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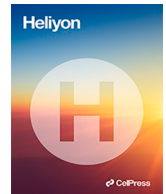
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U.S. parents' intentions to use anti-bullying apps: Insights from a comprehensive model

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ABSTRACT

Cyberbullying has become a prominent risk for youth and an increasing concern for parents. To help parents reduce their child's cyberbullying risk, anti-bullying apps (ABAs)—mobile applications for identifying and preventing instances of cyberbullying—have been developed in recent years. Given that ABAs are an emerging technology, limited research has been conducted to understand the factors predicting parents' intentions to use them. Drawing on three interdisciplinary theoretical frameworks, a sample of parents in the U.S. recruited through Amazon Mechanical Turk completed an online survey to assess parents' knowledge of, attitudes about, and intentions to use ABAs. Participants also rated the importance of a range of ABA functions and provided information about their child's social media use and bullying history. A series of path analyses revealed that the importance parents placed on an app's ability to provide information about their child's cyberbullying risk predicted more positive attitudes toward ABAs and greater perceived usefulness of them. Stronger intentions to use ABAs were predicted by greater cyberbullying concern, greater importance of social recommendations, greater perceived usefulness, more positive attitudes toward the apps, and lower ratings of the importance of ease of use. These findings shed light on the factors predicting parents' intentions to use ABAs and the app features they view as most important. Crucial directions for future research and implications for anti-bullying efforts are discussed.

1. Introduction

Within the past decade, children and young adults, in particular, have become increasingly connected to online media [1,2]. A byproduct of this heightened connectivity is the increased risk of cyberbullying—bullying that occurs through electronic or digital media [3]. A systematic review by Zhu and colleagues [4], which examined the prevalence of cyberbullying in studies conducted globally from 2015 to 2019, found that rates of cyberbullying victimization among children and adolescents under the age of 18 ranged

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from 14.6% to 52.2%. Furthermore, there is some research to indicate that the prevalence of cyberbullying among children and teens has doubled from 2007 to 2019 [5]. Given these trends, it is not surprising that parents have growing concerns about cyberbullying. Indeed, a poll performed by the C.S. Mott Children's Hospital found that in a nationally representative sample of parents (with children 18 years old or younger), nearly one in three U.S. parents were concerned about the safety of their child online and more than one-third were concerned about bullying or cyberbullying [6]. Additionally, in research by Primus Telecommunications and PREVNet, a sample of Canadian parents indicated that cyberbullying was a greater concern than teen pregnancy, drug use, and alcohol use [7].

To mitigate this concern, parents can utilize a range of strategies to reduce their children's online risks, such as communicating about technology use [8], monitoring their child's online activity and social media accounts [9–11], or restricting their child's online activities using parental controls [12,13]. Yet, previous research has yielded inconsistent findings regarding the effectiveness of these strategies and parental involvement, in general. For example, some studies have found that parental monitoring increases children's safety online and reduces the likelihood of cyberbullying victimization [14,15], whereas others have found that greater parental restrictions correspond with an increased likelihood that children will attempt to bypass them and engage in riskier online behaviors [16,17].

1.1. Anti-bullying applications

In recent years, a number of standalone technologies, software programs, and mobile applications have been designed to help parents reduce their children's cyberbullying risk. In this paper, we use the term *anti-bullying app* (ABA) to refer to an application that parents can download and install that alerts them to and helps prevent instances of cyberbullying their child may be experiencing. Whereas most ABAs share in common the potential to reduce cyberbullying, ABAs do, however, vary in their specific functions and features. Some apps, including Bark, are general online protection tools that allow parents to limit the amount of time their children spend on various websites, view their children's browsing history, and receive alerts when keywords and phrases that might indicate bullying or harassment appear in their child's electronic communications (e.g., a text message) [18]. Other apps, including Know-Bullying, provide parents with information about how to discuss online risks and cyberbullying with their children [19]. Yet another type of app, such as STOPit, allows individuals (including parents, peers, and community members) to anonymously report harmful images, messages, and videos to government entities that can provide victims with help [20]. Furthermore, other apps, such as Bully Block [21] and BullStop [22], can be used to analyze messages, detect and record bullying activities, and automatically delete offensive messages.

Although these apps have yet to be widely adopted by parents across broader segments of the population—in large part due to the incipient stages of the technology—at least 16 of these apps were available for consumer use as of 2018 [23]. Surprisingly, there has been little research to better understand parents' decisions to adopt these types of anti-bullying technologies. There has, however, been some research surrounding children's adoption of apps, such as STOPit, which allow victims of bullying and even bystanders to effectively report bullying and provide evidence (i.e., images, videos) of the incident anonymously [24,25]. Given that cyberbullying is a prominent risk for youth, it is important to investigate new technological avenues that help parents reduce their child's cyberbullying risk. The goal of the current study was thus to examine factors predicting parents' intentions to use ABAs. In doing so, we draw on three interdisciplinary theories for understanding technology use intentions: the theory of planned behavior [26], uses and gratifications theory [27], and the technology acceptance model [28]. Below, we provide a brief overview of the key components of these theoretical frameworks and discuss how each one can be applied to predict parents' intentions to use anti-bullying apps.

2. Theoretical background

2.1. Theory of planned behavior

The theory of planned behavior (TPB) was developed to shed a more nuanced light on the link between the attitudes a person holds and their subsequent behavior [26]. When introduced, TPB—and its earlier instantiation, the theory of reasoned action [29]—was novel in its identification of behavioral intentions as a key mediator of the attitude-behavior link. That is, central to TPB is the idea that individuals are more likely to perform a behavior when they have sufficient intentions to do so [26], and those behavioral intentions are jointly determined by an individual's attitude about the behavior, perceived behavioral control, and subjective norms surrounding the behavior [26,30]. Within this framework, attitudes reflect an evaluation of a behavior and its consequences (e.g., as beneficial or harmful) [30–32]. Perceived behavioral control refers to one's confidence in their ability to perform a behavior, potential opportunities to engage in a behavior, and access to resources that help an individual to perform the behavior successfully [26]. Subjective norms reflect social pressure from others to perform a behavior arising from the extent to which other individuals support or discourage the behavior or perform it themselves [31,33]. More positive attitudes [31,34], greater perceived behavioral control [35], and stronger subjective norms promoting a behavior [31,33] predict stronger intentions to perform a behavior (i.e., behavioral intentions) and stronger intentions increase the likelihood that a behavior will be performed.

The TPB has been applied widely within health domains to investigate predictors of both healthy and unhealthy behaviors (see [36, 37] for reviews). More importantly, however, the TPB has been used to understand various forms of online technology use. For instance, TPB has been applied to predict the use of specific social media platforms [38,39] and behaviors performed on social media, such as sharing information online [40], following other users [41], and monitoring others' online activity [42].

A crucial question that remains is the extent to which parents' intentions to use ABAs can be predicted by the TPB. As with other forms of technology use, it seems likely that intentions to use ABAs might vary based on the favorability of parents' attitudes about

ABAs, perceived behavioral control to use ABAs effectively, and perceived norms surrounding the use of ABAs by family members, friends, and other parents. For example, parents' positive attitudes toward ABAs can arise from the expectation that using them will lead to additional protection and a reduction in cyberbullying experiences for their children. Further, the extent of perceived behavioral control is likely reflected in parents' beliefs about their ability to use ABAs (i.e., the ease of use of ABAs) to prevent their child's experiences of cyberbullying. Lastly, there is evidence to suggest that recommendations within one's circle of family and friends can facilitate parents' greater trust in online parenting information [43,44]. Therefore, subjective norms regarding the use of ABAs likely develop when ABAs are used or recommended by other parents, particularly those who are also friends or family members. Drawing on the TPB, we hypothesized that higher ratings of the importance that an ABA is recommended by others (subjective norms), higher ratings of the importance of an ABA's ease of use (behavioral control), and more positive attitudes about ABAs (attitude) will predict parents' greater intentions to use an ABA (**H1**).

2.2. Uses and gratifications theory

Uses and gratifications theory (UGT) is a framework developed within the field of communication for understanding the social and psychological factors that shape the use of different forms of mass media [27]. Although the theory predates the widespread use of electronic communication technology, it has been expanded to shed light on individuals' use of technology, such as the internet [45]. UGT assumes that media and technology use is motivated by a desire to fulfill specific goals or needs (i.e., "uses") [27]. Decisions surrounding whether or not to adopt or to continue using certain technology are thus determined by the extent to which using the technology will help fulfill (i.e., "gratify") various needs [27]. When their goals are adequately met, individuals are more likely to develop positive attitudes about the media or technology, leading to sustained or increased use [46,47]. Notably, research on UGT has identified several uses and gratifications that might be satisfied across different forms of media and technology [48,49], including cognitive (e.g., using the technology helps an individual gain information or knowledge), affective (e.g., using the technology helps an individual gain happiness or enjoyment), personal (e.g., using the technology helps support or supplement one's personal beliefs, values, or status), and social (e.g., using the technology helps an individual build social connections).

UGT has been used to investigate the adoption and continued use of a diverse range of media and technology, including artificially intelligent assistants (e.g., Siri, Cortana, and Amazon Alexa) [50,51], online and mobile shopping [52], digital live streaming [53], and liking and posting behavior on Facebook and TikTok [54–56]. It has also been applied to better understand parents' use of media as a tool to assist in child-rearing [57], parents' use of digital devices to entertain and provide supplemental education for their children [58], and the features of children's apps that parents rate as most important [59].

Although it stands to reason that many of the uses and gratifications that motivate technology use broadly (e.g., information-seeking, building social connections) are also relevant to ABA use, the UGT has not been applied to evaluate specific uses and gratifications related to ABAs. Based on the emerging literature on parents' concerns about cyberbullying, potential uses and gratifications for ABAs may, for instance, include an app's ability to monitor a child's safety online, provide information about a child's cyberbullying risk and cyberbullying, in general, prevent instances of cyberbullying, and build support networks with other parents tackling cyberbullying issues. This is supported by a 2016 Pew Research Center poll indicating that 84% of (U.S.) parents have taken at least one action (e.g., checked their child's social media profile, checked what websites were visited, looked through text or instant messages) to monitor their child's online behaviors [60]. Further, in separate meta-analyses of parents' online activities, Daneback and Plantin [61] and Dworkin et al. [44] found that gathering information was an important motive for parents to use online technology. Their research also indicated that parents often build social support networks through social media and online parenting discussion boards [44,61]. These online spaces are described as safe and supportive places to connect with other parents, allowing parents to feel less isolated and report higher levels of self-esteem [44,62]. Therefore, the extent to which an application fulfills some of these targeted needs should be beneficial for understanding parents' intentions to use ABAs. Drawing on the UGT, we predicted higher ratings of the importance that ABAs fulfill specific needs (uses and gratifications)—including providing social support, preventing cyberbullying, providing general information about cyberbullying, providing child-specific information about cyberbullying, and monitoring a child's online behavior—will predict more positive attitudes about ABAs, which, in turn, will predict greater use intentions (**H2**).

2.3. Technology acceptance model

Lastly, the technology acceptance model (TAM), similar to the UGT, accounts for individuals' perceptions of the usefulness and ease of use of a technology to predict their intentions to use it [28]. Perceived usefulness refers to how helpful the technology appears to be for performing a task, which tends to correspond with stronger intentions to adopt the technology, while ease of use refers to how much effort an individual believes using the technology will require, which tends to correspond with the frequency of use [28,63]. This model also takes into account external factors, such as social influences, that have the potential to impact perceived usefulness. For instance, the extent to which *others* indicate that a technology is useful corresponds with an increased likelihood that potential users, themselves, perceive the technology as useful [28,63].

The TAM has been used to better understand patterns of use of email [64], the internet [65], social networking sites [66,67], and smartphone apps [68,69]. Whereas the TAM has yet to be used to predict ABA use, the degrees to which ABAs are seen as effective at reducing cyberbullying risk (perceived usefulness), requiring low effort for parents (ease of use), and recommended by other parents (social recommendation) are likely predictive of increased use intentions. More specifically, we hypothesized that higher ratings of the importance that an ABA is recommended by others and is easy to use will correspond with greater perceived usefulness of ABAs and that greater perceived usefulness and ease of use will predict greater use intentions (**H3**).

3. Present study & hypotheses

The present research investigated parents' intentions to use ABAs through three theoretical frameworks. To summarize, based on the TPB, we hypothesized that higher ratings of the importance of others' recommendations, ease of use, and positive attitudes about ABAs would predict greater ABA use intentions (H1). Additionally, based on the UGT, we hypothesized that the extent to which ABAs are perceived as meeting specific needs (e.g., providing information) would predict more positive attitudes about ABAs and stronger use intentions (H2). Based on the TAM, we hypothesized that higher ratings of the importance of others' recommendations and ease of use would predict greater perceived usefulness and stronger ABA use intentions (H3). Fig. 1 displays the relations among the core hypotheses derived from the three theoretical frameworks.

In addition to the hypothesized model, there is the potential for several parent and child variables to play a role in these relationships. Specifically, we hypothesized that parents of children with greater cyberbullying history would report greater cyberbullying concern (H4), given that parents of children who have experienced cyberbullying in the past may be especially concerned about future instances [7]. We also expected that parents with greater cyberbullying concern would report more positive attitudes toward ABAs (H5) and greater intentions to use them (H6), given the potential for ABAs to help prevent future instances of cyberbullying. Further, given that younger parents are more dependent on mobile technology [70], we hypothesized that younger parents would report greater intentions to use ABAs (H7). Lastly, although not specified by any of the three theoretical frameworks, we hypothesized that greater importance placed on various ABA uses would be associated with greater perceptions of ABA usefulness (H8). In light of the limited research on ABAs, we also conducted several exploratory analyses to further investigate parents' ABA use intentions with additional child and parent variables. Chief among these was a comprehensive model that combined elements of all three theoretical frameworks with additional exploratory variables (e.g., parents' degree of cyberbullying concern).

4. Method

4.1. Participants & procedure

A sample of 249 adults in the U.S. with at least one child between the ages of 8 and 17 years old were recruited through Amazon's Mechanical Turk. This age range was chosen because 8 years old is typically when a child is considered a "tween" and 18 is typically the age at which an individual is considered an adult from a legal standpoint [71]. After providing informed consent, participants completed a 15–20-minute online survey for which they were compensated \$1.00. Participants ranged from 24 to 61 years of age ($M = 39.18, SD = 7.43$). The majority were female (62.7%), identified as White (74.7%), and had only one child between the ages of 8 and 17 (62.7%). Parents reported the following information about each of their children within the designated age range, starting with the oldest: age, race and ethnicity, gender, degree of bullying history, and their degree of concern that the child was being cyberbullied. In the relevant analyses reported below, we focused solely on the data participants provided about their oldest child within the designated age range ($M_{age} = 11.86, SD = 2.97$). Additional demographic information is provided in Table 1.

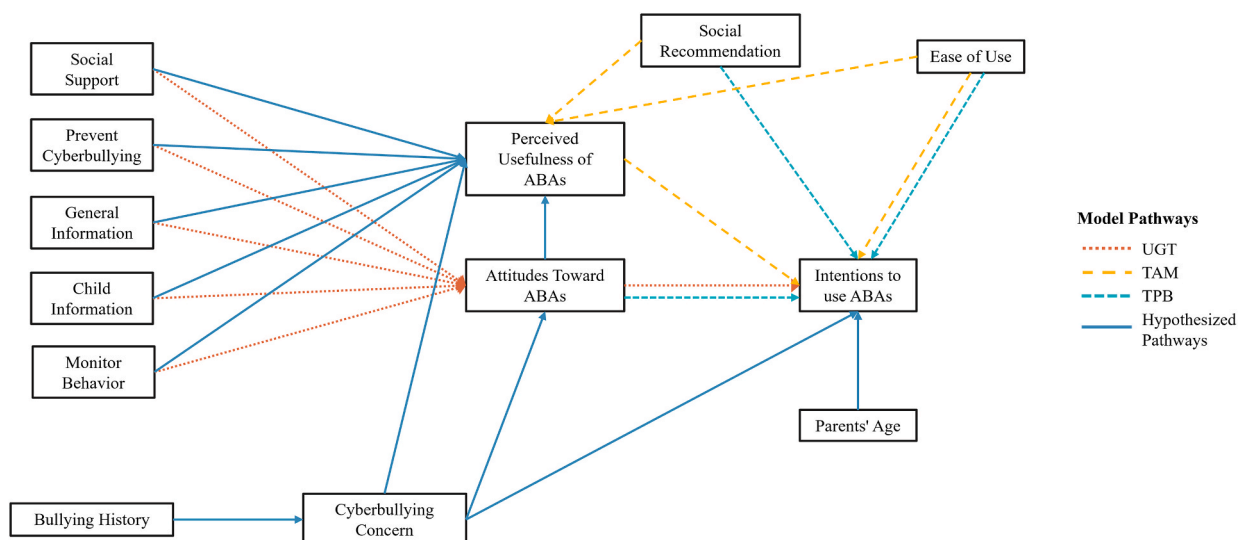


Fig. 1. A proposed comprehensive model combining elements from the TPB, UGT, and TAM models to predict parents' intentions to use ABAs.

Table 1
Participant demographics ($N = 249$).

	Mean	Standard Deviation	Range	n (%)
Parents' age	39.18	7.43	24–61	
Age of oldest child	11.86	2.97	8–17	
Gender				
Male				89 (35.7%)
Female				158 (63.5%)
Prefer not to answer				1 (0.4%)
Other				1 (0.4%)
Race				
White or European American				186 (74.7%)
Black or African American				26 (10.4%)
American Indian or Alaska Native				1 (0.4%)
Asian or Asian American				11 (4.4%)
Hispanic or Latino				15 (6.0%)
Multi-racial				10 (4.0%)
Education				
Some High School				1 (0.4%)
High School Degree or Equivalent				19 (7.6%)
Some college, without degree				63 (25.3%)
Associate degree (2-year college)				40 (16.1%)
Bachelor's degree (4-year college/university)				93 (37.3%)
Graduate degree				33 (13.3%)
Annual Household Income				
Less than \$25,000				22 (8.8%)
\$25,000 to \$34,999				26 (10.4%)
\$35,000 to \$49,999				41 (16.6%)
\$50,000 to \$74,999				71 (28.5%)
\$75,000 to \$99,999				39 (15.7%)
\$100,000 to \$149,999				37 (14.9%)
\$150,000 to \$199,999				8 (3.2%)
\$200,000 or more				5 (2.0%)
Number of Children between the ages of 8–17				
1 child				156 (62.7%)
2 children				75 (30.1%)
3 children				11 (4.4%)
4 children				5 (2.0%)
5 children				1 (.4%)
6 children				1 (.4%)

4.2. Measures

4.2.1. Anti-bullying app variables

Participants first read a brief description of ABAs. Specifically, they read the following text: “We use the term ‘anti-bullying app’ to refer to a mobile app that parents can use to help prevent, identify, and/or address bullying that their child may be experiencing or participating in online. Examples of some anti-bullying apps that you may have seen before include Bark, ReThink, STOPIt, BullyBlocker, and KnowBullying.” Appearing just below this text was an image that included screenshots of the specific ABAs listed as examples.

Participants were then asked if they had ever used an anti-bullying app, to rate the importance that ABAs include a range of specific functions and features, and indicate the overall favorability of their attitude toward and intentions to use ABAs. A full list of the measures utilized in this study can be found in the Supplementary Materials.

Social recommendation. To measure the importance that an ABA is recommended by others, we asked participants the extent to which two items (e.g., “friends and/or family recommend the app”) might influence their decision of whether or not to use an ABA in the next few months on a 5-point scale from (1) *not at all* to (5) *extremely*. The two items ($r_s = 0.85$) were adapted from previous research [72,73] and averaged to create a composite social recommendation variable, with higher values reflecting greater importance that an ABA is recommended by others.

Social support. To measure the perceived importance that an ABA provides parents with social support, participants indicated the extent to which three items, (e.g., “The app makes me realize that I am part of a community”) might influence their decision to use an ABA in the next few months on a 5-point scale from (1) *not at all* to (5) *extremely*. One of these items was adapted from previous research [73], whereas the other two were developed for this study. The three items ($\alpha = 0.86$) were averaged to create a composite variable, with higher values reflecting greater importance of an ABA’s ability to provide social support for parents.

Prevent instances of cyberbullying. To measure the perceived importance of an ABA’s ability to prevent future instances of cyberbullying, participants indicated the extent to which one item: “The app helps me prevent my child from being cyberbullied” might influence their decision to use an ABA in the next few months on a 5-point scale from (1) *not at all* to (5) *extremely*. This item was developed for this study. Higher values reflected higher ratings of the importance of an ABA’s ability to prevent cyberbullying.

General information about cyberbullying. To measure the importance of an ABA’s ability to provide general information about

cyberbullying, participants indicated the extent to which two items (e.g., “The app is convenient for getting information about cyberbullying”) would influence their decision to use an ABA in the next few months on a 5-point scale from (1) *not at all* to (5) *extremely*. The two items ($r_s = 0.81$) were adapted from previous research [73] and averaged to create a composite variable, with higher values reflecting greater importance of an ABA’s ability to provide general information about cyberbullying.

Child-specific cyberbullying risk. To measure the importance of an ABA’s ability to provide parents with information about their child’s cyberbullying risk, participants indicated the extent to which two items (e.g., “The app helps me to know what my child is experiencing online”) might influence their decision to use an ABA in the next few months on a 5-point scale from (1) *not at all* to (5) *extremely*. The two items ($r_s = 0.82$) were adapted from previous research [73] and averaged to create a composite variable, with higher values reflecting greater importance of an ABA’s ability to provide information about a child’s cyberbullying risk.

Monitor behavior. To measure the importance that an ABA monitors a child’s online behavior, parents indicated the extent to which three items (e.g., “The app helps me monitor what my child is doing on social media”) might influence their decision to use an ABA in the next few months on a 5-point scale ranging from (1) *not at all* to (5) *extremely*. These items were developed for this study. The three items ($\alpha = 0.87$) were averaged to create a composite variable, with higher values reflecting higher importance of an ABA’s ability to monitor a child’s behavior online.

Ease of use. To measure the importance of an ABA’s ease of use, parents indicated their level of agreement with three statements adapted from previous research [74,75] (e.g., “The app is easy to use”). The three items ($\alpha = 0.89$), which were measured on a 5-point scale from (1) *not at all* to (5) *extremely*, were averaged to create a composite variable, with higher values reflecting greater importance of an ABA’s ease of use.

Perceived usefulness. To measure the importance of an ABA’s perceived usefulness, parents indicated their level of agreement with two statements adapted from previous research [74,75] (e.g., “Anti-bullying apps are useful”). These two items ($r_s = 0.91$), which were measured on a 7-point scale from (1) *strongly disagree* to (7) *strongly agree*, were averaged to create a composite variable, with higher values reflecting greater importance of an ABA’s perceived usefulness.

Attitudes toward ABAs. Parents’ attitudes toward ABAs were measured using two items ($r_s = 0.84$) assessing their level of agreement with statements regarding how favorably they viewed ABAs (e.g., “I have a positive attitude toward anti-bullying apps”) on a 7-point scale from (1) *strongly disagree* to (7) *strongly agree*. These items were adapted from previous research [76,77].

Intention to use ABAs. Parents’ intentions to use an ABA were measured using four items ($\alpha = 0.95$), on which they indicated their level of agreement with statements about their likely use of an ABA in the future (e.g., “As a parent, using anti-bullying apps is something I will do in the future”) along a 7-point scale from (1) *strongly disagree* to (7) *strongly agree*. These items were adapted from previous research [74,75].

4.2.2. Parent and child variables

Parent technology use. Parent technology use was measured in two ways: average daily internet use and the number of mobile apps downloaded by the parent in the past year. Specifically, parents were asked to indicate along a 6-point scale, from (1) *less than 1 hour a day* to (6) *more than 8 hours a day*, how much time they spent, on average, on the internet per day. Parents were also asked to indicate via an open-ended item how many apps they had downloaded in the past year. Four outlying values for the number of apps downloaded in the past year were winsorized to match the closest value appearing in the data that fell within three standard deviations of the mean (i.e., 120 apps).

Child’s bullying history. Parents indicated the extent to which their child, to their knowledge, had previously experienced bullying along a 7-point scale from (1) *no history of being bullied* to (7) *extreme history of being bullied*. This item was adapted from previous research [78,79].

Parents’ cyberbullying concern. Parents indicated their level of concern about their child experiencing cyberbullying along a 5-point scale from (1) *never* to (5) *always*. This item was adapted from [78] to emphasize concern about cyberbullying (rather than in-person bullying).

4.3. Analytic approach

To test the previously stated hypotheses, an initial series of descriptive (i.e., means, standard deviations) and Pearson’s product-moment correlation analyses were performed using IBM SPSS (v.27). Additionally, a series of nested path models were specified to identify the extent to which parents’ intentions to use ABAs were predicted by the key components of the TPB, UGT, and TAM. These models were estimated using Mplus v.8.5 [80] with maximum likelihood estimation and 10,000 bootstrapped samples. As shown in Fig. 1, elements of each of these theoretical frameworks, as well as key parent-related (i.e., parents’ age) and bullying-related variables (i.e., bullying history and cyberbullying concern), were combined to create a comprehensive model. To investigate the potential benefit of integrating these three frameworks to better understand ABA use intentions, we compared the fit of this comprehensive model to three models, one for each individual theoretical framework, where the pathways not specified by the theoretical framework were constrained to zero. Comparative model fit was assessed by comparing the change in chi-square value between the original model where all pathways were freely estimated and the constrained model. The comprehensive fit of the model was assessed using the chi-square test of model fit, root mean square error of approximation (RMSEA), comparative fit index (CFI), standardized root mean squared residual (SRMR), and the Tucker-Lewis index (TLI), with the following criteria for establishing good fit: a nonsignificant chi-square test (i.e., $p > .05$), $RMSEA < 0.08$, $CFI \geq 0.95$, $SRMR < 0.08$, $TLI > 0.90$ [81,82]. Lastly, exploratory analyses were performed in IBM SPSS using the PROCESS macro (v3.4) [83].

Table 2
Descriptives and bivariate correlations for major study variables ($N = 249$).

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Parents' age	39.18	7.43	–														
2. Parents' daily internet use	3.71	1.31	0.03	–													
3. Number of apps downloaded in the past year	16.81	21.03	–0.07	0.23***	–												
4. Age of oldest child	11.86	2.97	0.38***	0.01	0.10	–											
5. Bullying history	2.45	1.58	0.07	0.10	–0.07	0.05	–										
6. Cyberbullying concern	2.64	1.21	–0.05	–0.09	–0.13*	–0.16*	0.37***	–									
7. Social support	3.07	1.20	–0.22***	0.04	0.07	–0.07	0.07	0.18**	–								
8. Prevent cyberbullying	4.24	1.03	0.07	0.17**	0.17**	0.08	0.02	0.11	0.28***	–							
9. General information	3.91	0.97	–0.10	0.15*	0.14*	0.01	0.03	0.17**	0.58***	0.66***	–						
10. Child's cyberbullying risk	4.07	1.01	–0.18**	0.13*	0.21**	–0.06	0.00	0.15*	0.41***	0.70***	0.66***	–					
11. Monitor online behavior	4.23	0.92	–0.03	0.14*	0.13*	0.04	0.04	0.14*	0.29***	0.76***	0.65***	0.82***	–				
12. Social recommendations	3.38	1.20	–0.12	0.02	0.05	–0.07	0.03	0.14*	0.55***	0.33***	0.47***	0.40***	0.42***	–			
13. Ease of use	4.15	0.93	0.01	0.16*	0.13*	0.12	0.06	0.13*	0.35***	0.67***	0.68***	0.70***	0.73***	0.47***	–		
14. Perceived usefulness of ABAs	5.42	1.34	–0.12	0.00	0.06	–0.01	0.01	0.21**	0.32***	0.53***	0.49***	0.64***	0.58***	0.36***	0.53***	–	
15. Attitudes toward ABAs	5.52	1.23	–0.18**	0.05	0.07	–0.05	0.04	0.20**	0.33***	0.50***	0.51***	0.59***	0.54***	0.40***	0.50***	0.88***	–
16. Intentions to use ABAs	4.73	1.59	–0.19**	–0.01	–0.04	–0.23***	0.13*	0.27**	0.42***	0.33***	0.42***	0.40***	0.34***	0.39***	0.33***	0.69***	0.73***

Note: *M* refers to the mean; *SD* refers to the standard deviation. *Correlation is significant at the < 0.05 level (2-tailed); **Correlation is significant at the < 0.01 level (2-tailed); ***Correlation is significant at the < 0.001 level (2-tailed).

5. Results

Table 2 presents the descriptive statistics and bivariate correlations for the key variables within the path models.

5.1. Theoretical models

The results indicated that the comprehensive model fit significantly better than the TPB model where all pathways except the paths from the importance that an ABA is recommended by others, ratings of the importance of ease of use, and parents' attitude toward ABAs to parents' intentions to use an ABA were constrained to zero ($\Delta X^2 = 558.03, p < .05$); the UGT model where all pathways except the paths from the importance of an ABA's ability to provide social support, prevent cyberbullying, provide general information about cyberbullying, provide child-specific information about cyberbullying risk, and monitor a child's online behavior to parents' attitude toward ABAs and from ABA attitudes to ABA use intentions were constrained to zero ($\Delta X^2 = 452.32, p < .05$); and the TAM model where all pathways except the paths from social recommendation and ease of use to perceived usefulness, and from ease of use and perceived usefulness to intentions to use ABAs were constrained to zero ($\Delta X^2 = 506.26, p < .05$). Thus, we interpret the parameter estimates from the comprehensive model. Fit statistics indicated that the comprehensive model was a good fitting model, $\chi^2(20, N = 237) = 44.55, p < .001, RMSEA = 0.07, 95\% CI = [0.04, 0.10], CFI = 0.97, TLI = 0.93, SRMR = 0.07$. A path diagram of this model is presented in Fig. 2.

As shown in Table 3, the results of this comprehensive model revealed that parents of children with more extensive bullying histories reported greater cyberbullying concern, $b = 0.26, p < .001$ (H4). Greater cyberbullying concern predicted greater ABA use intentions, $b = 0.21, p < .001$ (H6), and, although falling short of the threshold for establishing statistical significance, there was a trend for greater cyberbullying concern to predict more positive attitudes toward ABAs, $b = 0.09, p = .07$ (H5). Higher ratings of the importance that an ABA provides child-specific information about cyberbullying risk predicted more positive attitudes toward ABAs, $b = 0.43, p = .001$ (H2), and it trended toward predicting greater perceived usefulness of ABAs, $b = 0.15, p = .08$ (H7). More positive attitudes toward ABAs also predicted greater perceived usefulness, $b = 0.86, p < .001$.

Unexpectedly, higher ratings of the importance that an ABA provides general information about cyberbullying predicted lower perceived usefulness, $b = -0.15, p = .04$ (H2). More positive attitudes toward ABAs, $b = 0.64, p < .001$ (H1, H2), greater perceived usefulness, $b = 0.28, p = .004$ (H3), greater concern about cyberbullying, $b = 0.21, p < .001$ (H6), and higher ratings of the importance of social recommendations, $b = 0.16, p = .02$ (H1), all predicted greater use intentions. Interestingly, higher ratings of the importance of an ABA's ease of use also corresponded with lower use intentions, $b = -0.21, p = .02$ (H1, H3). However, parents' age did not significantly predict ABA use intentions (H8).

Multiple significant indirect effects were also observed (see Table 4). First, parents' cyberbullying concern mediated the relation between a child's bullying history and ABA use intentions, $b = 0.06, p = .005$. Second, attitudes toward ABAs mediated the relation between the importance that an ABA provides child-specific information about cyberbullying risk and ABA use intentions, $b = 0.28, p = .005$. In evidence of serial mediation, this indirect effect was further mediated by perceived usefulness, such that perceived usefulness mediated the relation between attitudes toward ABAs and use intentions, $b = 0.11, p = .04$. All other paths were nonsignificant.

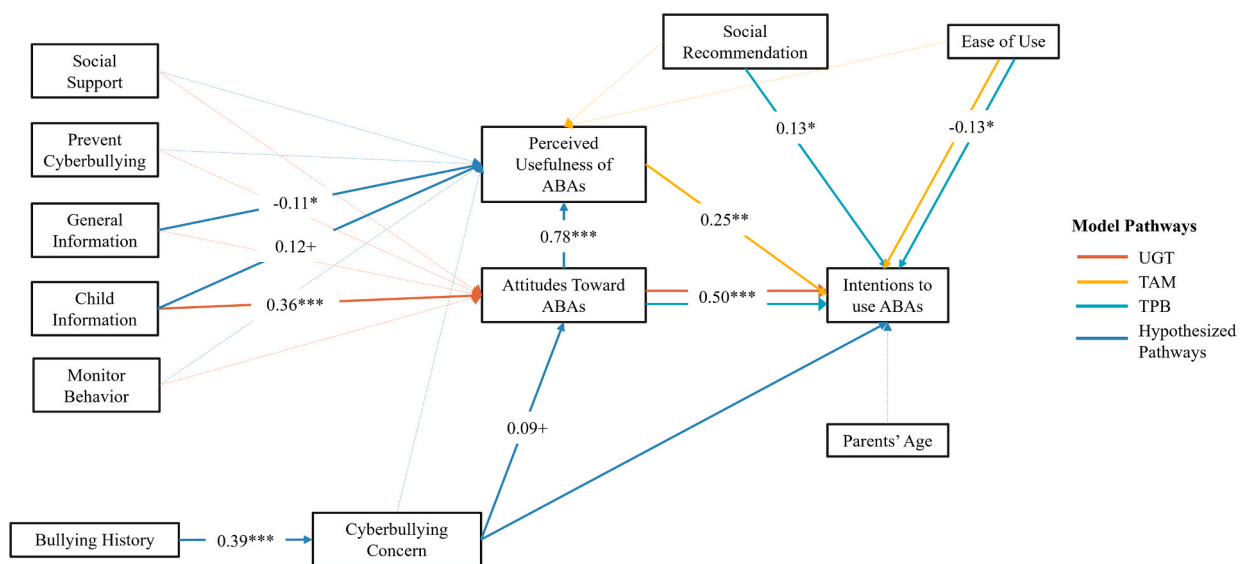


Fig. 2. Path diagram combining elements from the TPB, UGT, and TAM models to predict parents' intentions to use ABAs (N = 237). Values are standardized path coefficients; ***p < .001, **p < .01, *p < .05, +p < .10.

Table 3
Path coefficients for the comprehensive model ($N = 237$).

Independent Variable	Dependent Variable	<i>b</i>	<i>SE</i>	R^2
Bullying history	Cyberbullying concern	0.26***	0.05	.11**
Cyberbullying concern	Attitudes toward ABAs	0.09+	0.05	.38***
Social support		0.06	0.07	
Prevent cyberbullying		0.12	0.10	
General information		0.12	0.11	
Child's cyberbullying risk		0.43**	0.13	
Monitor online behavior		0.09	0.13	
Attitudes toward ABAs	Perceived usefulness	0.86***	0.05	.80***
Cyberbullying concern		0.04	0.03	
Ease of use		0.09	0.08	
Social recommendation		-0.04	0.04	
Social support		0.04	0.05	
Prevent cyberbullying		0.07	0.06	
General information		-0.15*	0.07	
Child's cyberbullying risk		0.15+	0.09	
Monitor online behavior		0.07	0.10	
Perceived usefulness	Intentions to use ABAs	0.28**	0.10	.57***
Attitudes toward ABAs		0.64***	0.11	
Ease of use		-0.21*	0.09	
Social recommendation		0.16*	0.07	
Cyberbullying concern		0.21***	0.06	
Parents' age		-0.01	0.01	

Note: *b* refers to the unstandardized regression coefficients; *SE* refers to the standard error; *** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$.

Table 4
Indirect effects for the comprehensive model ($N = 237$).

Indirect pathway	<i>b</i>	<i>SE</i>
Bullying history > Cyberbullying concern > Intentions to use ABAs	0.06**	0.02
Bullying history > Cyberbullying concern > Perceived usefulness > Intentions to use ABAs	0.00	0.00
Bullying history > Cyberbullying concern > Attitudes toward ABAs > Intentions to use ABAs	0.02	0.01
Bullying history > Cyberbullying concern > Attitudes toward ABAs > Perceived usefulness > Intentions to use ABAs	0.01	0.00
Social support > Perceived usefulness > Intentions to use ABAs	0.01	0.01
Social support > Attitudes toward ABAs > Intentions to use ABAs	0.04	0.04
Social support > Attitudes toward ABAs > Perceived usefulness > Intentions to use ABAs	0.02	0.02
Prevent cyberbullying > Perceived usefulness > Intentions to use ABAs	0.02	0.02
Prevent cyberbullying > Attitudes toward ABAs > Intentions to use ABAs	0.08	0.07
Prevent cyberbullying > Attitudes toward ABAs > Perceived usefulness > Intentions to use ABAs	0.03	0.03
General information > Perceived usefulness > Intentions to use ABAs	-0.04+	0.03
General information > Attitudes toward ABAs > Intentions to use ABAs	0.08	0.07
General information > Attitudes toward ABAs > Perceived usefulness > Intentions to use ABAs	0.03	0.03
Child information > Perceived usefulness > Intentions to use ABAs	0.04	0.03
Child information > Attitudes toward ABAs > Intentions to use ABAs	0.28**	0.10
Child information > Attitudes toward ABAs > Perceived usefulness > Intentions to use ABAs	0.11*	0.05
Monitor online behavior > Perceived usefulness > Intentions to use ABAs	0.02	0.03
Monitor online behavior > Attitudes toward ABAs > Intentions to use ABAs	0.06	0.09
Monitor online behavior > Attitudes toward ABAs > Perceived usefulness > Intentions to use ABAs	0.02	0.04
Social recommendation > Perceived usefulness > Intentions to use ABAs	-0.01	0.01
Ease of use > Perceived usefulness > Intentions to use ABAs	0.03	0.03

Note: *b* refers to the unstandardized regression coefficients; *SE* refers to the standard error; *** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$.

5.2. Additional exploratory analyses

Examination of the bivariate correlations among key study variables indicated that parents' age was significantly negatively correlated with intentions to use an ABA, $r = -0.19$, $p = .003$ —that is, older parents reported lower ABA use intentions. To better understand this, we performed a series of exploratory mediation analyses using the PROCESS macro (v3.4) [83] for SPSS. We first tested a parallel mediation model with the number of apps parents had downloaded in the past year and parents' daily internet use (i. e., indicators of parents' technology use) as mediators of the inverse relation between parents' age and ABA use intentions. Neither mediation pathway was significant, indicating that the relation between parents' age and ABA use intentions could not be explained by younger parents' greater number of apps or internet use. Based on the previous research suggesting a social support motive underlying the use of parenting technology, we next tested a model in which parents' ratings of the importance that an ABA provides social support was entered as a mediator. The results indicated that younger parents rated the importance that an ABA provides social support as higher, $b = -0.04$, $SE = 0.01$, $t(244) = -3.57$, $p < .001$, and this, in turn, predicted their greater intentions to use an ABA, b

$= 0.52$, $SE = 0.08$, $t(243) = 6.65$, $p < .001$. Finally, we added and found support for attitudes toward ABAs as a mediator of the link between the importance that an ABA provides social support and ABA use intentions. That is, a serial mediation effect was found such that higher ratings of the importance that an ABA provides social support predicted more positive attitudes toward ABAs, $b = 0.31$, $SE = 0.06$, $t(243) = 4.92$, $p < .001$, which, in turn, predicted greater use intentions, $b = 0.85$, $SE = 0.06$, $t(242) = 14.47$, $p < .001$.

Examination of the bivariate correlations among study variables also revealed that a child's bullying history was positively correlated with parents' intentions to use an ABA, $r = 0.13$, $p = .04$. Based on this observation, we tested a mediation model in which parents' cyberbullying concern mediated this relationship. Because cyberbullying concern was significantly negatively correlated with the child's age, $r = -0.16$, $p = .012$, we included the child's age as a covariate in this model. Evidence of an indirect effect emerged, such that parents with children who had more extensive bullying histories reported greater cyberbullying concern, $b = 0.29$, $SE = 0.04$, $t(244) = 6.36$, $p < .001$, and greater cyberbullying concern predicted stronger intentions to use an ABA, $b = 0.29$, $SE = 0.09$, $t(243) = 3.30$, $p = .001$. Notably, the mediation results were comparable with and without the inclusion of the child's age as a covariate in the model. Lastly, we tested a model with attitudes toward ABAs as a serial mediator of the relation between cyberbullying concern and ABA use intentions. Evidence of serial mediation emerged, such that child's bullying history predicted parents' greater cyberbullying concern, which predicted more positive attitudes toward ABAs, $b = 0.21$, $SE = 0.07$, $t(243) = 3.10$, $p = .002$, which, in turn, predicted greater intentions to use an ABA, $b = 0.91$, $SE = 0.05$, $t(242) = 16.62$, $p < .001$.

6. Discussion and implications

Guided by three theoretical frameworks, the aim of this study was to gain a deeper understanding of the factors predicting parents' intentions to use anti-bullying apps (ABAs). A series of nested models combining elements of three well-established theoretical frameworks for understanding technology use—the theory of planned behavior (TPB), uses and gratifications theory (UGT), and the technology acceptance model (TAM)—yielded relatively inadequate fit when pathways corresponding to each theory were constrained. However, when these pathways were allowed to be freely estimated – as indicated in the comprehensive model – the comprehensive model yielded the best model fit. Key findings were that parents who rated an ABA's ability to provide child-specific information about cyberbullying risk as higher in importance reported more positive ABA attitudes and (marginally) greater perceptions of ABAs' usefulness. In contrast, parents who rated an ABA's ability to provide general information about cyberbullying as more important reported lower perceptions of an ABA's usefulness. Furthermore, parents who perceived ABAs as being more useful had more positive attitudes toward ABAs, and parents who rated the extent to which ABAs are recommended by others as relatively more important reported greater intentions to use them in the future. Additional analyses indicated that parents of children with a more extensive bullying history reported greater cyberbullying concern and this concern, subsequently, predicted marginally more positive ABA attitudes and greater ABA use intentions.

Although models containing constrained pathways in concordance with the TPB, UGT, and TAM resulted in poorer model fit than the unconstrained comprehensive model, a number of effects that emerged in the separate models were consistent with previous research. For example, the TPB posits that intentions to perform a particular behavior are determined by an individual's attitudes, subjective norms, and perceived behavioral control [26]. Consistent with previous research (e.g., [39]), in both the separate (regression) model testing TPB predictors and the comprehensive model, attitudes toward ABAs and the importance placed on an ABA being recommended by others (i.e., a perceived norm) emerged as significant predictors of greater use intentions. Not surprisingly, this suggests that parents are more likely to use technologies they feel positively about, and that normative information provided by the recommendation of family, friends, and other parents plays a role in use intentions [31,43,44]. An interesting and unexpected finding was that parents who rated the ease of use as more important reported *lower* intentions to use ABAs. One possibility is that parents who value ease of use might think downloading and using an ABA would require more effort than they are willing to expend. In a focus group study by Helfrich et al. [13], some parents expressed frustration with online monitoring and parental controls due to a limited understanding of how to utilize them. This counterintuitive finding in our study highlights the importance that ABAs are designed with parents' ease of use in mind.

Several potential uses and gratifications associated with ABA use were analyzed. In the comprehensive model, however, only an ABA's ability to provide child-specific and general cyberbullying information emerged as significant predictors of use intentions. The valence of these effects suggests a more nuanced relation between parents' information-seeking motives and ABA use intentions. Parents' ratings of the importance that an ABA provides information about cyberbullying risk that is specific to their child underscores a motive to obtain information that is accurate for and tailored to their child's unique circumstances. In light of this, ABAs that only offer general cyberbullying information may have lower utility for parents. This finding, in fact, points to a mechanism for improving the effectiveness of parental cyberbullying interventions. Specifically, previous research has indicated that children and teens express reluctance to inform parents or guardians about their experiences with cyberbullying [84]. ABAs that can inform parents about their child's risk of cyberbullying could enable parents to intervene at earlier stages of cyberbullying.

We were somewhat surprised by the lack of significant findings for the other uses and gratifications that we tested. Given previous research indicating that parents have utilized monitoring strategies to reduce their child's likelihood of experiencing cyberbullying [60] and that the motive to form social connections predicts mobile technology use [85], we expected parents' ratings of the importance that an ABA helps them monitor their child, provides (parents with) social support, and helps prevent cyberbullying to be significant predictors of ABA use intentions. We can only speculate that the lack of these significant findings might have stemmed from our sample's relative unfamiliarity with ABAs prior to the study. Put differently, because the majority of parents in our sample had little prior knowledge about ABAs, they may have had difficulty envisioning how certain features (e.g., providing social support) could be implemented in an ABA.

Furthermore, given that ABAs are a relatively novel technology, it is possible that younger parents' increased intentions to use ABAs might be due to their increased technological literacy. Indeed, prior research has indicated that younger adults have greater technological literacy due to increased familiarity [86]. Relatedly, Neves and Mead [87] found that one concern limiting older adults' use of novel technologies is the need to acquire new knowledge or skills (that younger adults may already possess). On an encouraging note, they also found that older adults often recognize the benefit of new technologies and report interest in learning how to use them. Thus, for older parents, in particular, it may be essential for ABAs to provide clear instructions and guidance to assist them in developing efficacy in using the technology. As more research surrounding ABAs becomes available, it will be crucial to evaluate technological literacy as a factor in promoting or hindering ABA usage.

In a set of exploratory analyses, we found that younger parents placed a greater importance on an ABA's ability to provide social support and the greater perceived importance of this function predicted more positive ABA attitudes and greater use intentions. The importance of a social support function was not, however, significant within the comprehensive model. It is possible that older parents have already developed strong social support networks and would thus be less reliant on social support networks offered through an ABA. Additionally, similar to the findings in the comprehensive model, parents of children with more extensive histories of being bullied, in general, reported greater cyberbullying concern, more positive attitudes toward ABAs, and, subsequently, greater intentions to use ABAs. Considering the robust positive correlation between traditional (i.e., in-person) bullying and cyberbullying victimization among teens [88], it is perhaps not surprising that parents of children who have experienced any form of bullying in the past would be concerned about cyberbullying. Our findings suggest that this concern can motivate parents to look for and utilize new methods, such as ABAs, to protect their children.

6.1. Limitations and future directions

A major limitation of this study is the lack of data on parents' actual ABA use—that is, the analyses reported here focused exclusively on use intentions. Whereas behavioral intentions tend to correlate positively with actual behavior [26], our findings fall short of shedding light on predictors of actual ABA use among parents. Future work should investigate whether intentions to use ABAs, in fact, translate into ABA use or investigate factors and motives associated with app use among parents who have already adopted the technology. Relatedly, a majority of our sample was unfamiliar with ABAs prior to participation in this study. Future research should, therefore, be conducted with parents who have greater baseline familiarity with ABAs or assess use intentions after having parents actually use an ABA for a designated period of time.

Additional limitations that elucidate critical directions for future research include limits on the generalizability of our findings to more diverse populations and the cross-sectional study design. Our sample was predominantly White and female, highlighting the importance of future studies with greater sociodemographic diversity among the parents studied. As was the case for much of the prior research that the present study draws on, our sample was limited to parents in the United States. The predominant focus on WEIRD (Western, Educated, Industrialized, Rich, and Democratic) perspectives (e.g., [9,13]), despite the global nature of the phenomenon under investigation [4], is a major limitation. Although there have been some efforts to develop applications that cater to diverse cultures (e.g., [24,25]), future research is needed to build a more comprehensive and inclusive understanding of parents' attitudes, motives, preferences, and behaviors surrounding ABAs across cultures. Finally, the cross-sectional design of our study also leaves unanswered questions about how changes in attitudes toward ABAs and use intentions might evolve, particularly in response to dynamic factors such as a child's age, bullying history, and degree of technology (e.g., social media) use. Studies of parents' ABA use that employ a longitudinal design can provide greater insight into potential motivations for continuing or stopping use and the duration of ABA use, as well as how the value placed on different app functions might vary as one's child grows older or as a child's cyberbullying experiences and risk evolve.

In conclusion, as the world becomes increasingly connected to online media, it is important to understand parents' intentions to use new forms of technology, such as ABAs, to protect their children against the growing risk of cyberbullying. By understanding the ABA features parents consider the most important and the motivations behind ABA use intentions, it is possible to improve the appeal and effectiveness of ABAs for parents. Although ABAs are still in their infancy, this research provides a preliminary look at parents' intentions to use ABAs and can be used to guide future avenues for research and app development.

Author note

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Author contribution statement

Brittany Wheeler; Katie Baumel: Analyzed and interpreted the data; Wrote the paper.

Deborah Hall: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Yasin Silva: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Data availability statement

The data will be made available on our research project website (<https://bullyblocker.cs.luc.edu>) as well as the Open Science Framework (<https://osf.io>).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2023.e19630>.

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