

Promoting parent-early adolescent sexual communication with a smartphone application

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Abstract

Recent sexual education and health promotions have emphasized the importance of parent-child sexual communication in healthy sexual development of youth. By using effective parent-adolescent sexual communication, parents can provide their adolescent children with more accurate knowledge about sexuality and help them shape healthy sexual attitudes that might lead to wise decision-making during adolescence. In addition, effective parent-adolescent sexual communication serves as an influential factor in buffering adolescents' risky sexual behaviors. However, ineffective parent-adolescent sexual communication is likely prevalent among families as parents might face many barriers in initiating and discussing sexuality-related topics. Limited or no sexual communication may significantly undermine parents' potential to be optimal influencers of their adolescent's healthy sexual development. The increasing usage of smartphones and mobile apps among the U.S. adults gives unprecedented opportunities to deliver parent-based adolescent sexual health interventions to a wider and more diverse population. Guided by research, as well as Urie Bronfenbrenner's bioecological theory of human development, this report provides a research-based foundation on which to build a smartphone app, *Parent Sex Talk 12-14*, providing sexual health-related materials to parents of early adolescents aged 12- to 14-years-old to strengthen parent-early adolescent sexual communication.

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Chapter 1 - Introduction

Statement of Need

Parents and other legal guardians (hereinafter referred to as parents) can support the development of healthy sexuality of adolescents in many ways, including fostering an open and honest atmosphere for sexual conversation and questions (Edwards & Reis, 2014; Flores & Barroso, 2017; Heller & Johnson, 2010). By using effective parent-adolescent sexual communication, parents might provide their adolescent children with more accurate knowledge about sex and sexuality (Heller & Johnson, 2010) and help them shape healthy sexual attitudes that might lead to wise decision-making during adolescence (Jaccard et al., 2002; Lefkowitz & Stoppa, 2006). Moreover, based on previous research, effective parent-adolescent sexual communication, along with other parental involvement (e.g., parent-adolescent relationship quality, parental monitoring), serves as an influential factor in buffering adolescents' risky sexual behaviors (De Graaf et al., 2011; Guilamo-Ramos et al., 2012; Hutchinson & Montgomery, 2007; Widman et al., 2016).

Although the potential of parent-adolescent sexual communication in promoting healthy sexual development and in reducing negative sexual outcomes among adolescents has been widely identified by researchers (De Graaf et al., 2011; Flores et al., 2019; Guilamo-Ramos et al., 2012; Sneed et al., 2013; Widman et al., 2016), ineffective parent-adolescent sexual communication has also been found to be prevalent among diverse parent-adolescent dyads (e.g., mother-son, father-daughter, parent-sexual minority youth; Cox et al., 2008; Newcomb et al., 2018; Sneed et al., 2013). This is partially due to the fact that parents face many barriers in initiating and discussing sex and sexuality-related topics, which may greatly undermine their potential to be optimal influencers of their adolescent children's healthy sexual development

(Heller & Johnson, 2010; Morawska et al., 2015). The most commonly mentioned barriers in studies of parent-adolescent sexual communication include limited parental sexual health knowledge and communication skills, uncertainty about adolescents' readiness to talk about sex, and uncomfortable feelings related to sexual conversations (Elliott, 2010; Heller & Johnson, 2010; Malacane & Beckmeyer, 2016; Morawska et al., 2015; Randolph et al., 2017). Therefore, there is a pressing need for health care professionals and educators to promote tools that can facilitate effective sexual communication between parents and adolescents (Cederbaum, 2012; Edwards & Reis, 2014; Heller & Johnson, 2010). It is important to remember that parents' needs and perspectives should also be considered when developing effective parent-based adolescent sexual health interventions (Sanders & Kirby 2012).

Existing parent-based adolescent sexual health interventions mainly focus on increasing effective parent-child sexual health communication between parents and youth from low income (e.g., Cox et al., 2008; McKay et al., 2004) and minority backgrounds (e.g., Black and Latino American; Aronowitz & Agbeshie, 2012; Guilamo-Ramos et al., 2011; Kapungu et al., 2010; Prado & Pantin, 2011; Sneed et al., 2013). Many of them rely on traditional delivery methods, which involve in-person, group-based, multi-session, resource-intensive approaches (Akers et al., 2011; Burrus et al., 2012; Santa Maria et al., 2015). To some extent, these interventions have proved to be effective in improving parent-child sexual communication (Akers et al., 2011; Santa Maria et al., 2015). However, interventions that adopt traditional delivery methods face many challenges in terms of program distribution (e.g., laborious planning and implementation processes) and participant recruitment and retention (e.g., time and transportation difficulties of participants; Santa Maria et al., 2015). Thus, researchers called for further attention and exploration of innovative (e.g., applying technology) and barrier-reducing (e.g., accessibility)

approaches while disseminating parent-based interventions to effectively reach and affect a wider population (Santa Maria et al., 2015).

Mobile technologies such as smartphone applications (hereinafter referred to as apps) can serve as a promising platform to deliver education or interventions to targeted populations as the information is easily accessible and consistently available (Davis et al., 2017). However, the majority of adolescent sexual health interventions that are delivered through smartphone apps primarily target adolescents (e.g., Brayboy et al., 2017) and young adults (e.g., Richman et al., 2014) rather than their parents. Therefore, utilizing smartphone apps is a promising way to deliver parent-based adolescent sexual health interventions that educate parents on techniques to promote sexual health among adolescents (Morawska et al., 2015; Sanders & Kirby, 2012).

Purpose of Report

It is increasingly recognized that interventions are most effective in promoting healthy sexuality and decreasing sexual risk if they take place earlier in an adolescent's life (Wilson, 2018). The overall purpose of this report is to provide a research foundation on which to build a smartphone app that aims to facilitate effective parent-early adolescent sexual communication by supporting parents of *early* adolescents. The first component of this report is to review the current status of the literature on parent-adolescent sexual communication (e.g., barriers and influences on), existing parent-based adolescent sexual health interventions, and the increasing use of mobile apps in educational initiatives. By applying a comprehensive model in Urie Bronfenbrenner's bioecological theory of human development (Bronfenbrenner, 1994; Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Morris, 2006), the report will focus on developing a research-based foundation from adolescent parents' perspectives to maximize the practicability of the smartphone app. The second component of this report is utilizing the

research and implications of findings to design a smartphone app that aims to strengthen parent-early adolescent sexual communication. Finally, an evaluation plan that can be utilized in evaluating the effectiveness of the app and support the refining process of the app longer-term will be presented.

Chapter 2 - Review of Literature

Parent-Adolescent Sexual Communication

Adolescent Development and Sexuality

Because most parents serve as one of the earliest sources of sexual socialization for their children, parent-child sexual communication can occur across the developmental stages of childhood and adolescence (Heller & Johnson, 2010; Lefkowitz, & Stoppa, 2006). In general, parents are influential in supporting their adolescent children going through and adjusting to the sexual developmental changes during adolescence (Alcalde & Quelopana, 2013; Heath, 2018). Specifically, as their children begin to enter into puberty and increased sexual development, parents may face the need to explain body changes (e.g., menstruation for girls; Heller & Johnson, 2010) and sexual topics such as the basics of sex (Wilson et al., 2010), abstinence (i.e., waiting for sex until marriage; Sneed et al., 2013), and protective sexual practices (e.g., condom use; LaSala, 2015) to their adolescent children.

Due to this early socialization and the uniqueness of sexual development during puberty, there is an ongoing need for professionals and public attention to treat early adolescence as a critical opportunity for promoting effective interventions that promote healthy sexuality (Wilson, 2018). Adolescents typically enter puberty during early adolescence and show signs of primary and secondary sex characteristics maturation (e.g., breast development and menstruation for girls, genital development for boys; Alcalde & Quelopana, 2013; Dorn et al., 2006). Some parents use adolescents' sexual maturation and body changes during puberty as a need to initiate sexual communication (Flores & Barroso, 2017; Heller & Johnson, 2010), which may be later than it should occur. Specifically, parents might miss a crucial opportunity to express their expectations for their children's sexual behavior if they delay sexual conversations until the

children show cues of engaging in sexual activities (Malacane & Beckmeyer, 2016). Researchers have suggested that initiating parent-child sexual communication *early* in adolescence can be beneficial for shaping youth's healthy and positive sexual attitudes across the lifespan (Lefkowitz & Stoppa, 2006). Specifically, parents can foster positive perspectives toward their child's sexual development, which emphasizes normative, natural, and positive aspects of human sexuality through sexual communications (Dent & Maloney, 2017).

Additionally, hormonal changes during puberty bring about significantly increased sexual interests (Fortenberry et al., 2013) that may result in sexual behaviors among adolescents (Beckett, 2010; Kerpelman et al., 2016; Morris & Rushwan, 2015; Tolman & McClelland, 2011). Some sexual behaviors such as early (before the age of 15) and unsafe sexual intercourse can be particularly risky and place adolescents at considerable risk for sexually transmitted infections (STIs) and unintended pregnancy and parenthood, all of which can potentially increase their likelihood of negative physical, emotional, and social consequences into adulthood (Kerpelman et al., 2016; Morris & Rushwan, 2015; Tolman & McClelland, 2011). Adolescents usually conceal the exact timing and information about sex-related activities (e.g., kissing) from their parents (Daddis & Randolph, 2010); therefore, parents again would miss an optimal opportunity to educate their child about healthy sexuality prior to sexual engagement (Malacane & Beckmeyer, 2016). Helping children avoid the harmful consequences of sexual risk behaviors is a commonly reported motivation by parents to talk about sex with their children (Wilson et al., 2010). Researchers have paid particular attention to sexual communication between parents and their early adolescent children (e.g., Alcalde & Quelopana, 2013) as early adolescence can be a crucial period for interventions regarding sexual risk reduction among adolescents (Aronowitz &

Agbeshie, 2012; Beckett et al., 2010; Mauras et al., 2013; Murray et al., 2014; Sneed et al., 2013).

According to Heller and Johnson (2010), effective sexual communication between parents and adolescents is comparable to an authoritative communication style. Specifically, parents most effective in sexual communication are generally “comfortable, nurturing, respectful, and encouraging of discussion” (p. 160) and mostly provide “correct, complete, age-appropriate, and included information” (p. 150) regarding sex and sexuality to their children (Heller & Johnson, 2010). Although parents can support the development of sexuality-related competencies of adolescents by having effective parent-adolescent sexual communication (Bonafide et al., 2020; Deptula et al., 2010; DiIorio et al., 2007; Gilamo-Ramos et al., 2012; Harris et al., 2011), a lot of home-based sexual communication has proved to be ineffective and challenging as parents are facing various barriers in the communication process (Pop & Rusu, 2015). For example, many parents indicate a lack of knowledge when talking about topics of puberty and body changes with their children (Heller & Johnson, 2010). Therefore, parent-based adolescent sexual health interventions are pressing needed to assist parents in overcoming existing barriers and having effective sexual conversations with their adolescents (Sanders & Kirby, 2012), including through theory and research-based applications.

The PPCT Model

In order to better understand sexual communication between parents and adolescents, this report utilizes Urie Bronfenbrenner’s bioecological theory of human development (hereinafter referred to as bioecological theory; Bronfenbrenner & Morris, 2006) as a framework by which to investigate parent-adolescent sexual communication. There are four principal components in the bioecological theory, including Process, Person, Context, and Time (the PPCT model;

Bronfenbrenner & Morris, 2006). Building on previous ecological theory (Bronfenbrenner, 1979; Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Morris, 1998), the bioecological theory provides a more comprehensive lens to study the interaction (i.e., the proximal process) between a biopsychological individual and persons, symbols, and objects within contextual environments over time (Bronfenbrenner & Morris, 2006). All components in the PPCT model dynamically and interactively relate to each other (Bronfenbrenner & Morris, 2006).

When applying the PPCT model to understand the parent-adolescent sexual communication and informing our approach with the smartphone app, it is practical to investigate the sexual communication between parents and their adolescent children as the *proximal process*; to see the parents as the *person*; to identify the multiple contextual environments that affect the parent-child sexual communication as the *context*, and the influence of *time* (i.e., both developmental and historical). All of the characteristics of the parents, multi environmental contexts around the parents, and time periods (e.g., early to late adolescent development, historical changes in societal attitudes toward parent-child sexual communication) together affect the process of the parent-adolescent sexual communication. It is important to note that the purpose of the current report is to aid parents of early adolescents in engaging in effective parent-child sexual communication. Therefore, substantial efforts in the section of the literature review will be put on examining parent-adolescent sexual communication from the parents' perspective (e.g., parental perceived barriers in sexual communication) by utilizing the PPCT model. The PPCT model (Bronfenbrenner & Morris, 2006) and relevant literature will be used to build a firm research foundation on sexual communication for developing the parent-based adolescent sexual health intervention via a smartphone app.

The Process: Parent-Adolescent Sexual Communication

Bronfenbrenner and Morris (2006) indicate that the proximal process should be directional, regular, and enduring to be developmentally effective. As parent-adolescent sexual communication is the reciprocal exchange of sexuality-related information between parents and their adolescent children, in the sexual communication process, initiatives and influence can come from both parents and their children (Flores & Barroso, 2017). Specifically, parental factors such as emotions and feelings (Cox et al., 2008), communication skills (Heller & Johnson, 2010; Wilson et al., 2010), and knowledge (Miller et al., 2009) related to sexual communication greatly influence the proximal process. Similarly, adolescents' reaction toward sexual communication with parents also greatly affect the continuity of the communication process (Cox et al., 2008; Elliott, 2010; Guilamo-Ramos et al., 2008; Williams et al., 2015). For example, parents have reported that their children have uncomfortable feelings and avoid the conversation with them (Cox et al., 2008).

The Person: The Parents of Adolescents

In the current report, the *Person* refers to parents of adolescents. Researchers have widely identified parents as the ideal and most common sexual educator for their children (Aronowitz & Agbeshie, 2012; Flores & Barroso, 2017; Jaccard et al., 2002). Specifically, parents are considered valuable sources of sexual information and advice, and they have the possibility to shape the attitudes and behaviors of their children related to sexuality (Alcalde & Quelopana, 2013; Jaccard et al., 2002; Morawska et al., 2015). According to Bronfenbrenner and Morris (2006), there are three types of person characteristics, which include types of *forces*, *resources*, and *demands*, that are “distinguished as most influential in shaping the course of future development through their capacity to affect the direction and power of the proximal process

through the life course” (Bronfenbrenner & Morris, 2006, p. 795). Different types of adolescent parents’ characteristics undoubtedly play a decisive role in influencing the effectiveness and the continuity of sexual communication between parents and their adolescent children.

The Force Characteristics

The force characteristics are “active behavioral dispositions” that can “set proximal processes in motion and sustain their operation, or, conversely, actively interfere with, retard, or even prevent their occurrence” (Bronfenbrenner & Morris, 2006, p. 810). In parent-adolescent sexual communication, being aware of parental roles and responsibilities has been a widely mentioned factor by parents that stimulates the communication process (e.g., Ballan, 2012; Randolph et al., 2017; Williams et al., 2015). In addition to perceived parental roles and responsibilities, parents’ responsiveness to having children ask sex and sexuality-related questions also affects the development of the parent-adolescent sexual communication process (Miller et al., 2009; Pariera, 2016). For instance, a study examining the factors contributing to sexual communications between Black mothers and their preadolescents found that mother’s responsiveness, in the realms of sexual knowledge, skills, comfort, and confidence, consistently predicted early mother-child sexual conversation (Miller et al., 2009). Further, gender of parents has been found to be a strong and consistent factor influencing parent-child communication (Flores & Barroso, 2017; Kapungu et al., 2010; Tobey et al., 2011; Wilson et al., 2010). In general, mothers have more frequent, effective, and early communication with adolescents about sex (Kenny & Wurtele, 2013; Mauras et al., 2013; Murray et al., 2014; Sneed et al., 2013) compared to fathers (Collins et al., 2008; Nielsen et al., 2013; Randolph et al., 2017).

Contrarily, parents’ uncertainty about adolescents’ readiness for talking about sex has been frequently mentioned in studies of parent-adolescent sexual communication as a barrier (Alcalde & Quelopana, 2013; Flores & Barroso, 2017; Heller & Johnson, 2010). Some parents

reported that their children were too young to start the conversation related to sexual topics (Heller & Johnson, 2010; Hutchinson & Cederbaum, 2011), even when their children reached the stage that they might become sexually active (Malacane & Beckmeyer, 2016; Pariera, 2016). Moreover, parents may be reluctant to openly and directly engage in conversation about sexual topics (Malacane & Beckmeyer, 2016). Uncomfortable feelings and emotions such as embarrassment and fear commonly occur among parents when talking with their children about sex (Elliott, 2010; Heller & Johnson, 2010; Nielsen et al., 2013; Rose et al., 2014; Wilson et al., 2010). Even when parents discuss sex with their children, they still felt uncomfortable addressing specific topics, such as accessing birth control (Hyde et al., 2013) and oral sex (Kapungu et al., 2010). However, a study targeted at college students found that adolescents felt a loss of an important and reliable source of sexual information when parents avoided discussing sex with them (Goldfarb et al., 2018).

Further, some parents are intent on seeing other sources of sexual information (e.g., sex education at school, peers) as a replacement of home-based sexual communication to avoid uncomfortable feelings such as embarrassment (Heller & Johnson, 2010). Additionally, parents can be more hesitant to talk about topics of sexual diversity due to their tendency to socialize heterosexuality for their children (Solebello & Elliott, 2011). Specifically, research has shown that parents of sexual minority youth generally wait to have children ask questions related to sex rather than actively start the conversation themselves (LaSala, 2015).

The Resource Characteristics

The resource characteristics refer to the “ability, experience, knowledge, and skill are required for the effective functioning of proximal processes at a given stage of development” (Bronfenbrenner & Morris, 2006, p. 796). To a great extent, the effectiveness of parent-child sexual communication is affected by parents’ knowledge about sexuality (e.g., Miller et al.,

2009) and communication skills (e.g., Heller & Johnson, 2010) and their own related experiences (e.g., Cederbaum, 2012; Edwards & Reis, 2014).

The role of parents' sexual knowledge is apparent in promoting parent-adolescent communication about sexuality (Heller & Johnson, 2010; Miller et al., 2009). Real or perceived parental knowledge about sexuality links to parents' likeliness to engage in conversations about sexuality topics with their children (Heller & Johnson, 2010; Hyde et al., 2013; Jaccard et al., 2000). Many parents indicate that they usually seek or receive information about sexuality primarily through the internet and health professionals, along with other sources of information such as books and magazines (Morawska et al., 2015). However, some parents have indicated that they do not have adequate sexual knowledge related to opposite-sex children (Cox et al., 2008). Some parents are likely to provide incomplete, inaccurate, or little information related to specific topics such as HIV and AIDS in sexual communication (Heller & Johnson, 2010).

Parents have also reported that lacking communication skills (e.g., discomfort with communication) was another barrier that hinders both parents and children engaging in parent-child sexual communication (Flores & Barroso, 2017; Heller & Johnson, 2010; Murray et al., 2014; Nielsen et al., 2013; Wilson et al., 2010). In general, parents are more likely to express uncomfortable feelings and be controlling or avoiding when ineffectively discussing sexual topics with their adolescents (Heller & Johnson, 2010; Nielsen et al., 2013). Conversely, parents who have been perceived by children as good communicators about sexual topics are usually attentive to their children's feelings and open and honest during the discussion (Murray et al., 2014; Nielsen et al., 2013).

Studies that focus on parent-adolescent sexual communication have also put their attention on parents' historical experience regarding their own sex education during childhood

and adolescence (e.g., Alcalde & Quelopana, 2013; Flores & Barroso, 2017; Kenny & Wurtele, 2013; Randolph et al., 2017). In general, parents reported experiencing a range from having *no* parental influence related to sex education to receiving *somewhat* sexual information through parents and other sources (e.g., school, media, friends) in ineffective ways (Alcalde & Quelopana, 2013; Morawska et al., 2015; Randolph et al., 2017). However, a longing to fulfill parental roles regarding children's sex education and an intent to help children reduce negative sexual outcomes drive adolescent parents' tendency to initiate sexual communication with their children (Alcalde & Quelopana, 2013; Randolph et al., 2017).

Further, studies have revealed that parents' lived experiences of sex-related trauma (LaSala, 2015) and mistakes (i.e., unwise sexual decisions during adolescence; Williams et al., 2015), sexual risk behaviors (Grossman et al., 2015; Murphy et al., 2012), and HIV status (Cederbaum, 2012) are linked to parent-adolescent sexual communication. In many cases, parents' negative experiences related to sex have facilitative effects on sex-related discussions with their adolescents (Cederbaum, 2012; Grossman et al., 2015; Roberts, & Herbeck, 2012). For example, among Black families with HIV-infected mothers, the lived experience of HIV positively stimulate the mother-daughter sexual communication as it brings closeness and uniqueness between mother and daughter, and helps adolescent daughters see HIV as a real consequence of sexual risk behaviors (Cederbaum, 2012). However, some parents are also likely to react negatively to their previous sexual traumas and refuse to talk about sex and sexual risks with their children (LaSala, 2015). Overall, parents face barriers including limited sexual knowledge and communication skills when participating in parent-adolescent sexual communication.

The Demand Characteristics

The demand characteristics “invite or discourage reactions from the social environment that can foster or disrupt the operation of proximal processes” (Bronfenbrenner & Morris, 2006, p. 796). Parental characteristics such as gender, socioeconomic status, race, and ethnicity can be demand characteristics that encourage or suppress attention or supports from social contexts that affect sexual communication. Specifically, mothers are usually considered by society as the optimal person, compared to fathers, in educating their children about sexuality-related information across different cultures (e.g., Alcalde & Quelopana, 2013; Flores & Barroso, 2017). In general, mothers are likely to have more frequent communication with adolescents about sex (e.g., Padilla-Walker, 2018) and they have received more attention than fathers in the research of parent-adolescent sexual communication (Mauras et al., 2013; Murray et al., 2014; Sneed et al., 2013) and interventions of sexual risk reduction among adolescents (Dancy et al., 2006; DiIorio et al., 2006; Sutton et al., 2014).

Similarly, families with low socioeconomic status (e.g., low-income; Cox, 2008) or those from minority race and ethnicity backgrounds (e.g., Black and Latino populations) have received more public attention (i.e., research and interventions) that aim to reduce sexual risk behaviors among adolescents (Alcalde & Quelopana, 2013; Aronowitz & Agbeshie, 2012; Bonafide et al., 2020; Edwards & Reis, 2014; Guilamo-Ramos et al., 2011; Harris et al., 2011; Kapungu et al., 2010; Sneed et al., 2013; Sutton et al., 2014). This is largely because adolescents from at-risk and minority backgrounds are at higher risk of engaging in risky sexual behaviors and negative health disparities (Aronowitz & Agbeshie, 2012; Edwards & Reis, 2014; Harris et al., 2011; Murray et al., 2014).

The Context: The Ecological Environment that Influences the Parent-Adolescent Sexual Communication

The ecological environment that influences the development of the proximal process and the person has been conceptualized as a set of nested structures that influence development, including the microsystem, mesosystem, exosystem, and macrosystem (Bronfenbrenner, 1979; 1994; Bronfenbrenner & Morris, 2006). With parent-adolescent sexual communication, the ecological factors in different systems within and outside the family affect the development of the communication process. Specifically, the interaction between the ecological factors, which include adolescent parents' immediate family and community environment and the societal landscape, significantly influence the sexual communication between parents and their adolescent children.

The Microsystem

According to Bronfenbrenner (1994), the microsystem refers to the most immediate environment (e.g., family, friends, and community) that influences the developing person. As Bronfenbrenner described, "It is within the immediate environment of the microsystem that proximal processes operate to produce and sustain development...their power to do so depends on the content and structure of the microsystem" (Bronfenbrenner, 1994, p. 5). In the case of seeing the parent as the person and parent-adolescent sexual communication as the proximal process, the ecological factors in the immediate environment of the microsystem that affect the sexual communication process relate to "activities, social roles, and interpersonal relations" (Bronfenbrenner, 1994, p. 5) experienced by the parents of adolescents. Specifically, the ecological factors relate to adolescent children, peers of parents, and parents' regularly attended settings, which have direct interaction with and influence on adolescent parents and thus affect parent-child sexual communication.

Adolescent Children. From the children's perspective, asking questions related to sexuality by adolescents is a facilitator for initiating sexual communication with parents (McRee et al., 2012; Pariera, 2016). Additionally, adolescent children's negative reactions to sexual communication, such as discomfort or negative responses, also affect parents' motivation to talk about sex and sexuality-related topics and decide the continuity of sexual communication (Cox et al., 2008). Moreover, adolescents' gender also influences the communication frequency and content (Flores & Barroso, 2017; Kapungu et al., 2010; Tobey et al., 2011; Wilson et al., 2010). For example, daughters have reported more frequent sexual conversations with their mothers compared with sons (Malacane & Beckmeyer, 2016; Sneed et al., 2013; Tobey et al., 2011). Additionally, communication difficulty, such as having uncomfortable feelings, has been particularly found in sexual communication between daughters and their fathers and sons and their mothers (e.g., Cox et al., 2008; Hutchinson & Cederbaum, 2011; Sneed et al., 2013). For example, research has shown differences in the specific sexual topics discussed during the conversations based on gender of the adolescent (Murray et al., 2014; Sneed et al., 2013). For example, parents discuss the topic of abstinence more often with daughters, whereas condom use is more frequently discussed with sons (Alcalde & Quelopana, 2013; Sneed et al., 2013).

Peers of Adolescent Parents. Peers of the parents (e.g., other parents) can be influential in sexual communication by providing social support regarding parenting. For example, according to a systematic review (Niela-Vilén, 2014), peers connected via the internet and social media can provide parents with needed information and support. Moreover, internet-based peer support can be a supplemental source for professional supports (Niela-Vilén, 2014). Peers of the parents can affect parent-sexual communication by establishing norms around these conversations. For example, an individual's perception about significant others' views toward

specific behavior can potentially determine the individual's behavioral intention (i.e., injunctive norms; Cialdini, et al., 1990; Fishbein & Ajzen, 2011). Bute and Jensen's (2010) study indicated that injunctive norms among peers (e.g., friends, coworkers) might guide individuals' behaviors and beliefs around sexual health and parent-adolescent sexual communication. Specifically, parents' perceptions of what their peers believe related to parent-child sexual communication may affect parents' intention to participate in the communication process. For example, Zurcher (2019) found that peers can serve as social supports and resources that encourage effective pornography communication between parents and adolescents; however, some peers may withhold from giving suggestions that may potentially discourage related communication. However, there is limited research that has investigated the topic of understanding the role parent's peers may have on parents' behavior.

Religious Settings. At the community level, messages received from religious settings (e.g., church) may significantly influence parents' religious beliefs and values that may sequentially affect parent-adolescent sexual communication (Cox et al., 2008; Dent & Maloney, 2017; Heller & Johnson, 2010; Williams et al., 2015). For example, in Heller and Johnson's (2010) study, parents who identified as religious and more frequently attended religious services had extremely negative reactions related to same-sex relationships in their parent-adolescent sexual conversations. In contrast, parents who did not identify as religious generally emphasized being respectful and non-judgmental toward other persons' choices when discussing the topic of sexual orientation with their children (Heller & Johnson, 2010). This might be due to how religious entities and communities affect their social attitudes toward same-sex relationships (Maslowe & Yarhouse, 2015), wherein the stronger the individuals' religious beliefs, the more negative their attitudes toward same-sex relationships and the community of lesbian, gay,

bisexual, transgender, queer, and others (LGBTQ+) can be (Maslow & Yarhouse, 2015). Moreover, parents involved in religious communities are likely to emphasize abstinence during sexual communication with their children as they may believe that pre-marital sex is immoral and teaching children to wait for sex until marriage is the key to avoiding unintended pregnancy and STIs (e.g., William et al., 2015).

The Mesosystem

As Bronfenbrenner (1994) described, the mesosystem refers to “the linkages and processes taking place between two or more settings containing the developing person” (p. 6). In short, the mesosystem is “a system of microsystems” (p. 6), such as the interaction between adolescent children and their siblings, senior family members, and religious settings.

Siblings and Adolescents. Siblings play an influential role in adolescents’ romantic relationships (e.g., romantic competence; Doughty et al., 2015) and sexual development (e.g., sexual attitudes; Killoren et al., 2019). Shawn et al. (2019) indicated that, in general, sibling influence might decline with age, and their research revealed that siblings’ risky behaviors (e.g., alcohol use) had a bidirectional effect on one another. By having multiple children, parents may expect that younger siblings learn about sex from their older siblings, which may affect sexual communication between parents and younger children (Elton et al., 2018). For example, Elton et al.’s (2018) study revealed that both last-born men and women had reported less sexual communication with parents during adolescence when compared to first- or middle-born adults.

Family Values and Adolescents. Senior family members can transmit family or personally held values to younger family members through direct and indirect messages (Goldsmith, 2013; Min et al., 2012; Tam et al., 2012). Some family values can be firmly transmitted across generations and then remain stable in adolescent and young adult children’s lives for decades (Min et al., 2012). Family values can affect parents’ attitudes and expectations

related to their children's sexuality, which will influence the topics discussed during conversations with their children (Hutchinson & Cederbaum, 2011; William et al., 2015). When expressing family values and expectations during sexual communication, parents usually mention topics relating to abstinence (i.e., waiting for sex until marriage), love and negotiation of sexual engagement (e.g., sex does not mean love), and relationships (e.g., monogamous relationships; Hutchinson & Cederbaum, 2011).

Religious Settings and Adolescents. Despite interacting with siblings and senior family members, some adolescents from religious families also have chances to interact with religious settings such as churches. Churches have been increasingly involved in providing sex education to youth (Smith, 2017). However, barriers such as limited resources (e.g., curriculum, technology, leaders) greatly hinders the education process (Smith, 2017). Additionally, churches may have difficulties confronting same-sex sexual relationships when educating about sexuality and sexual risk reduction (Harris, 2010); faith leaders also indicated a lack of related sexual knowledge and teaching skills when implementing sexual health education within religious settings (Smith et al., 2005). In general, the messages related to sexuality that adolescents have learned from churches are mainly focused on viewing sexuality as divine (Shtarkshall et al., 2007) and the immorality of same-sex relationships and premarital sex (Williams et al., 2012; Williams et al., 2015); also, limited messages have been taught around specific knowledge and strategies of sexual risk reduction (e.g., condom use; Williams et al., 2015). Further, limited information about contraception methods from religious settings might put adolescents at increased sexual risk when they become sexually active (Williams et al., 2015).

The Exosystem

The exosystem refers to “the linkages and processes taking place between two or more settings, at least one of which does not contain the developing person, but in which events occur

that indirectly influence processes within the immediate setting in which the developing person lives” (Bronfenbrenner, 1994, p. 6). In addition to parents, there are other sources of sexual information, such as media, sex education at school, and peers that contribute to adolescents’ sexual socialization (Alcalde & Quelopana, 2013). Although parents do not interact with these sources directly, the existence of the available sources for sexual information among adolescents affects parent-adolescent sexual communication (Solebello & Elliott, 2011).

Media. Media (e.g., television, films, and music videos) contains a varied amount of sexual messages and has long been an influential source of sexuality information among adolescents (Scull & Malik, 2019; Tolman & McClelland, 2011; Vandebosch, 2018; Ward et al., 2019). The internet has also become a major platform for adolescents to seek sexual-related information and activities (Clark, 2014), including through the use of pornography (i.e., sexually explicit material; Tomić et al., 2018), which may affect parent-adolescent communication. Additionally, with the prevalence of social media (e.g., Facebook, Instagram), adolescents are more readily able to explore and express their sexual identity and observe others’, as well (Morelli et al., 2017; Ringrose, 2009). Parents may use content from media as an opportunity to initiate sexuality-related conversations (Flores & Barroso, 2017; Heller & Johnson, 2010; McRee et al., 2012; Morgan et al., 2010). Specifically, parents may initiate sexual conversation and provide accurate information if the media is portraying incomplete, inaccurate, and unhealthy information about sexuality and sexual health (e.g., condoms are only for birth control; Heller & Johnson, 2010; Scull & Malik, 2019). Moreover, some parents may have the concern that exposure to pornography could negatively affect their children’s sexual attitudes (Peter & Valkenburg, 2009) and sexual behaviors (Harris, 2011; Owens et al., 2012), and thus parents may initiate a conversation about how pornography could bring negative outcomes to their

adolescent children's overall development (Zurcher, 2017). However, communication about pornography can be challenging as it leads to uncomfortable feelings and parents reporting lacking knowledge on how to discuss this topic (Zurcher, 2017).

School-Based Sexual Health Education. School-based sex education today is required in about half of all states in the United States, which means that formal sex education is an important source of sexual socialization for many adolescents (Pop & Rusu, 2015). The existing school-based sex education options include (a) abstinence-only sexual education, which claims abstinence as the only optimal way for avoiding risks of sexual behaviors among adolescents; (b) abstinence-plus sex education, which emphasizes abstinence but also includes information about contraception and STIs; and (c) comprehensive sexual education, which covers possible contraceptive and safer sex methods (Dent & Maloney, 2017). Having children receive sex education at school affects parents and home-based sexual communication in many ways. For example, some parents feel uncomfortable with the specific content (e.g., negotiating condom use) that their children learned at school, as family values regarding sexual practices may be undermined (Shtarkshall et al., 2007). Contrarily, some parents see school-based sex education as a replacement for sex education or communication within the family because they believe that their children will or have received needed sexual information, such as condom use and HIV/AIDS prevention, at school (Heller & Johnson, 2010).

Peers of Adolescents. In general, as adolescents grow more mature and independent, peers are increasingly more influential in adolescents' sexual socialization when compared to other sources such as parents and formal sex education (Malacane & Beckmeyer, 2016; Secor-Turner et al., 2011; Whitfield et al., 2013; Zimmerman, 2016). The role of peers in adolescents' sexual socialization in terms of sexual norms, attitudes, and behaviors is thought to be the effect

of normative development of adolescents turning away from their family (Tolman & McClelland, 2011). During adolescence, young people increasingly focus on peer friendships and romantic relationships (Heath, 2018). Rather than parents, peers often become important new data sources and confidants of adolescents when seeking and talking about sexual information (Shtarkshall et al., 2007). Peer sexual communication commonly focuses on various topics, such as experiences and beliefs about sex and romantic relationships (Epstein & Ward, 2007), which may shape peer norms about sexuality (Vandenbosch, 2018) and thus affect parent-adolescent communication. Similar to the source of school-based sex education, some parents see children's peers as a normal source of sexual information for their adolescent children, which can sometimes lead to few or no sexual conversations within the family (Heller & Johnson, 2010). For example, in Solebello and Elliott's (2011) study, many fathers recalled the reason that they had very limited sexually-related conversations with their adolescents was due to the assumption that the children would seek information from other sources (e.g., schools, friends).

The Macrosystem

The macrosystem comprises "the overarching pattern of micro-, meso-, and exosystems characteristic of a given culture or subculture" such as "the belief systems" that are "embedded in each of these broader systems" (Bronfenbrenner, 1994, p. 6). Although the macrosystem refers to the most distant layer of the ecological environment, it still affects the individual and the process significantly (Bronfenbrenner, 1979; Bronfenbrenner & Morris, 2006). For example, mothers are generally expected by society to teach their children about sexuality rather than fathers, among the Latino population (Alcalde & Quelopana, 2013, p. 297). Belief systems, such as societal attitudes toward one's sexual preferences, have been found to be strongly associated with the engagement in parent-adolescent sexual communication in literature. Additionally,

cultural influences associated with race and ethnicity have also been linked to the content and frequency of sexual communication between parents and adolescents.

Societal Attitudes Toward Sexual and Gender Identity. There has been considerable change in societal acceptance of non-heteronormative sexual orientation and gender identity in the past decades within Western countries (Brown, 2017; Pew Research Center, 2019a). The change has been reflected in many aspects of life, such as increased media exposure focusing on the LGBTQ+ community, education in the school curriculum, and changes in legislation (Maslowe & Yarhouse, 2015). As adolescence is a period that young people explore their identity (e.g., sexual identity), they are trying to define who they are and how they will fit into the broader culture (Erikson, 1968; Heath, 2018). The involvement, acceptance, closeness, and supports from family play crucial roles in sexual and gender minority people's sexual health outcomes (Katz-Wise, 2016; LaSala, 2015) and overall well-being (e.g., self-esteem and identity achievements; Heath, 2018; Newman et al., 2020; Van Beusekom, 2015).

There has been increasing research investigating and describing the process of parent-child sexual communication in the family of sexual and gender minority youth (e.g., Flores et al., 2019; Newcomb et al., 2018; Rose et al., 2014; Rusow et al., 2019). In general, research has found that parents assume their children's sexual identity as heterosexual and try to socialize heterosexuality for their children, especially for sons (Solebello & Elliott, 2011). Although parents have been considered as one of the preferred sources of sexuality information, many parents have limited knowledge about LGBTQ+-specific sexual health information (Flores et al., 2019; Newcomb et al., 2018; Rose et al., 2014) and uncomfortable feelings such as fear and embarrassment (Rose et al., 2014).

Race and Ethnicity. Cultural influences associated with race and ethnicity have been shown to affect the frequency of parent-adolescent sexual communication as well as the discussion topics (Flores & Barroso, 2017; Heller & Johnson, 2010; Kim & Ward, 2007; Malacane & Beckmeyer, 2016; Romo et al., 2010). For example, cultural influences within Asian communities may decrease the frequency of sexual communication. In fact, Asian-American parents have been found to talk least frequently and with about the fewest number of sexual topics with their children (Kim & Ward, 2007). Further, cultural influences within White communities have been associated with communication styles during sexual conversations. For example, in a study of parent-adolescent sexual communication among most White fathers, implicit and casual discussion and low involvement have been commonly found among participants (Solebello & Elliott, 2011). Moreover, as specific races and ethnicities may face barriers that lead to higher rates of sexual risks (e.g., among Black and Latino populations), parent-early adolescent communication about STIs, HIV, and pregnancy prevention occurs the most frequently within these populations (Murray et al., 2014). Another study has found that Latino mothers talk more about the need for and benefits of delaying sex and avoiding sexual risks as well as self-protective strategies (Romo et al., 2010).

The Time: Changes of Sexual Communication Over Time

As the last component of the PPCT model, time allows for the process to change by both the historical context and the developmental progression of the individual (Bronfenbrenner, 1994; Bronfenbrenner & Morris, 2006). Specifically, changes within the environment that surround the parents of adolescents over historical time have significant effects on the sexual communication process within the family (Bronfenbrenner, 1994; Zimmerman, 2016). For example, school-based sex education has been a social controversy for decades, and the ongoing

disagreements over sex education mainly focus on including the role of government, school, and parents in teaching sex education (Shtarkshall et al., 2007; Zimmerman, 2016). However, Zimmerman (2016) emphasized that the family had historically been considered by society as the proper setting in which sex education should take place, and the mother should take the role of educating their children about sex and sexuality carefully.

Additionally, the developmental changes of adolescents and family dynamic changes have a great effect on parent-adolescent sexual communication as time goes on (e.g., Morgan et al., 2010; Padilla-Walker, 2018). Parents are more likely to have confidence and knowledge when communicating with young children (i.e., before ages of 10; Morawska et al., 2015) about sexuality-related topics than with adolescents (Heller & Johnson, 2010). Adolescence is a significant period when major developmental changes take place, such as entering puberty, increased independence, and maturity (Alcalde & Quelopana, 2013; Dorn et al., 2006; Heath, 2018). The developmental changes during adolescence also alter parent-child relationships and call for parents' adjustments while interacting with adolescent children (Heath, 2018; Morgan et al., 2010). For example, adolescents normally begin questioning parental authority as they develop the ability for abstract thought (Heath, 2018). Moreover, a sense of equality develops between adolescents and their parents as they grow older, including moving from "unilateral and restrictive sex-based topics to more reciprocal and relationship-focused conversations" (Morgan et al., 2010; p. 139) as children age from high school students to young adults.

Bronfenbrenner and Morris (2006) mentioned that "The degree of stability, consistency, and predictability over time in any element of the systems constituting the ecology of human development is critical for the effective operation of the system in question" (p. 820). When applying time to parent-adolescent sexual communication, it is also important to assess the

frequency and consistency of sexual communication to examine the stability over time (i.e., as children grow older). For example, a longitudinal study that examined the frequency and stability of parent-child sexual communication from early to late adolescence found that both mother- and father-child sexual communication continued with low frequency and high stability over time, whereas mothers significantly had more frequent sexual communication with their children compared to fathers (Padilla-Walker, 2018). The study also indicated that mothers initially had less sexual communication with their sons compared with daughters; however, the mother-son (not mother-daughter) sexual communication had increased significantly as they grew older (Padilla-Walker, 2018).

Implications for Parent-Based Adolescent Sexual Health Interventions

Although there are various other sources (e.g., school, peers, siblings, media) for adolescents to acquire sexual information, a parent's role is still crucial in providing unique sexual information and supporting adolescents' interpretation of the content from other sources (Heller & Johnson, 2010; Lefkowitz & Stoppa, 2006). Based on the previously stated research and theory, parents may benefit from education and intervention efforts (Jerman & Constantine, 2010) as parent-adolescent sexual communication can be challenging, overwhelming, and intimidating. Parent-based approaches have many advantages in promoting sexual health and reducing sexual risks among adolescents: (a) parents are able to present and discuss sexual information that is consistent with their family's fundamental values; (b) parents are able to adjust the sexual information based on the practical circumstances of social, family, and personal characteristics; and (c) parents can have more consistent and regular contact with their child about sex compared to formal sex education at school (Jaccard et al., 2002).

Although parents have the willingness to educate and communicate with their children about sexuality, they still need supports in terms of knowledge, skills, and motivation to help them achieve desired goals, such as reducing sexual risk behaviors among their children (Pop & Rusu, 2015). Parents can participate in parent-based adolescent sexual health interventions to increase the effectiveness of parent-child sexual communication (e.g., increased communication and comfort; Santa Maria et al., 2015). One systematic review also indicated improvements in frequency, quality, intentions, comfort, and self-efficacy among participants when compared with control groups (Akers et al., 2011). Based on the literature guided by the PPCT model, there are some key takeaways that can inform future parent-based adolescent sexual health interventions.

First, interventions should inform parents about the crucial role they play in their adolescent children's sexual development and health, and the effect of effective parent-adolescent sexual communication on their children's sexual outcomes (Heller & Johnson, 2010). For example, the interventions can emphasize adolescents' appreciation about parental inputs as their primary source for sexually related information and highlight the benefits of effective sexual communication between parents and their children. In addition, interventions should encourage parents to proactively initiate *early* and *frequent* sexual conversations with their children to avoid missing the critical opportunities to influence their children's sexual attitudes and behavior (Daddis & Randolph, 2010; Malacane & Beckmeyer, 2016; Padilla-Walker, 2018; Pariera, 2016).

Second, interventions can strength parents with knowledge about sexuality and communication skills to increase parents' ability to participate in sexual conversations with their adolescents (Heller & Johnson, 2010; Hyde et al., 2013; Jaccard et al., 2000; Miller et al., 2009;

Wilson et al., 2010). For instance, interventions can provide parents with the complete, accurate, and factual information about sexuality (e.g., sexual organ maturation, reproduction, birth control, and HIV transmission) so that parents may have the knowledge to talk about and explain related topics to their adolescents with correct, complete, and age-appropriate information. Providing information from reputable, research- and evidence-based sources may also boost parents' sense of confidence and reduce parental discomfort during the sexual conversation (Cox et al., 2008; Elliott, 2010; Guilamo-Ramos et al., 2008; Wilson et al., 2010). For example, Kirstie (2020) indicates that providing more information about birth control to parents would be beneficial in increasing the frequency of related sexual discussions within the family. The intervention can also provide additional resources (e.g., book lists, websites, and videos) that may improve parents' communication skills by teaching authoritative communication that is more respectful, encouraging, and less reactive (Aronowitz & Agbeshie, 2012).

Third, interventions should emphasize to support effective parent-adolescent sexual communication of all dyads (e.g., mother-son, father-daughter, parent-sexual minority youth) and provide specific information and resources to meet particular needs of parents (Wilson et al., 2010). For example, intervention efforts can emphasize supports for both mothers and fathers in communicating sexual topics with both boys and girls; particular attention should be given to dyads such as mother-son and father-daughter about communicating sexual issues (Coley et al., 2009; Malacane & Beckmeyer, 2016; Wilson et al., 2010) as limited intervention efforts have focused on these dyads (Santa Maria et al., 2015).

Further, supporting both mother- and father-child sexual communication is especially important to strengthen the sexual health of adolescents from single families. According to the latest data from the U.S. Census Bureau (2020a), in 2018, out of 121,520,180 total households in

the United States, 2.3% are male households (no wife present) and 6.4% are female households (no husband present), both with children under 18 years of age; there were approximately 10,519,285 single-parent households in the United States in 2018 (U.S. Census Bureau, 2020a). Due to the lack of supports from a spouse, adolescent parents in single families are more likely to face challenges talking about sex with children of other sexes. Moreover, poverty is more prevalent in single-parent households than in other family structures (Kramer et al., 2016), and adolescents from low-income families are at higher risk of engaging in sexual risk behaviors (Cox et al., 2008; Romo et al., 2010; Santa Maria et al., 2015). Thus, it would be meaningful for intervention efforts to pay attention to parents from single families and equip these parents to have effective sexual communication within the family.

Fourth, interventions should also support parents of sexual minority youth in communicating sexuality-related information. The intervention can help parents of sexual minority youth better understand the development of their children's sexual identity and provide practical strategies to support their children's sexual health through conversation. As adolescents' awareness of same-sex sexual attraction occurs as early as around age of 10 (Flores et al., 2019), it is crucial for health care professionals to support parents with LGBTQ-related sexuality knowledge in discussing the topics of sexual orientation, gender identity, and sexual risk prevention early with their adolescents for promoting sexual health and reducing sexual risk among sexual and gender minority youth (Flores et al., 2019; Newcomb et al., 2018; Rose et al., 2014; Rusow et al., 2019).

Fifth, interventions should assist parents in identifying family values related to sexuality and support them to transmit these values through sexual communication to their adolescent children (Shtarkshall et al., 2007). In particular, the intervention can help parents identify their

familial and religious beliefs and values and be aware of how these beliefs and values will affect their sexual communication with their children. As many parents have the concern that some of the information in the formal sex education, such as school- or web-based sex education, are in opposition to their family values (Jaccard et al., 2002), interventions can support parents relaying information that is consistent with their family values. It is important to help parents to transmit their family values while communicating sexuality to the next generation to influence their children's attitudes and decision making related to sexual health and relationships (Wight & Fullerton, 2013).

Lastly, interventions should provide parents with coping strategies to deal with the potential negative effects of media, the internet, and other relevant sources on their adolescent children's sexual socialization (Clark, 2014; Zurcher, 2017). Specifically, interventions can equip parents with knowledge and skills to distinguish misleading sexual information conveyed through media and help them communicate with their adolescents with accurate and healthy sexual information (Heller & Johnson, 2010; Scull & Malik, 2019). Moreover, interventions can inform parents about media influences and teach them strategies to communicate their expectations and rules with their children (Clark, 2014).

Existing Programs

A recent systematic review of existing programs found that parent-based adolescent sexual health interventions that primarily focused on improving parent-adolescent sexual communication were more likely to target parents of minority youth and adolescents under the age of 16 (Santa Maria et al., 2015). In general, interventions aimed to improve parents' self-efficacy, attitudes, and communication skills regarding sexual communication (Santa Maria et al., 2015). Moreover, a considerable portion of intervention relied on in-person, group-based,

multisession delivery models in community settings (Santa Maria et al., 2015). However, resource-intensive interventions that use face-to-face approaches face numerous challenges, including funding, resources, program-fidelity, and significant participant recruitment and retention challenges (Burrus et al., 2012; Santa Maria et al., 2015); therefore, there is a need for exploration of more accessible interventions (e.g., self-paced approaches) for disseminating parent education (Burrus et al., 2012; Santa Maria et al., 2015).

Furthermore, there are limited programs developed and evaluated for aiding parents from different family structures and backgrounds in educating their children about sexuality (Santa Maria et al., 2015). For instance, Santa Maria et al. (2015) indicated that future interventions targeting parents of sexual minority youth and custodial grandparents are needed. Further, there is limited evidence on the effectiveness of these parent-based programs; therefore, there is an urgent need for evidence-based interventions on adolescents' sexual health that takes into account the needs and perspectives of parents from diverse backgrounds (Morawska et al., 2015; Sanders & Kirby, 2012).

Educational Mobile Apps

The increasing accessibility of smartphones and apps among U.S. adults gives unprecedented opportunities to deliver parent-based adolescent sexual health interventions to a wider and more diverse population. Between 2013 and 2018, around 80% of the U.S. population had a broadband internet subscription (U. S. Census Bureau, 2020b), which may increase the reach of internet-based education or intervention programs. However, internet access at home is likely less prevalent among low-income families compared to families with higher incomes (Mitchell et al., 2014; Pew Research Center, 2019b). According to Pew Research Center's survey of Americans' smartphone ownership, the percentage of Americans that own smartphones

have been steadily increasing from 35% in 2011 to 81% in 2019 (Auxier et al., 2019). Adults in America increasingly prefer to use their smartphone as the primary tool to go online (Auxier et al., 2019), and this is especially true among young, Black, and lower-income adults who have limited access to home broadband service (Pew Research Center, 2019b). In addition, a large proportion (i.e., 77% in 2015) of smartphone users have downloaded apps in the past (Atkinson, 2015b). Among the various app categories (e.g., entertainment, tools), educational apps are most commonly downloaded by smartphone users (Atkinson, 2015c). As Atkinson (2015a) described, apps “allow users to tailor their powerful pocket computer into a device with hundreds of potential uses that meet their owners’ specific needs” (p. 2).

Developing new and innovative apps on parent education and interventions can provide target parents opportunities to be exposed to ongoing and timely information repeatedly, and therefore enhance parents’ intake and retention of educational information (Davis et al., 2017). Younger generations of parents who are familiar and comfortable with using apps and minority populations (e.g., Black parents; Mitchell et al., 2014) may benefit more from these new and emerging delivery methods (Santa Maria et al., 2015). Unfortunately, to date, no parent-based intervention efforts that aim to promote adolescent sexual health by increasing parent-child sexual communication via a smartphone app have been developed. Additionally, further research is needed to determine the effectiveness of these interventions long-term compared to more traditional approaches (Santa Maria et al., 2015).

Mobile Apps for Sexual Health Education

Mobile technologies such as smartphone apps are promising platforms to deliver education and/or interventions to targeted populations and to overcome the barriers of more traditionally delivered interventions as information is consistently available and accessible

(Davis et al., 2017). The increasing accessibility of mobile apps for tablets and smartphones has given unprecedented opportunities to deliver sexual health information among adolescents (e.g., Brayboy et al., 2017) and young adults (e.g., Richman et al., 2014). These new and innovative ways to deliver accurate, up-to-date, and comprehensive sexual health information to younger populations have been shown to be effective in increasing awareness of sexual health (Brayboy et al., 2017) and promoting healthy sexuality (Richman et al., 2014). For example, a smartphone app, *Girl Talk*, conveys comprehensive sexual health information to adolescent girls and has been found to connect girls with new and detailed sexual health information when compared to a health class (Brayboy et al., 2017). In addition, mobile apps have also been applied to other sex-related fields, such as sexual abuse prevention for elementary school children; this initiative showed that children improved awareness of sexual abuse and increased skills to avoid child sexually abusive situations (Moon et al., 2017).

Mobile Apps and Parent Education

Mobile apps for sexual health education that target parents are lacking. More existing mobile apps have been used in the fields of parenting (e.g., Virani et al., 2019), pregnancy (e.g., Thomas & Lupton, 2016), infant and child health (e.g., Davis et al., 2017) and care of children (Richardson et al., 2019). For example, according to Davis and colleagues (2017), apps supporting parents of infants have focused on providing parents with information on infant development, health, emotional needs, and safety. Other apps have focused on supporting pregnant mothers while others have focused on providing parenting tips in general. For parents who are frequently using technology (Virani et al., 2019), or populations of pregnant and parenting women (Waring et al., 2014), apps are now their preferred tool for accessing needed information, tracking their infant's development, and learning about parenting (to name a few).

Unfortunately, there is an abundance of low-quality apps with limited functionality and low credibility (Davis et al., 2017) that hinders the process of finding a reliable source for parents (Richardson et al., 2019). For example, when critiquing existing parenting apps, Davis et al., (2017) found that most apps took their users to a website or an article to read, and many apps lacked identification of sources (i.e., references).

To sum up, using smartphone apps to deliver parent-based interventions has significant potential to overcome the aforementioned challenges of traditional delivery methods. However, there are no existing adolescent sexual health apps that primarily target parents in the field. As low-quality education and intervention apps are prevalent in the market, there is a need to develop a quality and research-based app that target adolescent parents to promote adolescent sexual health. Therefore, the report will develop a smartphone app that aims to facilitate effective parent-early adolescent sexual communication in the next chapter.

Chapter 3 - Developing a Parent Aimed Smartphone App

Parent Sex Talk 12-14

Based on findings from previous literature, utilizing an accessible, quality, and affordable smartphone app is promising in introducing trustworthy and parental need-based sexual health materials to parents effectively. The innovative way would allow parents of early adolescents to easily access information needed through their smartphones that has the potential to improve their knowledge, skills, and confidence about parent-child sexual communication. Therefore, the purpose of this report is to provide a research foundation on which to build a quality smartphone app, *Parent Sex Talk 12-14*, that aims to promote effective sexual communication between parents and their early adolescents. The *Parent Sex Talk 12-14* app will provide credible sexual health-related materials to any parents (also referred to legal guardians) of adolescents aged 12- to 14-years-old in the United States, despite differentiations such as race and ethnicity, socioeconomic status, and family structure.

A pilot study is a small-size study that has been widely conducted by researchers to test various aspects of research techniques (e.g., the participant recruitment strategy, the research instrument) prior to the larger study or intervention (Connelly, 2008; Hassan, 2006). Conducting a pilot study can help researchers to identify the potential problems and deficiencies that exist in the research protocols and, therefore, to make adjustments for the full study (Hassan, 2006). As the *Parent Sex Talk 12-14* app is aimed to target adolescent parents across the United States, a pilot study would be an optimal way to test the app as well as the evaluation process in advance of the full implementation of the app national wide.

Therefore, the *Parent Sex Talk 12-14* will initially be a 3-year program, which involves a 2-year pilot phase of app implementation and evaluation, targeting early adolescent parents

within the state of Kansas, the United States. Specifically, the program will include 3 main phases: (a) the first 9-month phase is for app development; (b) the second 3-month phase is for the app marketing and the participant recruitment; (c) the third 2-year phase is for piloting the app including implementation and evaluation (the app will be available for participants to download from the app stores at the beginning of this phase). The wide-scale availability of the app and further implementation of the program will highly depend on the effectiveness of the *Parent Sex Talk 12-14* app during the 2-year pilot phase as well as the grants and funding availability. The director of the *Parent Sex Talk 12-14* program is responsible for seeking out grants prior to the first phase (i.e., app development) to cover the majority of the expenses (e.g., app development, maintenance, advertisements, salaries, incentives, etc.) for the three phases. The director will search and apply for sexual health and well-being grants and funding opportunities in the United States, including from potential sources such as Federal agencies (e.g., National Institutes of Health, Center for Disease Control and Prevention). Once the grants and funding have been approved, and the program has received the funding, the initial phase of the program will begin. As the app will open access for the user donation during the pilot phase, other sources of funding may come from donations from app users, partners, and so on.

The First Phase: App Development

Content

The staff of the *Parent Sex Talk 12-14* program (i.e., the researchers and sex educators) will be responsible for developing the content of the *Parent Sex Talk 12-14* app. In order to provide high-quality information to parents, the content will be developed according to two key criteria, credibility and understandability. The credibility of information refers to several aspects of the information: (a) all content will be selected from identifiable, creditable, and peer-

reviewed sources and will include references, (b) all content will be the most up-to-date information and the platform will be updated regularly, (c) all content will include factual information to ensure accuracy, and (d) typographical and spelling errors will be minimized when delivering messages. These criteria will ensure the delivered information is valid, current, and research-based (Davis et al., 2017). Specifically, the app's content will be selected from government agencies (e.g., the Centers for Disease Control and Prevention and the Department of Health and Human Services' Office of Adolescent Health), national organizations (e.g., National Coalition for Sexual Health), community-based organizations (e.g., the Cooperative Extension System from Land Grant Universities), and related credible publications (e.g., peer-reviewed research).

Understandability refers to the fact that information will be refined and translated in simple, straightforward educational materials that users can easily understand. For example, in Dent and Maloney's (2017) study, parents have indicated their preference for simple information of sexuality-related biology (e.g., reproduction) in the context of parental support. Simple information can be very effective in improving audiences' knowledge (Logsdon et al., 2015) and can be highly acceptable for audiences with different levels of income, education, and literacy (Davis et al., 2013; DeWalt & Pignone, 2005).

Topics. At the initial phase of app development, the content will be English-only. The content within the app will be sorted under several main topics: (a) sexual development during early adolescence, (b) sexual risk reduction, (c) family values, (d) tips for sexual communication, (e) media matters, (f) LGBTQ+, (g) resources, and (h) frequently asked questions (by both parents and early adolescents). Each of the topics will be discussed in detailed ways.

Sexual Development During Early Adolescence. Specifically, the topic of sexual development during early adolescence will include information such as adolescence and puberty, sex organs, and male and female reproductive systems (Dent & Maloney, 2017). This information will help parents better understand what they should expect around sexual development during early adolescence. The information is meant to increase parents' awareness of their children's sexual development and allow parents to use this information to explain sex-related topics to their children.

Sexual Risk Reduction. The topic of sexual risk reduction will include information such as unintended pregnancy, sexual risk behaviors, sexual risks, and contraception options. Previous research has demonstrated buffering effects of parent-adolescent sexual communication on adolescents' risky sexual behaviors (De Graaf et al., 2011; Guilamo-Ramos et al., 2012; Hutchinson & Montgomery, 2007; Widman et al., 2016). Under this topic, parents will learn more about sexual risk behaviors in adolescence and initiate a dialog about prevention strategies.

Family Values. The topic of family values will include information that informs parents about the crucial role of family values and beliefs (or religious values and beliefs) in influencing adolescents' sexual attitudes and behaviors (Dent & Maloney, 2017). According to Lefkowitz and Stoppa (2006), parents' belief systems can not only influence their children's beliefs and values but also can affect the effectiveness and content of parent-child sexual communication. Under this topic, parents will be supported in identifying sex topic-related family values and beliefs and transmitting those values and beliefs through sexual communication within the family.

Tips for Sexual Communication. The topic of tips for sexual communication will provide parents with practical tips to initiate effective sexual communication with their children

and to maintain an ongoing and open communication atmosphere in their family. Miller et al.'s (2009) findings have indicated that parents need support in the areas of emotions, skills, and confidence to avoid difficult sexual communication with their children.

Media Matters. This topic will introduce parents to the types of media (e.g., social media, apps, websites) that their early adolescent children may access for connection and information, so parents may be aware of and understand their children's media usage in daily lives. The topic of media matters will also inform parents about the potential effects of media exposure and usage that may affect their children's sexual attitudes and behaviors or even safety in both positive and negative ways. The parents can communicate with their early adolescent children about the risks (e.g., receive inappropriate advertising for their age, exposure to sexually explicit information) and benefits (e.g., stay connected with others and events, find needed information) of media usage. The topic will also provide parents with some coping strategies for parents to communicate family rules about media usage as well as to help their children foster critical thinking while using media and encountering unhealthy and inaccurate sexual information via media.

LGBTQ+. The topic of LGBTQ+ will include LGBTQ+-specific information for all parents who use the app, including parents of early adolescents who self-identified as LGBTQ+, to better understand the LGBTQ+-specific knowledge about sexual development and sexual risk reduction during adolescence. The topic will also equip parents with knowledge and communication tips to prepare them for how to respond if their early adolescent children identify as LGBTQ+ and/or indicate their uncertainty about their own sexual orientation or gender identity. Further, the content is to help parents properly respond to their children's questions about LGBTQ+-related topics. The topic of LGBTQ+ aims to help parents have effective and supportive communication with their children regarding LGBTQ+-specific topics and to promote

early adolescents' exploration and transition toward sexual orientation and gender identity by increasing knowledge, understanding, and acceptance of parents (LaSala, 2015; Solebello & Elliott, 2011).

Resources. Under the topic of resources, parents will find a list of additional resources, such as books, websites, and organizations that can potentially support sexual communication with their children and promote healthy sexual development of their children. For example, the staff may regularly recommend relevant and credible books that can help parents learn more about specific topics; the websites may refer to some official sites (e.g., .gov or .edu sites) related to adolescent sexual development; or the resources may consist of some parent organizations on social media that aim to promote adolescent sexual health (Niela-Vilén, 2014). The topic of additional resources has many advantages in helping parents in terms of gaining additional related knowledge and connecting with other parents for social support.

Frequently Asked Questions. Last, the topic of frequently asked questions will provide some frequently asked questions (FAQs) related to adolescent sexual health and parent-adolescent sexual communication by parents and adolescents. These FAQs will be collected and refined by the staff (i.e., researchers and educators) of the *Parent Sex Talk 12-14* program from other credible sources and sites to ensure accuracy and credibility. This section will help parents better understand their peers' (other parents) and early adolescents' perspectives and questions in general. Parents can use the FAQs area to find information about commonly asked sex-related questions from their children. In addition, some general questions and answers about the *Parent Sex Talk 12-14* app will also be developed by the staff to clarify the background, mission, funding source, standards, and other information of the app, so parents may have a better understanding of and build trust in the app.

App Design

To develop a quality smartphone app as an ideal platform that prioritizes app user experiences and delivers the aforementioned content, the staff of *Parent Sex Talk 12-14* program will look for and work with a reputable mobile app development company for the design, development, testing, launching, and maintenance of the *Parent Sex Talk 12-14* app. Based on the mutual understanding of the *Parent Sex Talk 12-14* program, the program staff will communicate their expected criteria of the *Parent Sex Talk 12-14* app design and development with the mobile app developers. The criteria of app development are guided by the Mobile App Rating Scale (MARS), a tool that can be used to provide a checklist for the design and development of new high-quality health apps (Stoyanov et al., 2015). In addition to MARS, Davis et al.'s (2017) review of existing parent education apps also provided many valuable standards in the developmental process of the app.

Compatibility. During the pilot phase of the app, the smartphone app will be made for both platforms of iOS and Android to reach a wider population. Parents and caregivers of Kansas who participate in the pilot study with an iOS or Android device will be able to easily access the smartphone app through the internet at any location and at any time. In considering that frequent, reliable internet access may not apply to some households such as rural and low-income families (Pew Research Center, 2019c), the app will set up some offline functions and allow some materials and resources (e.g., articles, infographics) to be downloadable. Additionally, with users' consent, the app will be able to track user behavior (e.g., exact user interactions with the app), usage time (e.g., the time that a user spends on a specific topic), and usage progress (e.g., the completeness of reviewing a specific topic) by cooperating with other analytics tools (e.g., Google Analytics). Tracking user behavior will be beneficial for the evaluation and improvement

processes. For example, the evaluator can examine what functions work well or which topic has been reviewed most frequently in the app for future improvement.

Aesthetics and Functionality. The app will adopt clean and eye-catching interfaces with a typical and fashionable color scheme to ensure it is visually appealing. Interfaces will use visually appealing and theme-related graphics to not only capture and maintain users' attention but also illustrate the content. The main interface of the smartphone app will incorporate several modules of topics. Users can click on these modules to access more related information. All content within the app will be formatted for easy navigation and will be readily understood on the basis of the topics. Moreover, the app will apply some time-efficient strategies such as the use of videos and infographics to illustrate the information.

Maintenance. Sex educators, researchers, or other professionals who are qualified in finding and translating credible sources and research findings will write and update content for the app constantly based on the updated research findings and information in a collaborative way. Professionals will also consistently revise the content to ensure accuracy if incorrect information is found. The app development company will also be responsible for the app maintenance, including uploading updated content to the app, making needed app adjustments and improvements, and solving technological problems.

Anticipated Limitations

There are several anticipated limitations while developing the app for the initial pilot phase (i.e., 2 years). First, the app firstly will only provide English-only content. The further expansion of the app in terms of available languages (e.g., Spanish, Chinese) and regions (e.g., outside of Kansas, the United States) will greatly depend on the availability and continuity of funding. Second, the app excludes interactive features such as including sections of forums and

comments. Although forums and comments are beneficial for increasing user engagement and for evaluation, maintaining sections of forums and comments are time and cost consuming. Therefore, this can be upgraded in the further full implementation of the app once funding allows. Third, specific content designed for parents from different backgrounds (e.g., culture, race and ethnicity, family structure) may initially be limited. The limitation is primarily due to the reason that existing research and intervention have rarely targeted some types of parents, such as custodial grandparents (Santa Maria et al., 2015). As the app aims to benefit all parents of adolescents aged 12- to 14-years-old regardless of background differentiations, the specific content will be updated once related research is sufficient.

The Second Phase: App Marketing

The content and the functionality of the *Parent Sex Talk 12-14* app will be well developed during the initial 9-month phase. As the following 3-month phase, the staff of the program will decide and use marketing strategies to reach out to potential early adolescent parents of Kansas and invite them to participate in the pilot study during the second 3-month phase. The 3 months will also allow companies of app stores (e.g., Apple) to review the app for the formal release at the app stores. The staff will utilize social platforms and cooperate with local partners of Kansas to recruit more extensive app users (i.e., early adolescent parents) by advertising the app as well as the pilot study. As the app will be formally launched in the third phase, the staff will focus on advertising the pilot study and app's formal release date and gather potential app users' email addresses in the second phase. The staff will create a simple pre-launch website that introduces the procedure of the app pilot testing, the app's purpose, features, key content, and formal release date. The pre-launch website will also encourage early adolescent parents of Kansas to leave their email addresses for receiving further notifications

about the study and the app's formal launch. The *Parent Sex Talk 12-14* program will mainly advertise the pre-launch website via social platforms (e.g., Facebook, Instagram, Twitter, Pinterest, etc.) by using promotional, entertaining, and engaging words and content. The advertisements on social platforms aim to get potential app users of Kansas anticipated the pilot testing of the app and encourage them to visit the pre-launch website and leave their email addresses.

The staff will also collaborate with some local organizational partners of Kansas and advertise the pre-launch website in several ways. To maximize the sample diversity and representativeness, the staff will recruit participants purposefully by inclusively working with local partners from urban, suburban, and rural counties of Kansas. First, the staff of the *Parent Sex Talk 12-14* program will reach out to parents of 7th and 8th graders by working with parent-teacher organizations of several middle schools of selected counties within Kansas. An introduction about the app, the pilot study, and the linkage of the pre-launch website will be sent out to parents via the flyer and emails. Second, the program will work with local health departments at the community level. The director of the *Parent Sex Talk 12-14* program will reach out to the health departments of selected counties and introduce the purpose of the pilot study and the app, which can be a supplemental resource for programs targeting parents of adolescents, especially those from at-risk and minority backgrounds. Upon receiving consent from the health departments, the flyer including an introduction about the app, the pilot testing, and the linkage of the pre-launch website will be distributed to parents of adolescent parents during related event and program implementation periods. Third, the director of the *Parent Sex Talk 12-14* program will contact extension agents (Kansas State University) of selected counties and communicate the purpose and anticipated outcomes of the pilot study to them. Once received

the cooperation intention from these extension agents and the approval from Kansas State University, the director will work with local extension agents to recruit potential participants through parenting programs. The early adolescent parents will be invited to participate in the pilot study by the oral notification of extension agents as well as by receiving the flyer indicating the study procedure.

The Third Phase: App Implementation and Evaluation

In the third phase, the staff of the *Parent Sex Talk 12-14* program will mainly focus on the app release and pilot testing. Once the app is formally launched at app stores, the staff will send out an invitation along with a code for the app user registration via email to each potential app user who has left their email addresses through the pre-launch website. The invitation will emphasize that the study will only initially target parents of early adolescents aged 12- to 14-years-old within the region of Kansas. The staff will also update information on social platforms about the app launch and encourage parents of early adolescents in Kansas to participate in the pilot testing by downloading and using the app. The staff will also encourage participants to leave ratings and reviews on the app stores at the end of the study, which may potentially encourage other users to download the app in the future.

The Consent and the Voluntary Nature of Participation

The staff will invite app users who self-identified as parents of early adolescents aged 12- to 14-years old and currently lived in Kansas to participate in the pilot study, which includes the evaluation process, by sending invitations via the app and emails. The *Parent Sex Talk 12-14* program will compensate parents who participate in the pilot study with digital gift cards (e.g., \$5 for each survey) as appreciation. The ethical issues the evaluator will need to consider while developing and implementing the pilot study begin with obtaining participant's consent; this will

ensure that participants understand the basic information of the pilot study and agree to participate in the study as well as the evaluation process. The consent information should clearly explain the purpose, methods, and procedures, benefits of the pilot study and the evaluation process, and what has been done to ensure the parents' safety and minimize risk and harm. Also, the staff of the *Parent Sex Talk 12-14* program and the evaluator should respect participants' free choice to participate in the pilot study and the evaluation process by providing a voluntary participation statement; the participants will understand that their participation in the study is voluntary, and they may withdraw at any time. Their decision will not be associated with participants' received services and benefits throughout the study.

The Logic Model

Parents of adolescents face many challenges, such as limited sexual knowledge and communication skills, when initiating and participating in sexual communication with their children. Moreover, there are no existing adolescent sexual health apps that target parents of early adolescents. Based on the problems stated above, the *Parent Sex Talk 12-14* app aims to promote effective parent-adolescent sexual communication from parents' perspectives. The objectives for the pilot testing of the app is that, within 2 years, the app staff will continually distribute credible and understandable materials related to adolescent sexual health to Kansas parents of early adolescents aged 12- to 14-years-old via the app, resulting in 80% of the parents reporting increased effective sexual communication with their children. According to W. K. Kellogg Foundation (2017), the logic model is particularly "useful for informing the design of a strategy, initiative or program; its implementation; the plan for evaluating it; communication of the evaluation findings; and its improvement" (p. 109). Therefore, the logic model for the 2-year

app pilot implementation is described below, including specific inputs, activities, outputs, outcomes, and assumptions (UW-Extension, 2003; W. K. Kellogg Foundation, 2004).

Inputs. The first component of the logic model are inputs (also called resources or factors), which refer to “the human, financial, organizational and community resources” that are needed for the program operation (W. K. Kellogg Foundation, 2017, p. 116). In the *Parent Sex Talk 12-14* program, inputs include grants and funding, time, the *Parent Sex Talk 12-14* app, an office, office equipment, one director, one administrator, two sex educators as consultants, two researchers in the field of human sciences, a mobile app development company (i.e., the one which previously developed the app), credible sources of information related to adolescent sexual health (e.g., research results), social platforms, and organizational partners of the *Parent Sex Talk 12-14* program (i.e., parent-teacher organizations in the middle school, health departments at the community level, county-level extension agents of Kansas State University).

Activities. The second component of the logic model are activities, which are “the processes, techniques, tools, events, technology and actions of the planned program” that can lead to intended improvements (W. K. Kellogg Foundation, 2017, p. 116). For the *Parent Sex Talk 12-14* program, the activities include: (a) the app staff will continually provide the *Parent Sex Talk 12-14* app on app stores for early adolescent parents to download and install to their smartphones at no costs for 2 years; (b) the *Parent Sex Talk 12-14* app will provide information, materials, and resources related to adolescent sexual health to early adolescent parents via the app; (c) the app staff will regularly update all of the information, materials, and resources of the app; and (d) the app will track app users’ behaviors, usage time, and usage progress by using an analytics tool with app users’ consent.

Outputs. The third component of the logic model are the outputs, which refer to “the direct results of program activities” (W. K. Kellogg Foundation, 2017, p. 116). In the *Parent Sex Talk 12-14* program, the outputs include: (a) early adolescent parents who own smartphones will download and installed the *Parent Sex Talk 12-14* app to their smartphone at a low cost; (b) early adolescent parents’ will access to the *Parent Sex Talk 12-14* app to read, watch, and download needed information, materials, and resources from the app; (c) early adolescent parents will receive notifications about any updates (especially for the content) via the app that the *Parent Sex Talk 12-14* app will have made; and (d) the analytics tool will collect data related to app users’ behaviors, usage time, and usage progress for further analysis and improvement.

Outcomes. The fourth component of the logic model are outcomes, which can include short-term, intermediate-term, and long-term outcomes (UW-Extension, 2003). Specific, the short-term outcomes usually refer to the changes in awareness, attitudes, knowledge, motivation, etc. (UW-Extension, 2003). The intermediate-term outcomes are the changes that follow the short-term outcomes and related to behavior, skills, practice, action, etc. (UW-Extension, 2003; W. K. Kellogg Foundation, 2004). The long-term outcomes (or impacts) relate to “lasting changes with organizational, community or systems-level benefits” (W. K. Kellogg Foundation, 2017, p. 117).

During the 2-year pilot phase of the *Parent Sex Talk 12-14* app, the short-term outcomes include: (a) parents’ increased awareness of their parental roles and responsibilities regarding parent-child sexual communication, (b) parents’ increased knowledge of their early adolescent children’s sexual development, (c) parents’ increased knowledge of sexual risk reduction, (d) parents’ increased knowledge of LGBTQ-specific information, (e) parents’ increased knowledge

of the effect of media on their children's sexual socialization, and (f) parents' increased awareness about the role of family values play in parent-child sexual communication.

In general, the intermediate-term outcomes of the *Parent Sex Talk 12-14* app refer to increased effective parent-early adolescent sexual communication that will have been reported by parents. Specifically, the intermediate outcomes reflect on: (a) parents have more frequent sexual communication with their adolescent children; (b) parents adopt constructive communication skills during sexual communication; (c) parents experience increased comfort during sexual communication with their adolescent children; (d) parents provide more accurate sexual information to their adolescent children.

The long-term outcomes of the *Parent Sex Talk 12-14* app regard positive changes in the family environment and the well-being of the target early adolescent parents and their children. Specifically, the long-term outcomes reflect on (a) adolescent parents will have a positive impact on children's sexual development and overall well-being; (b) parents are expected to constructively influence their adolescent children's attitudes, decisions, and behaviors related to sexuality; (c) parents will have a better relationship with their children; (d) parents will learn more about their own sexual health and sexual development; (e) there will be a more open atmosphere for sexual communication within the family.

Assumptions. Finally, the assumptions of the *Parent Sex Talk 12-14* app during the 2-year pilot phase include: early adolescent parents in Kansas have a reliable, affordable, and accessible source of supports when intent to initiate and participate in parent-child sexual communication; early adolescent parents in Kansas are satisfied with the overall quality of the *Parent Sex Talk 12-14* app in terms of the functionality and credibility. Due to the fact that parents may review the content with different timing and at a different pace, the evaluator of the

Parent Sex Talk 12-14 app will evaluate the short-term, intermediate-term, and long-term outcomes based on each parents' progress of app usage.

Program Evaluation

According to the W.K. Kellogg Foundation (1998; 2017), there are three levels of evaluation consisting of project-level evaluation, cluster evaluation, and programming and policymaking evaluation. The current report will only focus on the first level of evaluation, project-level evaluation, which is primarily used to “improve and strengthen” programs and defined as “the consistent, ongoing collection and analysis of information for use in decision making” (W. K. Kellogg Foundation, 1998, p. 14). The *Parent Sex Talk 12-14* program will hire a professional evaluator from an evaluation company to be responsible for the evaluation process to ensure the validity and avoid potential biases.

Key Stakeholders. The primary stakeholders of the *Parent Sex Talk 12-14* program will include the funder, the administration of the *Parent Sex Talk 12-14* program (i.e., the director, the administrator), the staff of the *Parent Sex Talk 12-14* program (i.e., sex educators, researchers), the smartphone app development company, the app users (i.e., early adolescent parents), and the partners of the *Parent Sex Talk 12-14* program (i.e., parent-teacher organizations of local middle schools, local health departments at the community level, county-level extension agents of Kansas State University).

Data and Information Collection. As the outcome evaluation questions will help the evaluator measure changes brought about by the app (Radhakrishna & Relado, 2009), the evaluation question for the pilot testing of the *Parent Sex Talk 12-14* app mainly refers to “To what extent does the app lead to the anticipated changes?” The evaluator of the *Parent Sex Talk 12-14* program will collect data and information via the app by distributing surveys to early

adolescent parents who are using the app during the 2-year pilot phase. Each survey will be expected to take about 10 to 20 minutes for parents to complete. The surveys for evaluating the short-term outcomes will mainly focus on examining the changes in parents' awareness and knowledge related to parent-child sex communication. To evaluate the short-term outcomes, parents will be invited to participate in the short-term outcome evaluation process voluntarily. Upon receiving parents' consent for participation, parents will be asked to fill out a pre-survey when they start each relevant topic (i.e., topics of sexual development during early adolescence, sexual risk reduction, family values, tips for sexual communication, media matters, and LGBTQ+), and then be asked to fill out a post-survey when parents complete reviewing at least 80% of particular content. As most parents will choose content to review according to their needs, particular content under some topics might not apply to parents' interests. Therefore, the evaluation process will treat 80% of completeness as full engagement. The consideration will also apply to the intermediate-term outcome evaluation.

Specifically, the app system will automatically detect the completeness of parents' usage of each relevant topic. Once the completeness of one topic reaches 80%, which means parents have reviewed 80% of the content under that topic, the app system will send the post-survey to parents. For example, to evaluate parents' increased knowledge of sexual risk reduction, the pre-survey will ask parents some related true or false questions (e.g., questions related to HIV knowledge) in general to assess their knowledge of sexual risk reduction at baseline. When the app system detects that parents have completed 80% of the sexual risk reduction topic, a post-survey that includes true or false questions that related to the topic, such as "Vaginal fluids can transmit HIV," will be sent to parents to fill out.

Similarly, the intermediate-term outcome evaluation will mainly focus on examining the changes in parents' behaviors related to parent-child sex communication, which in terms of increased effective sexual communication between parents and adolescents. To evaluate the intermediate-term outcomes, parents will be invited to participate in the intermediate-term outcome evaluation process voluntarily. Upon receiving parents' consent for participation, parents will be asked to fill out a pre-survey when they start using the app and then be asked to fill out a post-survey when the app system detects that parents have completed reviewing at least 80% of the whole content of the app and/or has been using the app for at least 6 months. Parents will be asked about some questions related to their past sexual communication with their children during the previous 6 months and their perceived effectiveness about these communications by filling out a pre-survey. For example, in the pre-survey, parents may be asked questions with multiple choices such as "How often have you talked with your adolescent child about sexuality-related topics in the past 6 months?" They will be asked similar questions such as "How often have you talked with your adolescent child about sexuality-related topics since using information from the *Parent Sex Talk 12-14* app?" in the post-survey. Conducting the pre- and post-survey will allow the evaluator to assess the changes in parents' sexual communication with their children as well as its effectiveness.

The long-term outcome evaluation will examine the effect that the app brings to the early adolescent parents' immediate environment (e.g., family, children). In order to evaluate the long-term outcomes, a follow-up survey via Qualtrics will be conducted 6 months later when parents complete the post-survey of the intermediate-term outcome evaluation. As parents might no longer use the app at the time point, parents will receive an invitation to fill out the survey through an email. Parents will be asked some questions related to their adolescent children's

sexual well-being, their relationships with their children, family atmosphere for sexual communication, etc. The survey will allow the evaluator to assess the ongoing effect of the app on early adolescent parents.

In addition, the evaluator will collect parents' demographic data by asking related questions during the registration process when parents start using the app. The demographic questions will primarily focus on parents' caregiver role, family structure, age, race and ethnicity, education level, and income for later analysis. This will help the evaluator to understand if the app has reached and served the target population.

Data Analysis. The data for short-term and intermediate-term outcome evaluation will be ongoing and automatically collected by the app system. The app evaluator will collect data from the app system every 6 months (4 times in total) and analyze the data for the short-term and intermediate-term outcome evaluation. At the end of the 2-year pilot phase, the evaluator will conclude the 4-time short-term and intermediate-term outcome evaluation and summarize the overall evaluation outcomes. Specifically, to evaluate the short-term outcomes, the evaluator will compare the pre-post levels of parents' knowledge toward their early adolescent children's sexual development, sexual risk reduction, LGBTQ+-specific information, and the effect of media on their children's sexual socialization. Similarly, the evaluator will compare the pre-post degrees of parents' awareness related to their parental roles and responsibilities regarding parent-child sexual communication as well as the role family values play in parent-child sexual communication. According to Jacobs' (1988) Five-Tiered Approach to program evaluation, Tier 4 is primarily concerned with short-term outcome evaluation, which is mainly focused on the modification of the program to allow programs to better adjust their programming toward

objectives. Thus, the short-term evaluation results will allow for program modification (e.g., resource shifting) to reach expected objectives.

For evaluating the intermediate-term outcomes, the evaluator will compare the pre-post level of parents' perceived frequency of parent-adolescent sexual communication, the parents' adopted constructive communication skills during sexual communication, the levels of comfort related to sexual communication, and parents' perceived accuracy of sexual information that provides to their children. The intermediate-term evaluation results will help stakeholders understand whether the app is moving in the intended direction; the results will also be beneficial for stakeholders planning for the next steps of the app.

To evaluate the long-term outcomes, further and comprehensive research is needed. While piloting the app and collecting data from the parents who use the app (i.e., the intervention group), researchers will parallelly recruit another group of early adolescent parents who do not use the app as the comparison group. Parents of the comparison group will be asked to answer similar questions via Qualtrics as parents of intervention group voluntarily in the aspects of their adolescent children's sexual well-being, parent-child relationships, and family atmosphere for sexual communication, etc. When evaluating the long-term outcomes at the end of the 2-year pilot phase, the evaluator will compare the data of the intervention group to the data of the comparison group.

Additionally, the evaluator will analyze the data of parents' demographic information to assess the specific backgrounds of users. The evaluator will also calculate the overall number of downloads and ratings and reviews in the App store to assess user engagement. Finally, the evaluator will summarize the 2-year data for reporting the overall effectiveness of the app for further decision making and funding application.

Plan for Dissemination of Results. Based on the various characteristics of key stakeholders, the dissemination of evaluation results will be specific and different. The funders of the *Parent Sex Talk 12-14* app are critical to the program's sustainability and will expect the app to be effective and to be implemented as described. Therefore, the dissemination plan for the funders will be a comprehensive written report along with executive summaries sent through email and formal mail. The administration of the *Parent Sex Talk 12-14* app will be in charge of the app and dissemination of information. A comprehensive written report along with executive summaries will be sent through email to them in advance, and a verbal presentation by the evaluator can be conducted during a working session. An email includes the results of the evaluation will be sent to the staff of the *Parent Sex Talk 12-14* app. The results of the short-term and intermediate-term outcome evaluation will be advertised within the app through a notification and a special section within the app; results of long-term outcome evaluation will be sent out via email. Informing parents about the evaluation results may not only encourage parents' further involvement of the app but also potentially stimulate their willingness to referral the app to other early adolescent parents. The organizational partners of the *Parent Sex Talk 12-14* app are the groups who provide the essential supports to the program; they will receive the executive summaries through email to know the results and keep their supports.

Implications for Intervention

The *Parent Sex Talk 12-14* app utilizes a smartphone app as a platform to deliver research-based adolescent sexual health intervention to early adolescent parents. The app has several implications for future parent-based intervention that focuses on educating parents, strengthening parent-child sexual communication, and promoting adolescent sexual health. By working with parents, rather than simply working with adolescents as seen in previous

interventions, this app aims to improve parent's knowledge and skills related to sexuality that will improve sexual communication with their children. As research has shown the importance of encouraging early parent-child sexual communication and maximizing parental influences in children and adolescents' sexual socialization, this app can help set the foundation for future effective communication between parents and children. For example, the intervention described above will encourage parents to have ongoing and effective parent-child sexual communication that parallel with their children's growth, rather than a one-time "sex-talk."

Further, successful interventions should be research- and evidence-based to maximize practicality and credibility, including within the realm of parent-adolescent sexual communication. As research updates continually, the above intervention can disseminate updated and credible research findings into understandable information and deliver it to parents. Parents and their adolescents are expected to benefit from credible sources for optimal intervention outcomes.

Despite the wide utility and hypothesized effectiveness of this smartphone app, future updates and interventions can help to improve the outreach and effectiveness of this app. For example, future versions of this app and interventions should be more inclusive to other age periods, including covering topics for children and adolescents of all ages. Specifically, as sexuality develops across childhood rather than just during one age period, this would allow parents to find age-appropriate information and materials according to their children's age and needs across sexual developmental stages. Thus, future interventions can be developed focusing on parents of younger children (e.g., preschoolers). Further, future interventions are encouraged to keep focusing on reaching diverse populations, such as including meeting the special educational needs of grandparents and/or parents of children with a disability, to name a few.

Conclusion

Parents have been widely considered as optimal influencers for their children's sexual development. Notably, parents have the potential to promote healthy sexuality and reduce negative sexual outcomes for their adolescent children by using effective sexual communication (De Graaf et al., 2011; Guilamo-Ramos et al., 2012; Lefkowitz & Stoppa, 2006; Widman et al., 2016). However, parents might face many barriers in initiating and discussing sexuality-related topics and thus practice ineffective sexual communication. In order to maximize parents' influences on their adolescent's healthy sexual development, the current report develops a smartphone app, *Parent Sex Talk 12-14*, that aims to promote parent-early adolescent effective sexual communication. This is done through using technology to reach a broader population (i.e., internet outreach), and using peer-reviewed research and programming for maximizing the practicality and credibility of this app. Overall, the report encourages adolescent sexual health interventions to pay attention to parents' perspectives and needs when developing sexual-based education programs. This may be especially important for promoting healthy sexuality among adolescents.

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