



Effects of Eight-Week Interaction with a Conversational AI Chatbot on Loneliness and Psychological Well-Being among Lonely Adults in Tehran: An Explanatory Sequential Mixed-Methods Study

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ARTICLE INFO	ABSTRACT
Article History: Received 2 June 2025 Received in revised form 11 August 2025 Accepted 17 September 2025 Available online 18 December 2025 Keywords: Conversational Artificial Intelligence; Loneliness; Psychological Well-Being; Technology Attachment; Digital Mental Health Intervention; Mixed-Methods Research	Conversational artificial intelligence (AI) is increasingly used for companionship, yet evidence on its effects on loneliness outside Western contexts is limited. Objective: This study examined the effects of sustained interaction with a conversational AI chatbot on loneliness and psychological well-being, the association between technology attachment and loneliness reduction, and participants' lived experiences. Methods: In an explanatory sequential mixed-methods design, 120 adults aged 20–45 years in Tehran with UCLA Loneliness Scale scores above 45 were randomly assigned to an experimental group ($n = 60$), which interacted with a chatbot for at least 15 minutes per day, five days per week, for eight weeks, or to a no-intervention control group ($n = 60$). Outcomes were assessed with the UCLA Loneliness Scale and Ryff's Psychological Well-Being Scales, and technology attachment was measured in the experimental group at posttest. Fifteen experimental-group participants were then interviewed. Results: Mean loneliness decreased from 58.3 to 42.1 in the experimental group and from 57.9 to 56.8 in the control group, and the group difference remained significant after controlling for pretest scores ($F(1, 117) = 176.61, p < .001$). Well-being scores increased on all six dimensions in the experimental group. Technology attachment correlated positively with loneliness reduction ($r = .34, p < .01$). Interviews yielded four themes: nonjudgmental reflection, constant and predictable companionship, the illusion of intimacy and reduced motivation for human interaction. Conclusions: Conversational AI may offer short-term support for lonely adults but should complement rather than replace human relationships; longer-term controlled studies are needed.

1. INTRODUCTION

1.1. Background

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Loneliness and social isolation have become a major public health concern, with consequences for psychological well-being, life satisfaction, and physical health [1], [2]. Loneliness is commonly defined as a distressing discrepancy between an individual's desired and actual social relationships [3]. Persistent loneliness has been linked to depression, cardiovascular disease, cognitive decline, and increased mortality, with an association with mortality that is comparable in magnitude to that of established risk factors such as smoking [1], [2].

Interventions for loneliness have largely relied on human-delivered approaches, including cognitive behavioral therapy, social skills training, and community-based support [3]. The rapid development of digital technologies has added a different possibility: autonomous conversational AI agents that provide virtual social support and companionship [4]–[6]. Advances in generative large language models have moved these systems beyond task-oriented assistance toward relational "AI companions" intended for sustained emotional interaction [5], [7]. Such systems simulate empathic responses, retain conversational context over time, and use active-listening cues [4], [8].

The Computers Are Social Actors (CASA) paradigm offers a theoretical account of why such interactions can feel socially meaningful. It holds that people apply social rules and attribute human-like traits, such as understanding and empathy, to computers that display social cues [9]. As AI companions become part of everyday life, evidence on their effects on loneliness is needed to guide both clinical use and ethical design.

1.2. Problem Statement and Rationale

Conversational AI is simultaneously a scalable, low-cost source of support and a possible source of new psychosocial risks. Existing studies indicate short-term reductions in loneliness, but the long-term consequences of replacing human contact with synthetic relationships remain poorly understood and contested [5], [10]. Much of the available research has also focused on Western users and platforms, so little is known about how users in other cultural settings, including Iran, respond to such systems. A design that combines controlled outcome measurement with an in-depth account of users' experiences is well suited to examining both the benefits and the risks.

1.3. Aims

The present study had four aims: (a) to examine whether eight weeks of interaction with a conversational AI chatbot reduces loneliness relative to a no-intervention control condition; (b) to describe changes in psychological well-being among chatbot users; (c) to examine the association between technology attachment and loneliness reduction; and (d) to explore participants' lived experiences of using the chatbot.

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW

2.1. Empirical Evidence on AI Companionship

Studies across diverse samples suggest that conversational AI can serve as an accessible and cost-effective source of support for lonely individuals [4], [6], [8]. Experimental and longitudinal work indicates that regular interaction with emotionally expressive chatbots can reduce momentary and self-reported loneliness, particularly when users feel heard by the system [5], [8]. Systematic reviews of conversational agents report mild to moderate improvements in loneliness, social anxiety, and depressive symptoms [11], [12]. The mechanism most often proposed is a nonjudgmental, confidential, and continuously available channel for emotional disclosure [6], [11].

Qualitative studies also report limitations, including repetitive conversational patterns, empathy that users experience as shallow, and difficulty adapting to specific cultural and situational nuances [4], [6].

2.2. Need to Belong

The need to belong theory proposes that humans have a strong, innate motivation to form and maintain a minimum number of enduring, positive interpersonal relationships. When this need is unmet, loneliness and a range of psychological and physical consequences are likely to follow [13]. From this perspective, a chatbot that provides attention and responsiveness might partly satisfy belonging needs, although whether it can fully do so is open to question.

2.3. Social Exchange Theory

Social exchange theory, rooted in the work of Homans [14] and Blau [15], treats relationships as governed by a cost–benefit evaluation. Individuals maintain relationships while perceived rewards, such as companionship, emotional support, and validation, outweigh costs such as time, self-disclosure, and risk of rejection [16]. With conversational AI, the costs of interaction are low: there is no social judgment, no obligation of reciprocity, and little risk of rejection, while rewards such as continuous attention and apparently empathic responses are immediate and predictable. Chatbot interaction may therefore be especially attractive to people with social anxiety or a history of rejection. The exchange is, however, asymmetrical. Because responses are designed to satisfy and engage users, these interactions lack the constructive ambiguity, negotiation, and interpersonal challenge that contribute to personal growth.

2.4. Attachment Theory and Technology Attachment

Attachment theory [17] explains how early caregiving experiences shape attachment styles that influence later relationships. Research suggests that people can also show attachment-related behavior toward technologies, including proximity seeking, reliance for comfort, and separation distress [18]. A chatbot's constant availability, immediate responsiveness, and supportive design can allow it to function as a virtual secure base, which may appeal to individuals with anxious or avoidant attachment because it avoids fears of rejection or abandonment. Turkle [19] cautions that such technologies may offer the appearance of companionship without the demands of genuine relationships, and that this may discourage people from working through difficult interpersonal dynamics and leave them in a comfortable but artificial relational environment.

2.5. Surveillance Capitalism

Zuboff [20] frames digital platforms within surveillance capitalism. From this perspective, the relationship between a user and a companion AI is asymmetrical: users may experience an emotionally meaningful bond, while providers collect, analyze, and monetize highly personal emotional data. This view moves attention from individual psychology to questions of power, governance, and privacy, and suggests that relief from loneliness may be accompanied by reduced privacy and autonomy and greater vulnerability to data exploitation.

2.6. Complement or Substitute: Technology-Mediated Interaction and Well-Being

Research on technology-mediated communication distinguishes between a stimulation hypothesis, according to which online interaction strengthens existing relationships and thereby enhances well-being, and a displacement hypothesis, according to which it displaces time and energy that would otherwise be invested in offline relationships [21]. Applied to conversational AI, this distinction suggests that AI may have positive effects when it complements human relationships, for example as a communication bridge, a social-skills coach or a temporary source of support that encourages further engagement with others, whereas its benefits are likely to be temporary, and may become harmful over time, when it substitutes for human contact.

Taken together, these perspectives suggest that whether conversational AI reduces or exacerbates loneliness depends on individual characteristics such as attachment style and social competence, design features such as anthropomorphism and platform objectives, and the user's social context.

2.7. Research Gap and Research Questions

Short-term benefits of conversational AI are reasonably well documented, but three gaps remain. First, the long-term trajectory of reliance on AI companions is under-researched, and it is unclear whether such use acts as a bridge to social reintegration or fosters dependence [5], [10]. Second, current evidence does not clearly distinguish how interaction modality (text versus voice) and design characteristics affect vulnerable users [6], [12]. Third, evidence from Iranian and other non-Western populations is limited. This study addressed these gaps by combining a controlled pretest–posttest comparison with in-depth interviews in a sample of lonely adults in Tehran. It addressed four research questions:

- RQ1. Does eight weeks of chatbot interaction reduce loneliness relative to a no-intervention control group, after controlling for pretest loneliness?
- RQ2. How do the six dimensions of psychological well-being change among chatbot users?
- RQ3. Is technology attachment associated with the magnitude of loneliness reduction?
- RQ4. How do participants experience the benefits and risks of interacting with the chatbot?

3. METHOD

3.1. Research Design

An explanatory sequential mixed-methods design was used. In the first phase, a pretest–posttest control-group design with random assignment was used to examine the effect of the intervention. In the second phase, qualitative interviews guided by Interpretative Phenomenological Analysis (IPA) explored participants' lived experiences of interacting with conversational AI in more depth.

3.2. Participants and Sampling

The target population was adults aged 20–45 years living in metropolitan Tehran, Iran, with internet access and a smartphone. Participants were recruited through voluntary convenience sampling, using announcements distributed through social media and university networks. For the quantitative phase, 120 individuals whose UCLA Loneliness Scale scores exceeded the predetermined cutoff (> 45) were included and randomly assigned to an experimental group ($n = 60$) or a control group ($n = 60$). For the qualitative phase, 15 participants were purposively selected from the experimental group using maximum variation sampling, to ensure diversity in gender, age, and degree of loneliness reduction at posttest.

3.3. Instruments

UCLA Loneliness Scale (Version 3). This 20-item self-report scale assesses subjective loneliness and social isolation on a 4-point Likert scale (possible range 20–80), with higher scores indicating greater loneliness [22]. Earlier studies have reported Cronbach's alpha coefficients up to .94.

Ryff Psychological Well-Being Questionnaire (PWQ-84). This 84-item questionnaire measures six dimensions: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance [23]. The reliability and validity of the Persian version have been confirmed in earlier Iranian studies.

Technology Attachment Scale (TAS). The Persian-adapted 21-item TAS assessed participants' emotional and cognitive attachment to technological devices and digital systems.

Semi-structured interview guide. The researchers developed a guide covering motivations for using conversational AI, perceived quality of the relationship with the AI system, changes in participants' human relationships, and ethical concerns and reflections.

3.4. Procedure

Quantitative phase. After written informed consent, participants in both groups completed pretest measures (UCLA Loneliness Scale and Ryff questionnaire). The experimental group interacted with a selected conversational AI chatbot for eight consecutive weeks, for at least five days per week and at least 15 minutes per day. The research team verified the chatbot's basic conversational capabilities before selection. Participants could discuss any topic but were encouraged to talk about daily experiences, emotions, concerns, and personal interests. The control group received no intervention. At the end of the eight weeks, all participants completed posttest measures, and the experimental group also completed the TAS.

Qualitative phase. After the quantitative phase, individual in-depth interviews were conducted with the 15 selected participants, face-to-face or online. Each lasted approximately 45–60 minutes. Interviews were audio-recorded with permission and transcribed verbatim.

3.5. Data Analysis

Quantitative data were analyzed using SPSS version 26. Normality and homogeneity of variance were examined before hypothesis testing. Paired-samples t-tests compared pretest and posttest scores within groups, analysis of covariance (ANCOVA) compared posttest scores between groups while controlling for pretest scores, and correlation analysis examined relationships among loneliness, psychological well-being, and technology attachment. Interview transcripts were analyzed in line with the IPA orientation of the study: transcripts were coded systematically, recurring patterns of meaning were identified, and, through iterative analysis, major themes and subthemes were derived to capture participants' experiences of interacting with conversational AI.

3.6. Ethical Considerations

The study followed established ethical standards for research with human participants. Written informed consent was obtained from all participants, confidentiality and anonymity were ensured, and participants could withdraw at any stage without penalty. Personal data were protected with appropriate security measures. Participants whose participation or interviews caused emotional distress were referred to psychological counseling services.

4. RESULTS

4.1. Loneliness (RQ1)

Table 1 shows that mean loneliness in the experimental group decreased from 58.3 (SD = 7.2) at pretest to 42.1 (SD = 6.8) at posttest, a change of 16.2 points, about 2.3 pretest standard deviations. In the control group, mean loneliness changed only from 57.9 (SD = 7.5) to 56.8 (SD = 7.3), a change of 1.1 points. Pretest means and standard deviations were similar across groups, indicating comparable baseline loneliness.

Table 1. Loneliness scores (UCLA Loneliness Scale) by group

Group	Pretest (M ± SD)	Posttest (M ± SD)	Change
Experimental (n = 60)	58.3 ± 7.2	42.1 ± 6.8	−16.2
Control (n = 60)	57.9 ± 7.5	56.8 ± 7.3	−1.1

After controlling for pretest loneliness, the group effect on posttest loneliness remained significant (Table 2; $F(1, 117) = 176.61, p < .001$). The adjusted posttest means were 42.00 in the experimental group and 56.90 in the control group, and partial eta squared was .602, a large effect by conventional benchmarks.

Table 2. ANCOVA of posttest loneliness, controlling for pretest scores

Source	Sum of squares	F	p	Partial η^2
Group	6648.07	176.61	< .001	.602
Error	4404.20	—	—	—

4.2. Psychological Well-Being (RQ2)

In the experimental group, scores increased from pretest to posttest on all six dimensions (Table 3). The largest increases were in self-acceptance (+3.3), positive relations with others (+3.1), and purpose in life (+2.9). The increases in environmental mastery and autonomy were at the .05 threshold of significance. Results in Table 3 refer to within-group change in the experimental group, and no correction for multiple comparisons was applied.

Table 3. Change in psychological well-being dimensions in the experimental group (Ryff scale)

Dimension	Pretest (M ± SD)	Posttest (M ± SD)	Change (M ± SD)	p
Positive relations with others	18.3 ± 5.3	21.4 ± 5.1	+3.1 ± 1.2	.001
Environmental mastery	18.1 ± 4.9	19.9 ± 4.7	+1.8 ± 1.1	.05
Personal growth	19.5 ± 4.6	22.0 ± 4.4	+2.5 ± 0.9	.01
Purpose in life	17.9 ± 5.0	20.8 ± 4.8	+2.9 ± 1.0	.01
Autonomy	18.0 ± 5.4	19.5 ± 5.2	+1.5 ± 1.3	.05
Self-acceptance	19.8 ± 4.7	23.1 ± 4.5	+3.3 ± 0.8	.01

4.3. Technology Attachment (RQ3)

Technology attachment, measured in the experimental group at posttest ($n = 60$), correlated positively with loneliness reduction ($r = .34$, $p < .01$). Participants reporting stronger attachment, intimacy, or trust toward the chatbot tended to show larger reductions in loneliness.

Table 4. Correlation between technology attachment and loneliness reduction

Variables	Pearson r	p
Loneliness reduction × technology attachment	.34	.01

4.4. Qualitative Findings (RQ4)

Four main themes emerged from the interviews, two reflecting perceived benefits and two reflecting concerns.

Nonjudgmental reflection. Many participants said they could express their deepest thoughts and emotions, including ones they found embarrassing, without fear of judgment, often for the first time. They described this safe space as facilitating emotional catharsis and greater self-understanding.

Constant and predictable companionship. Participants frequently referred to the chatbot's continuous availability and immediate responses as reducing feelings of abandonment and isolation. This was especially valuable for people who had experienced instability or inconsistency in their human relationships.

Illusion of intimacy. Some participants reported that during prolonged conversations they occasionally forgot they were talking to a machine and developed strong emotional attachment. When reminded of its artificial nature, they often felt embarrassment, disappointment, or discomfort. Several described this experience as approaching "the edge of an emotional cliff."

Reduced motivation for human interaction. Participants acknowledged comfort and emotional relief while worrying that growing dependence might weaken their motivation to seek meaningful human relationships. One participant said: "It feels like covering a wound with a beautiful bandage instead of actually treating it. It looks better on the outside, but underneath it is still infected."

5. DISCUSSION

5.1. Principal Findings

This study examined the effects of eight weeks of interaction with a conversational AI chatbot on loneliness and well-being among lonely adults in Tehran. Loneliness fell by 16.2 points in the experimental group and by 1.1 points

in the control group, and the group difference persisted after controlling for pretest scores. Experimental-group scores also rose on all six well-being dimensions. Technology attachment was positively associated with loneliness reduction, and the interviews revealed both perceived benefits and concerns about illusory intimacy and dependence.

The direction of the loneliness findings agrees with earlier work reporting reductions in self-reported loneliness after chatbot use, particularly when users feel heard [5], [8]. The qualitative theme of nonjudgmental reflection also matches the proposed mechanism of a nonjudgmental, confidential, and always-available channel [6], [11]. The size of the change, however, deserves caution. Earlier reviews describe mild to moderate improvements [11], [12], whereas the pre–post change here exceeded two pretest standard deviations. Those reviews concerned different populations (for example, older adults) and interventions, so comparison is limited. Self-report measures, the absence of blinding, a no-intervention comparison, and expectancy effects may all have contributed, and replication in samples with an active control is needed before the magnitude is treated as reliable.

5.2. Interpretation in Light of Theory

The findings fit several theoretical perspectives, although none was directly tested. Consistent with the need to belong [13], reduced loneliness may reflect partial satisfaction of belonging needs through attention and responsiveness. The qualitative themes also fit social exchange theory [16]: participants valued the absence of judgment and the predictability of companionship, which lower the costs of interaction. The same asymmetry that makes the exchange attractive also limits it, as participants' concerns about reduced motivation for human relationships suggest.

The positive association between technology attachment and loneliness reduction ($r = .34$) is modest and open to several interpretations. It may indicate that an emotional bond with the chatbot contributes to its benefits, in line with attachment-based accounts [17], [18]. Because attachment was measured once, after the intervention, and only in the experimental group, it is equally possible that people who benefited more became more attached. The scale also targets attachment to technological devices and systems in general rather than to the chatbot specifically. The correlation therefore cannot be interpreted as evidence of a mechanism. It also raises the concern voiced by Turkle [19] that strong attachment to a system without the demands of relationships may discourage engagement with people, and this concern appeared directly in the themes of illusory intimacy and reduced motivation for human interaction.

Increases in positive relations with others, self-acceptance, and purpose in life may reflect the reflective, supportive character of the conversations and the safe setting for self-expression that participants described. These interpretations are tentative. Well-being change is reported here for the experimental group only and no multiplicity correction was applied. Improvements in environmental mastery and autonomy were at the .05 threshold, so the evidence for them is weaker.

The distinction between stimulation and displacement [21] offers a useful frame for the qualitative paradox. Participants who valued the chatbot as comfort while worrying about substituting it for human contact were describing the distinction between AI as a bridge and AI as a replacement. The study did not measure participants' wider social ecosystem, so this account remains an interpretation of the interviews rather than a test of these hypotheses. Finally, from the perspective of surveillance capitalism [20], the intimacy participants described occurs on platforms that may collect and monetize emotional data, so short-term benefits should not be separated from questions about privacy and governance. The present study did not examine these issues empirically.

5.3. Integration of Quantitative and Qualitative Findings

The two strands are largely complementary. The quantitative results show that loneliness decreased and that attachment was linked with larger decreases, while the interviews describe how users experienced this: through a space for nonjudgmental self-disclosure and predictable availability. The interviews also qualify the quantitative picture, because the same features that participants valued were the source of their concerns about illusory intimacy and weaker motivation for human contact. Reduced loneliness scores should therefore not be read as evidence of unambiguous benefit.

5.4. Practical Implications

Design and policy. Developers and regulators should place ethical considerations at the center of conversational AI design. Periodic reminders that users are talking to an artificial system could reduce the illusion of intimacy and excessive attachment. Systems should be designed to strengthen human relationships rather than replace them, for example by identifying maladaptive beliefs about relationships, encouraging interpersonal skills, and suggesting real-world social activities. Privacy, data ownership, and the collection of emotional and behavioral data should be communicated clearly to users, and the use of sensitive emotional data for advertising, profiling, or behavioral manipulation should be strictly regulated. Mental health authorities should consider developing ethical and clinical guidelines for responsible use.

Clinical practice. Mental health professionals should ask about clients' use of conversational AI, since motivations for chatbot use may reveal unmet emotional needs, attachment patterns, and social anxieties. Under professional supervision, time-limited use may serve as a supplementary tool for practicing social skills, managing distress, or enhancing self-reflection. Clinicians should remain alert to emotional transference to AI systems and to avoidance of human relationships.

Public education. Educational programs, particularly for adolescents and other vulnerable groups, should explain both the benefits and the limits of emotionally engaging with AI, and emphasize that it cannot reproduce the complexity, warmth, and reciprocity of human relationships.

5.5. Limitations

Several limitations should be considered. First, the sample was recruited through convenience sampling in a single city, which limits generalizability. Second, the control group received no intervention, so the effects of chatbot interaction cannot be separated from those of attention, expectancy, or novelty, and participants could not be blinded. Third, all outcomes were self-reported. Fourth, follow-up was absent, so persistence of effects and the development of dependence could not be assessed. Fifth, the chatbot's characteristics and participants' conversational content were not standardized, and monitoring of adherence is not described. Sixth, technology attachment was measured only at posttest and only in the experimental group, so the association with loneliness reduction cannot be interpreted causally. Seventh, well-being results are reported for the experimental group only, without a between-group comparison or correction for multiple tests. Eighth, attrition and the reliability of the instruments in this sample are not reported. Ninth, the qualitative sample was selected from the experimental group and may overrepresent users who engaged with the chatbot. The qualitative findings should be read as describing participants' experiences rather than as generalizable.

5.6. Future Research

Future studies should include follow-up of six months, one year, or longer to determine whether reductions in loneliness persist and whether prolonged use leads to dependence or social withdrawal. They should compare the intervention with active controls and examine individual differences, including attachment style (secure, anxious, avoidant), social competence, and specific psychological conditions, to identify who benefits and who may be harmed. Hybrid models, such as AI combined with online group therapy, periodic counseling, or peer support, also warrant study. Given that much existing research focuses on Western platforms, culturally adapted conversational AI systems for Iranian users should be developed and evaluated, with attention to linguistic nuance, cultural values, social norms, and communication styles. Finally, interdisciplinary work integrating psychological, ethical, legal, social, and technical perspectives is needed to support responsible governance of this technology.

6. CONCLUSION

Within the limits of a convenience sample, self-report measures, and a no-intervention comparison, eight weeks of chatbot interaction was associated with lower loneliness among lonely adults in Tehran, alongside higher scores on dimensions of psychological well-being in the experimental group. Participants valued the nonjudgmental, constantly available support, yet some described illusory intimacy and weakened motivation for human contact. These findings suggest that conversational AI may serve as a short-term supportive resource, provided it is designed

and used as a complement to human relationships, with attention to transparency, privacy, and dependence. Longer-term and controlled studies are needed before stronger conclusions can be drawn.

Authors' Contributions

All authors contributed to the conception and design of the study, the interpretation of the results and the preparation of the manuscript. All authors read and approved the final manuscript.

Declaration of Generative AI Use

During the preparation of this work, the authors used generative AI tools to assist with translation into English and to improve the language and readability of the manuscript. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Declaration of Competing Interests

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.

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Ethics Considerations

The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants, confidentiality and anonymity were ensured, and participants could withdraw at any stage without penalty.

Data Availability

The quantitative data and anonymized interview transcripts supporting the findings of this study are available from the corresponding author upon reasonable request, subject to ethical and confidentiality considerations.

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