4.1 (0.9)	2.1	n/a

Notes: The table reports F statistics for Dosage
**** p < .001 ** p < .01 * p < .05 + p < .10*

The results showed no significant effect for any of the outcomes. First, the results showed that reading dosage elicited statistically significant differences in mean father engagement $F(3,80) = 3.29$, $p = .02$ and in mean father self-efficacy $F(3,51) = 4.22$, $p = .01$, but post hoc analyses using the Scheffé post hoc criterion indicated no significant differences between the groups for either of these two variables. Second, the results showed that reading dosage did not elicit statistically significant differences in mean parenting alliance $F(3,50) = 2.9$, p = insignificant.

To understand whether this lack of significant effects could be a result of differences in characteristics of fathers who completed the post-intervention questionnaire and fathers who did not, we compared means and distributions of a few relevant variables between the two groups. First, t-tests were conducted for continuous variables (age, education, employment, and income), and the observed difference between the means of each of these variables between the two groups did not differ significantly. Second, a Kolmogorov-Smirnov test was conducted for the relationship status with the mother of the child, a categorical variable. This test compared two distributions (instead of comparing means) and tested the hypothesis that the two are sampled from the same population. Test results (p-value = .01) showed that the two groups—fathers who completed the post-intervention questionnaire and fathers who did not—were sampled from populations with different distributions for this variable. Table 9 summarizes these results.

[1]Note that, it could be that, regardless of dosage, participation in the text-messaging program could be associated with change in outcomes due to unobserved factors. To account for this possibility, we ran a regression model where a time trend was included in addition to dosage. The results indicated that time did not play a significant role in changing outcome, suggesting that the observed changes are not associated with unobserved factors.

Table 9. Comparison of means (t-test) and comparison of distributions (Kolmogorov-Smirnov test) between fathers who completed and fathers who did not complete the post-intervention questionnaire

	Completed	Did not complete
Outcome and ranges	M or % (SD)	M or % (SD)
Age	36.1 (.9) (n = 87)	34.0 (1.7) (n = 28)
Education (1–7)	4.1 (.1) (n = 87)	3.7 (.1) (n = 32)
Employed	90% (n = 87)	75% (n = 32)
Type of employment (1=full time, 4=temporal)	1.4 (.1) (n = 77)	1.5 (.2) (n = 24)
Income (1–7)	3.6 (.2) (n = 84)	2.8 (.3) (n = 32)
Relationship status with child's mother*	(n = 86)	(n = 30)
Married	50%	17%
Separated	2%	3%
Divorced	4%	7%
Cohabiting	28%	30%
Romantic no cohabiting	1%	10%
Friends	1%	13%
No relation	12%	20%
Mother deceased	1%	0%

*** $p < .001$ ** $p < .01$ * $p < .05$ + $p < .10$

Contrary to the statistical results showing no significant effects for any outcomes, a very preliminary examination of the qualitative data obtained through focus groups indicates that the intervention was influential for some men who perceived changes in their involvement with their children. For example, using text messages that suggest ways to read to children when not living in the same household—" . . . If you don't live with your child, you can do this on the phone or with any form of video chat" —a participant said:

> *"My girls are off-island . . . so this was a way, with a limited amount of time to see and talk to them, this was just a great tool . . . to maximize that time. Well, yeah. I would read to them, start reading books . . . over FaceTime, and I would share some of the stuff with them. It was encouraging. I need constant reminding because I would just go off somewhere."*

In addition, focus group participants discussed some advantages of the intervention format, such as flexibility around reading the text messages in terms of time and as many times as needed:

> *"I like the [convenience] because I have a busy schedule and I got four kids and you don't have time to commit to coming to a class, so it's kind of at your own leisure, you get a text and you can check it out when you get time . . . It just takes the stress off of having to get to a class and interrupting your day. I think it works best when you get the text, you know what days, Mondays [Wednesdays] and Fridays, and you have a day in between just in case you have to get back [and read again]. It works out."*

Discussion

Given the extensive evidence that involved fatherhood benefits children, understanding how to support fathers to increase their positive and active participation in parenting their children has become a central concern for policymakers, researchers, and practitioners. The current study contributes important new information about a specific type of father-focused intervention, based on a pilot technology-assisted text-messaging intervention delivered to fathers in Hawai'i.

Considering that studies conducted with mothers indicate that participation dosage in parenting programs is frequently low, the current study examined a text messaging intervention that potentially may result in higher participation rates. Specifically, the first goal of this study was to examine whether characteristics of fathers (demographics and personal characteristics) predict fathers' participation dosage in *Key to Kāne* (i.e., number of texts the participant read, or reading dosage).

Dosage has been operationalized differently in different studies, and for this study we followed prior studies and recommendations (Fagan & Iglesias, 1999; Fagan & Pearson, 2018; Kim & Jang, 2018) and calculated dosage as high (read 70% of the texts or more), moderate (read 40% to 69% of the texts), low (read fewer than 40% of the texts), and no-dosage (zero texts read) and systematically examined influences on dosage.

In terms of father's demographic characteristics, we found two significant results. First, we found that fathers with fewer children chose to read more text messages compared to fathers with a larger number of children, who were more likely to read none of the text messages. We do not know of prior studies with similar findings but can suggest two alternative explanations. First, it is possible that fathers with higher numbers of children feel more knowledgeable about parenting and less in need to learn new things. In this context, fathers with fewer children may be parents who are eager to learn more. Second, it is possible that fathers with a larger number of children are busier with work and family life and have less time to read text messages. This could be especially true in the case of multi-partner fertility. Thus, men who had their children with more than one partner might experience more unstable family relationships and make fewer investments in their children (Carlson & Furstenberg, 2006).

Second, we found that Native Hawaiian/Pacific Islander fathers were almost twice as likely to read no texts and approximately 30% less likely to be in the high reading dosage group compared to non-Native Hawaiian/Pacific Islander fathers. We are not aware of previous studies that looked at parenting interventions with Native Hawaiian/Pacific Islander fathers but can suggest two explanations, both related to the distinctive sociocultural context of Native Hawaiians/Pacific Islanders. First, the Hawaiian word that is used for family—*ohana*—is not about the nuclear family: it is about the extended family, and even a larger family that is not necessarily connected by blood. Many Native Hawaiian/Pacific Islander families live in multigenerational households that include not only grandparents but also aunts and uncles, where the adults collaborate financially and in raising the children. In fact, 13% of all the Native Hawaiian/Pacific Islander family households are multigenerational households, the highest rate compared to all other races/ethnicities (Lofquist, 2012). In this situation, when adults share common resources such as childcare, it may be the case that no specific adult carries the full parenting responsibility and that fathers are less motivated, or less in need, to acquire parenting knowledge and skills. Second, in terms of parenting practices, a very limited body of work suggests that, compared to White parents, Native Hawaiian parents are less warm (they are less emotionally demonstrative towards their children and praise them less), offer less cognitive stimulation (they engage in less explicit teaching), show less educational responsibility (they expect children to read social cues without prompting), and use more harsh discipline methods (see DeBaryshe, Yuen, Nakamura, & Stern, 2006). Since it is very important for Native Hawaiians/Pacific Islanders to preserve traditions, these men may well be less receptive to parenting approaches and interventions that are not specific to this culture.

We are also not aware of any studies that looked at father's personal characteristics as predictors of participation dosage. Our composite measure of fathers' personal challenges did not predict reading dosage. However, considering that prior studies found a negative relationship between fathers' daily hassles in areas such as work, health, and family, and accessibility and play interaction with their children (Fagan, 2000) that may be due to a lack of energy or time, we believed that the same hassles could affect participation dosage in parenting programs. We therefore proceeded to examine individual personal-challenge items, and indeed found that some of them negatively predicted reading dosage. This includes economic challenges, such as not having enough money to buy things for

the children, and behavioral and legal challenges, such as difficulties keeping a job, being accused of violence toward a partner, and having a protection order against him.

In summary, our findings constitute strong evidence that different fathers respond differently to the same intervention. Because eliciting active participation in fatherhood programs continues to be a major challenge, there is clearly more room for researchers to expand the examination of the different types of influence on dosage.

Because there are few evaluation reports with data on fathers' participation dosage in programs (Fagan & Pearson, 2018), the second goal of this study was to assess whether different reading dosage in *Key to Kāne* differentially affect levels of father engagement, paternal self-efficacy, and parenting alliance.

A very small number of studies have looked beyond the effects of participation, seeking to understand dosage effects, believing that, among other reasons, it would be beneficial to determine whether fathers can benefit from different levels of attendance or to identify a threshold dosage level that is sufficiently large to lead to positive outcomes (see Fagan & Pearson, 2018). These studies showed an association between high dosage participation and better outcomes, such as increased father involvement with children or increased parenting satisfaction (Fagan & Iglesias, 1999; Kim & Jang, 2018).

Contrary to the expectation based on previous research findings that demonstrated that it is possible to significantly modify parenting behavior using non-traditional, technology-based parenting interventions (Bigelow et al., 2008; Carta et al., 2013; Hurwitz et al., 2015; Kraft & Monti-Nussbaum, 2018), the findings presented here do not provide evidence that higher reading dosage in *Key to Kāne* can effectively encourage fathers' engagement with their children. We propose two possible explanations for this discrepancy, one related to the individual needs of the participants, and the other related to their initial levels of father engagement.

Although we tailored text messages to match the focal child's developmental stage to enhance the relevance of content to individual fathers, we did not customize messages to address the needs and interests of each individual father. For example, some fathers may benefit from text messages on basic needs such as sleep, nutrition, health, and behavior (Cabell, Zucker, Decoster, Copp, & Landry, 2019), while other fathers may prefer something else. In addition, since we targeted both residential and nonresidential fathers, our messages may have been inappropriate for some fathers. For example, some nonresident fathers do not have any face-to-face or phone or electronic contact with their children, possibly due to maternal gatekeeping—when mothers restrict and exclude fathers from involvement with children (Allen & Hawkins, 1999; Fagan & Barnett, 2003; Gaunt, 2008; Stevenson et al., 2014; Gaunt, 2008)—or to court orders that restrict contact. These fathers would not have the opportunity to use our intervention's ideas for ways to engage with their children or enjoy the words of encouragement on their fathering role. Therefore, fathers with individual needs not covered in our text messages may not have benefited from the intervention, even if they had faithfully read texts and registered a high reading dosage.

In addition, it could be that fathers who enrolled in the intervention were fathers with fewer barriers to involvement and higher involvement levels to begin with as analysis indicated that their initial engagement levels were high, a mean of 4.3 on a 1–5 scale. Therefore, it may be that there was little room to grow during the intervention and that higher reading dosage could not help them become a better father (that diminished the effectiveness of the intervention). It is possible that we had a "ceiling effect" from recruiting mostly low-risk participants, as we would expect stronger effects with high-risk participants. This might have been exacerbated by the fact that among those who completed the post-intervention questionnaire, 78% live with the mother of the child (either married or cohabiting), and among those who did not complete the post-intervention questionnaire, 53% do not live with the child's mother. Losing nonresident fathers and retaining more resident fathers—who may have been more involved to begin with—at the post-intervention questionnaire may have contributed to the "flat" results. Arguably, the nonresident fathers are the ones who might have greater levels of need and stand to benefit from more parenting support and information.

Many parents in other studies valued receiving similar parenting information directly on their cell phones. It appears, therefore, that using cell phones in interventions, either as an enhancement to other forms of intervention or even as the main mode of intervention, could be an effective tool for delivering parenting information, especially with enhanced tailoring and even more effective delivery. It is thus a promising avenue for future research.

Limitations

This study is not without limitations. First, due to budget and time constraints we were unable to create a randomized controlled trial assigning participants to treatment/control conditions, which remains the gold standard for testing the impact of intervention on outcomes. Furthermore, our study included a relatively small sample of fathers and it is important for future research to recruit a larger number of participants and randomly assign them to treatment and control groups to understand the impacts of cell phone-based interventions on parent engagement. Such strategies are important, given that there are not many studies on the effects of text messages on fathers' outcomes.

A second limitation is the self-reported nature of our data. Some prior research shows that either father or mother reports of father involvement can be used to create reliable father involvement measures because both reports are highly similar (Hernandez & Coley, 2007; Wical & Doherty, 2005). In fact, in some studies, father reports of father involvement showed more consistent predictive validity about children's outcomes than mother reports of father involvement (Hernandez & Coley, 2007). However, others have argued that self-report may be subject to social desirability biases, such as enhancement of positive attributes and denial of the negative ones (Paulhus & Reid, 1991). This limitation should be addressed in future research.

Third, our sample lacked cultural diversity. Despite racial differences, all fathers shared the Hawaiian/Pacific culture, creating a homogeneous sample and therefore future research should include a more culturally diverse sample, especially because existing literature shows differences in father involvement by ethnicity, in dimensions such as such as warmth, monitoring, and responsibility (Coley & Hernandez, 2006; Hofferth, 2003) and by cultural ideologies and norms (Hofferth, 2003; Lamb & Tamis-LeMonda, 2004).

Finally, a significantly larger proportion of men who live with the mother of the focal child responded to the post-intervention questionnaire, and a significantly larger proportion of nonresident fathers did not respond. The limited response rate of nonresident fathers might have biased the results. Resident fathers may have fewer barriers to involvement and higher involvement levels to begin with, while it could be argued that nonresident fathers are the ones who might have greater levels of need and could have benefitted the most from more parenting support and information.

Implications

Considering the results of the current study and its limitations, there are a few implications for future research and practice. First, while we carefully planned for and devoted time and resources to recruitment of participants, it was difficult to recruit participants who potentially were not engaged in their children's lives. Thus, recruitment efforts should continue targeting the vulnerable fathers who are less engaged. Second, considering that initial analysis of our qualitative data indicated that fathers would like to have meetings with other fathers, either face-to-face or through an online forum, future research should test *Key to Kāne* as an enhancement of an intervention that is more interactive, offered in combination rather than being a stand-alone program. Third, future studies should continue collecting qualitative data either with individual interviews or focus groups to determine the kind of help fathers want. The goal should be to ask not only whether reading dosage works, but also to determine the mechanisms by which such interventions are helpful, in order to better meet the needs of fathers.

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