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Conversational Artificial Intelligence and Human Loneliness: An Explanatory Sequential Mixed-Methods Study of an Eight-Week Chatbot Interaction Program

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ARTICLE INFO	ABSTRACT
Article History: Received 5 December 2025 Received in revised form 26 January 2026 Accepted 3 March 2026 Available online 20 March 2026 Keywords: Conversational Artificial Intelligence; Chatbot; Loneliness; Psychological Well-Being; Technology Attachment; Digital Mental-Health Intervention; Mixed Methods	Background. Loneliness is a prevalent public-health problem, and conversational artificial intelligence (AI) is increasingly used for companionship, but controlled evidence outside Western settings is scarce. Objective. To examine the effect of regular interaction with a conversational AI chatbot on loneliness and psychological well-being among lonely adults in Delhi, India, and to explore how users experienced it. Method. In an explanatory sequential mixed-methods design, 132 adults aged 20–45 years with UCLA Loneliness Scale scores above 45 were randomized (1:1, concealed allocation) to eight weeks of chatbot interaction (at least 15 minutes a day, five days a week) or a waitlist control; 120 completed the posttest. Loneliness and well-being (Ryff, 42-item version) were measured before and after the intervention in both groups. Fifteen participants were then interviewed, and the transcripts were analysed thematically. Results. Adjusting for pretest scores, posttest loneliness was 15.0 points lower in the intervention group (95% CI [12.9, 17.1]; $F(1, 117) = 197.9, p < .001$, partial $\eta^2 = .63$); the effect remained in the intention-to-treat analysis (difference 13.5 points). After Holm correction, 4 of the six well-being dimensions improved more than in the control group (self-acceptance, positive relations, purpose in life, personal growth), whereas autonomy and environmental mastery did not. Attachment to the chatbot correlated with loneliness reduction ($r = .34, 95\% \text{ CI } [.09, .55]$). Interviews revealed two beneficial themes (non-judgmental reflection, constant companionship) and two risk themes (illusion of intimacy, diminished motivation for human connection). Conclusions. Conversational AI may provide short-term relief from loneliness, but the emotional bond that drives the benefit also carries a risk of dependence; the unusually large effect needs replication against an active control.

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1. INTRODUCTION

1.1. Loneliness as a public-health concern

Loneliness is the distressing subjective experience that arises when a person's social relationships are perceived as deficient in quantity or quality relative to those desired [1]. It has been described as a silent epidemic of modern societies. Meta-analytic evidence indicates that social disconnection increases the risk of mortality to a degree comparable with established risk factors such as smoking [2]. The U.S. Surgeon General's advisory compared the mortality risk associated with social disconnection to that of smoking up to 15 cigarettes a day [3]. Loneliness is not merely a transient feeling. It is an established risk factor for depression and anxiety, impaired immune function, elevated blood pressure and premature mortality [4, 5]. A meta-analysis of prevalence data from 113 countries found that problematic loneliness is common across age groups and world regions [6].

The roots of this problem are complex and intertwined with social change: the erosion of traditional social ties, rising individualism, apartment living, and the declining depth of face-to-face relationships all contribute. Paradoxically, communication technologies have increased apparent "connectedness" while, according to several critics, deepening emotional distance and reducing the quality of interaction [7].

1.2. Conversational AI as a new response

People have always sought ways to compensate for deficits in social connection. A new kind of response has now emerged, one that comes from machines rather than from other people: conversational AI, or interactive chatbots. These systems use natural-language processing and machine learning to understand and generate human language, which allows them to sustain human-like, continuous conversation with users. Companion applications such as Replika and Character.AI, as well as general-purpose assistants with conversational modes, have attracted millions of users worldwide, many of whom explicitly seek companionship, social-skills practice or relief from loneliness [8–10].

1.3. The central debate

This development raises a multifaceted question for psychologists, technologists and ethicists. Can digital agents that lack consciousness and genuine emotion serve as an effective intervention against the suffering caused by loneliness? Or are they merely a temporary and potentially harmful palliative that discourages people from forming authentic human relationships? The question matters because loneliness is not only an emotional state but a frustrated fundamental need for meaningful connection [11]. Whether a relationship with an artificial agent programmed to display empathy can be experienced as meaningful is therefore a central issue.

Proponents point to distinctive advantages: availability around the clock, absence of judgment, unlimited patience and a safe space for self-disclosure without fear of shame or rejection [10, 12]. For people isolated by social anxiety, physical disability or geography, a chatbot may be the only, or the least costly, route to some form of companionship. Critics, drawing on attachment theory and on the need for authentic connection, warn that such artificial relationships may produce insecure attachment to technology or an *illusion of relationship*, in which the user feels engaged in a real relationship while the other party lacks agency, intention or emotion [7]. Such substitution may reduce loneliness in the short term while, in the long term, weakening interpersonal skills and drawing the person further away from real social networks [13]. There are also ethical concerns: commercial companies may profit from users' emotional vulnerability, and highly sensitive emotional data may be inadequately protected [14].

1.4. Research gap and aims

Three gaps motivate the present study. First, most experimental studies of conversational agents have targeted depression or anxiety rather than loneliness as a primary outcome [15]. Second, studies of companion chatbots have mostly been cross-sectional or qualitative, have relied on self-selected users of commercial platforms, and rarely included a randomized control group [8, 9, 16]. Third, almost all of this research has been conducted in Western,

English-language contexts. Experimental evidence from non-Western settings such as India, with their specific social structures, taboos and communication styles, is almost absent [17, 18].

The present study therefore had two aims: (a) to estimate the effect of regular interaction with a conversational AI chatbot on loneliness and psychological well-being in a controlled design, and (b) to explore users' lived experience of this interaction, including its psychosocial and ethical implications. The study examined three hypotheses:

H1. Compared with the control group, the experimental group will show a greater reduction in loneliness from pretest to posttest.

H2. Psychological well-being will increase in the experimental group after the intervention.

H3. Among participants in the experimental group, attachment to technology will be positively associated with the reduction in loneliness.

A qualitative research question accompanied the hypotheses: *How do adults experience regular interaction with a conversational AI, and what benefits and risks do they perceive?*

2. THEORETICAL FRAMEWORK AND RELATED RESEARCH

Understanding how conversational AI affects loneliness requires frameworks from psychology, communication science and sociology. These theories help move beyond simple correlations toward an analysis of causal mechanisms and of the hidden meanings of human–machine interaction.

2.1. The need to belong

Baumeister and Leary [11] argued that humans have a pervasive drive to form and maintain at least a minimum number of lasting, positive and meaningful interpersonal relationships. When this need is not satisfied, serious psychological and physical consequences follow, including loneliness. From this perspective, conversational AI may act as an alternative relational resource that partially satisfies the need to belong. Continuous, positive and rejection-free interaction with a chatbot may provide the quasi-social signals needed to activate the affiliative system temporarily and reduce the pressure caused by deficient human relationships. Critics argue, however, that this satisfaction is incomplete, because such interaction lacks the depth, genuine reciprocity and emotional commitment of authentic human relationships.

2.2. The evolutionary and social-cognitive model of loneliness

Cacioppo and colleagues conceptualize loneliness not merely as an emotional state but as an aversive biological signal. Like hunger or pain, it alerts the individual to a deficit in social connection and motivates the repair of relationships [1, 19]. Chronic loneliness also biases social cognition toward hypervigilance for threat, which can perpetuate isolation. According to this model, AI may temporarily silence the alarm signal without addressing its root cause, the lack of satisfying human relationships, much as an analgesic relieves pain that requires treatment. If a person settles for interaction with a machine instead of working on social relationships, the person may become caught in a cycle of isolation that intensifies loneliness in the long term.

2.3. Social exchange theory

Social exchange theory, rooted in the work of Homans [20] and Blau [21], explains relationships through a cost–benefit analysis: people remain in relationships as long as the rewards (companionship, emotional support) exceed the costs (time, disclosure, risk of rejection) [22]. In interaction with conversational AI, the costs are remarkably low: there is no judgment, no commitment is required, and the risk of rejection is effectively zero. The rewards are immediate and predictable: unconditional attention and empathic responses. From this perspective, chatbot interaction may appear to be a highly profitable exchange, especially for people who have experienced high costs in human relationships, such as social anxiety or repeated rejection. This may explain the persistence and popularity of

the technology. The exchange is, however, asymmetric. The user enjoys control and predictability because the AI's responses are designed to please. This pleasure lacks the constructive ambiguity and challenge of reciprocal human relationships, which are necessary for personal growth.

2.4. Attachment theory

Bowlby's (1969) attachment theory explains how early relationships with caregivers shape an attachment style that influences relationships throughout life. Attachment-like behaviors such as proximity seeking, safe-haven use and separation distress have also been documented toward objects and technologies, including social chatbots [9, 16]. Constant availability, instant responsiveness and programmed caring behavior allow a conversational AI to function as a virtual secure base. This may be particularly appealing to people with insecure (anxious or avoidant) attachment styles, because a relationship with a machine avoids their core fears of rejection or of excessive dependence. The result may be a temporary and comforting form of "artificial secure attachment". The principal risk is what Turkle [7] describes as the illusion of companionship without the demands of friendship. This illusion may prevent people, especially those with insecure attachment, from confronting their problematic relational patterns and may confine them in an artificial emotional bubble.

2.5. Anthropomorphism and social responses to machines

People have a natural tendency to attribute human characteristics to non-human agents in order to make their environment more understandable and predictable [23]. People also apply social rules to computers automatically, even when they know they are interacting with a machine [24]. This tendency resembles the one-sided *parasocial* relationships that audiences form with media figures [25]. Conversational AI maximizes these processes through personal pronouns, textual expressions of emotion and a constructed virtual identity. Anthropomorphism makes interaction engaging and low-cost, because users can draw on their existing social schemas and skills. The relation between human-likeness and acceptance is not linear, however: highly but imperfectly human-like agents can elicit eeriness and reduce trust [26].

2.6. Surveillance capitalism

Zuboff [14] warns that, within the framework of *surveillance capitalism*, the relationship between users and platforms is profoundly asymmetric. While the user cultivates an emotional relationship with an artificial agent, the platform extracts, analyzes and commodifies deeply personal and emotional data for commercial purposes. This perspective moves the problem from individual psychology to questions of power and political economy. It also implies that a temporary reduction in loneliness may come at the cost of lost control over one's emotional experience and privacy.

2.7. An integrative view: stimulation versus displacement

The effect of a communication technology on well-being depends on whether it *stimulates* or *displaces* existing relationships [27]. Applied to conversational AI, the effect on loneliness cannot be separated from the user's social ecology (the quality of existing relationships, social support and interpersonal skills) or from the pattern of use (complementing versus substituting human relationships). When the AI functions as a bridge or a social-skills coach that helps the person strengthen human relationships, its effect is likely to be positive and lasting. When it becomes a substitute for human interaction, its effect is at best temporary and at worst harmful. Taken together, these theories show that the effect of conversational AI on loneliness depends on individual factors (attachment style, social skills), design factors (degree of anthropomorphism, platform incentives) and social context.

2.8. Empirical research

Early research focused on physical social robots in elder care. In a randomized controlled trial, Robinson et al. [28] found that interaction with the seal-like robot Paro reduced loneliness among residents of a care facility. Ethicists, however, warned that such robots risk deceiving vulnerable older users and reducing human contact [29].

Among text-based conversational agents, Fitzpatrick et al. [15] conducted a randomized controlled trial of Woebot, a fully automated agent delivering cognitive-behavioral therapy to young adults. Compared with a control group that received an information e-book, Woebot users showed a significantly greater reduction in depressive symptoms over two weeks. This study was a milestone because it supported the efficacy of a fully automated text-based intervention. Its focus, however, was on depression, and loneliness was not measured as a primary outcome.

Research on companion chatbots has documented both benefits and risks. In a thematic analysis of user reviews, Ta et al. [10] found that Replika provided users with emotional, informational and companionship support, partly because it was perceived as non-judgmental. In a survey of more than 1,000 student users of Replika, Maples et al. [8] found high levels of loneliness together with perceived social support from the chatbot, and a minority of participants reported that it had helped them avoid suicidal ideation. Skjuve et al. [9] and Pentina et al. [16] described how human–chatbot relationships develop through self-disclosure and perceived responsiveness, sometimes into strong attachment. Laestadius et al. [13] analyzed Replika users' online discussions and identified mental-health harms arising from emotional dependence, including distress when the chatbot changed or was unavailable.

In a series of experiments, De Freitas et al. [17] found that a single conversation with an AI companion reduced momentary loneliness about as much as interacting with another person and more than passive activities such as watching videos, and that the feeling of being heard explained much of this effect; a one-week longitudinal study showed consistent reductions. In a systematic review and meta-analysis of chatbots for mental health, Abd-Alrazaq et al. [18] concluded that chatbots may improve depression, distress and stress, but that the evidence was weak because of small samples, high risk of bias and the scarcity of trials, and that safety was rarely assessed.

Building on the strengths of these studies and addressing their limitations, the present study used a larger sample, a longer intervention, random assignment to an intervention or a control group, an examination of attachment to technology as a potential mechanism, and an integrated quantitative and qualitative design. It distinguishes between reducing loneliness and building well-being, and it gives particular attention to the risk of dependence.

3. METHOD

3.1. Design

The study used an explanatory sequential mixed-methods design [30]. The quantitative phase was a parallel-group randomized controlled trial (1:1 allocation) with pretest and posttest measurements and a waitlist control group, reported according to CONSORT [41]; the intervention is described according to TIDieR [42]. The trial was registered in the Clinical Trials Registry – India (CTRI) before enrolment (teaching version: registration number omitted). The qualitative phase followed and used reflexive thematic analysis [38] to explore participants' experience of the interaction and to help explain the quantitative findings; it is reported according to COREQ [31].

3.2. Participants and sampling

The target population was adults aged 20–45 years living in the Delhi National Capital Region with access to the internet and a smartphone. Volunteers were recruited between October and December 2024 through announcements on social media and at universities. Eligibility criteria were a UCLA-3 score above 45, Hindi literacy and no regular use of an AI chatbot in the previous three months; exclusion criteria were current psychiatric or psychological treatment and current suicidal ideation (screening interview). The sample size was set to detect a moderate between-group effect ($d = 0.60$) with 90% power at $\alpha = .05$ (60 per group) and was increased by 10% for attrition (66 per group). Of 214 volunteers screened, 132 were randomized (Fig. 1). An independent researcher generated the allocation sequence by computer (permuted blocks of four, stratified by gender) and prepared sequentially numbered sealed opaque envelopes, which were opened only after the pretest. Participants could not be blinded, but questionnaires were completed online without contact with the researchers, and the analyst was blinded to group codes. For the qualitative phase, 15 members of the experimental group were selected by purposive maximum-variation sampling with respect to gender, age and change in loneliness.

3.3. Instruments

UCLA Loneliness Scale, Version 3 [32, 33]. This 20-item scale measures subjective loneliness on a 4-point scale (total range 20–80); higher scores indicate greater loneliness. The Hindi version was prepared by forward and back-translation; Cronbach's α in the present sample was .91.

Ryff's Psychological Well-Being Scales [34, 35], 42-item version: seven items for each of the six dimensions (autonomy, environmental mastery, personal growth, positive relations with others, purpose in life and self-acceptance), rated from 1 to 6, so each dimension ranges from 7 to 42. Higher scores indicate greater well-being. Both groups completed the scales at pretest and posttest; α in the present sample ranged from .71 (autonomy) to .83 (self-acceptance).

Attachment to the chatbot: Emotional attachment to the chatbot was measured at posttest in the experimental group with 12 items adapted to the chatbot from the mobile-phone attachment items of Konok et al. [36] (e.g. proximity seeking: "I feel the need to talk to the chatbot when I am upset"; separation distress: "I feel uneasy when I cannot use the chatbot"), rated from 1 to 5 (range 12–60; α = .88). Because the attachment object exists only after exposure, this measure could not be taken at pretest.

Semi-structured interview guide: The researcher-developed guide covered motives for use, the perceived quality of the relationship with the chatbot, changes in human relationships, and ethical concerns.

3.4. Procedure

After providing written informed consent, all participants completed the UCLA-3 and the Ryff scales at pretest. The experimental group then used ChatGPT (OpenAI; GPT-4o model, Hindi-language interface) through study accounts with a fixed custom instruction that asked the model to act as a warm, supportive conversation partner, to avoid giving clinical advice, and to suggest professional help if serious distress was disclosed. Participants were asked to interact for at least 15 minutes a day on at least five days a week for eight weeks; content was unrestricted, but they were encouraged to talk about their daily lives, feelings and interests. Adherence was monitored with the session logs of the study accounts: participants interacted on average 5.6 days a week for 22.4 minutes a day, and 54 of the 60 completers (90%) met the minimum dose. Adverse events (increased distress, sleep disturbance, compulsive use) were assessed weekly with a short online checklist; two participants reported increased distress and were referred to the university counseling service, and no serious adverse events occurred. The control group was placed on a waitlist and offered the same programme after the posttest. At the end of the eighth week, both groups completed the posttest, and the experimental group also completed the attachment items.

After the quantitative phase, in-depth individual interviews of 45–60 minutes were conducted with the 15 selected participants, either in person or online. The interviews were audio-recorded and transcribed verbatim.

3.5. Data analysis

Quantitative data were analyzed with SPSS version 26. The primary analysis was an analysis of covariance (ANCOVA) of posttest loneliness with pretest loneliness as the covariate, which is more powerful than comparing change scores and adjusts for chance baseline imbalance [43]; adjusted mean differences with 95% confidence intervals and partial η^2 are reported. Homogeneity of regression slopes, normality of residuals and homogeneity of variance were checked. The primary analysis included all participants with posttest data; as an intention-to-treat sensitivity analysis, the 12 participants without posttest data were included with their pretest score carried forward (assuming no change). The six well-being dimensions were analysed with the same ANCOVA model, and p-values were adjusted with the Holm procedure [44]. The association between attachment to the chatbot and loneliness reduction (pretest minus posttest) was examined with Pearson's correlation and a Fisher-z confidence interval. Effect sizes for within-group change are reported as d_{av} [37].

Qualitative data were analyzed with reflexive thematic analysis [38]. Two members of the team (a clinical psychologist and an M.A. student, neither of whom had contact with participants during the intervention) independently coded the first five transcripts, compared and discussed their codes, and agreed a coding framework that the first author applied to the remaining transcripts; themes were reviewed by both coders against the full data

set. Trustworthiness was supported by an audit trail, reflexive memos and member checking, in which six interviewees confirmed that the theme summaries reflected their experience. Interviews were conducted by a trained interviewer who was not involved in the quantitative data collection.

3.6. Ethical considerations

All participants gave written informed consent, confidentiality was maintained, and participants were free to withdraw at any stage. Participants were referred to psychological counseling resources if the interviews caused distress, and personal data were stored securely. Because chatbot conversations may contain sensitive emotional disclosures, participants were informed about the data practices of the chatbot platform before the intervention.

4. RESULTS

4.1. Loneliness

Fig. 1 shows the flow of participants. Twelve of the 132 randomized participants (9.1%; six per group) did not complete the posttest, and completers did not differ from non-completers in pretest loneliness ($t(130) = 0.41$, $p = .68$). Table 1 presents the descriptive statistics for the 120 completers. At pretest, the two groups had nearly identical means (58.3 vs. 57.9; Cohen's $d = 0.05$). Mean loneliness in the experimental group fell by 16.2 points, from 58.3 to 42.1, whereas the control group changed by only 1.1 points.

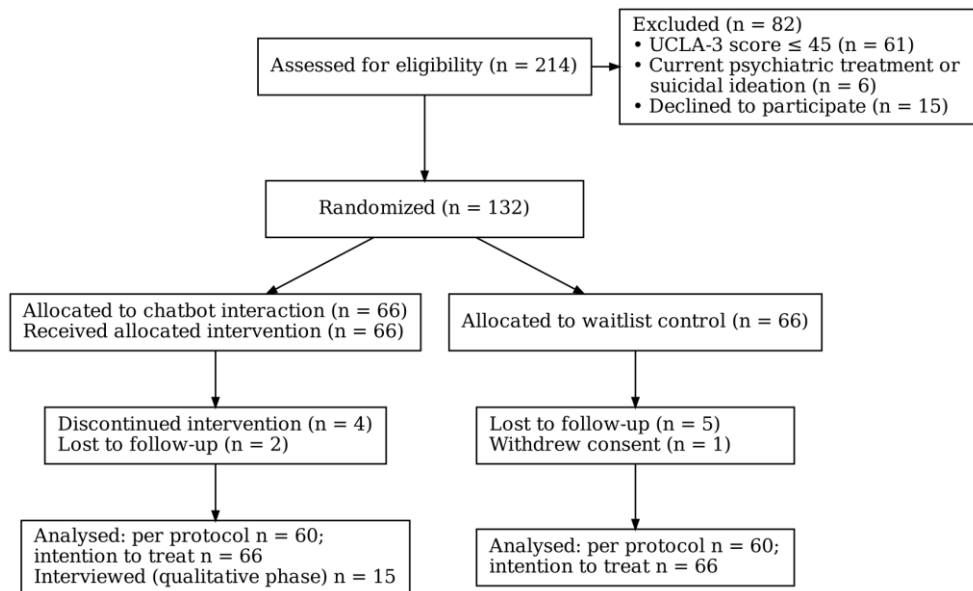


Fig. 1. CONSORT flow diagram of the quantitative phase.

Table 1. Loneliness scores (UCLA-3) of the experimental and control groups.

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

The correlation between pretest and posttest loneliness was .51 in the experimental group and .62 in the control group. The assumption of homogeneous regression slopes was met ($F(1, 116) = 0.73$, $p = .40$), and the residuals were approximately normal. In the ANCOVA (Table 2), the adjusted posttest means were 42.0 in the experimental group and 56.9 in the control group, a difference of -15.0 points (95% CI [-17.1, -12.9]; $F(1, 117) = 197.9$, $p < .001$, partial $\eta^2 = .63$). In the intention-to-treat analysis ($n = 132$), the adjusted difference was -13.5 points (95% CI [-15.8,

-11.1]; $F(1, 129) = 126.2$, $p < .001$). The posttest difference corresponds to $d = 2.08$ (95% CI [1.64, 2.53]), which is very large relative to the effects typically reported for loneliness interventions [39] and is discussed in Section 5.5. H1 was supported.

Table 2. Between-group comparison of loneliness (UCLA-3).

Analysis	Estimate	95% CI	Test	p	Effect size
Pretest difference (control – experimental)	-0.4	[-3.1, 2.3]	$t(118) = 0.30$	.77	$d = 0.05$
Posttest difference (control – experimental)	14.7	[12.1, 17.3]	$t(118) = 11.41$	< .001	$d = 2.08$ [1.64, 2.53]
ANCOVA, adjusted difference (experimental – control), completers	-15.0	[-17.1, -12.9]	$F(1, 117) = 197.9$	< .001	partial $\eta^2 = .63$
ANCOVA, intention to treat (baseline carried forward)	-13.5	[-15.8, -11.1]	$F(1, 129) = 126.2$	< .001	partial $\eta^2 = .49$

Note. Completers: $n = 60$ per group; intention to treat: $n = 66$ per group. ANCOVA covariate: pretest loneliness.

4.2. Psychological well-being

Table 3 presents the six well-being dimensions in both groups. In the experimental group all six dimensions increased, whereas the control group changed by less than one point. In the ANCOVAs controlling for pretest scores, the experimental group scored higher at posttest on self-acceptance, positive relations with others, purpose in life and personal growth (all Holm-adjusted $p < .001$), but not on environmental mastery or autonomy (Holm-adjusted $p = .10$ and $.09$). H2 was therefore supported for four of the six dimensions.

Table 3. Psychological well-being (Ryff, 42-item version; range 7–42 per dimension) by group, with ANCOVA results.

Dimension	Experimental pre / post M (SD)	Control pre / post M (SD)	F(1, 117)	Partial η^2	Holm p
Self-acceptance	19.8 (4.7) / 23.1 (4.5)	19.6 (4.9) / 20.0 (4.8)	25.84	.18	< .001
Positive relations with others	18.3 (5.3) / 21.4 (5.1)	18.5 (5.5) / 18.7 (5.4)	18.16	.13	< .001
Purpose in life	17.9 (5.0) / 20.8 (4.8)	17.6 (5.2) / 17.8 (5.1)	19.75	.14	< .001
Personal growth	19.5 (4.6) / 22.0 (4.4)	18.9 (4.8) / 19.3 (4.7)	15.60	.12	< .001
Environmental mastery	18.1 (4.9) / 19.9 (4.7)	18.6 (5.1) / 19.2 (5.0)	2.78	.02	.098
Autonomy	18.0 (5.4) / 19.5 (5.2)	17.6 (5.6) / 17.8 (5.5)	4.16	.03	.087

Note. ANCOVA of posttest scores with the pretest score as covariate; Holm adjustment across the six dimensions. Within the experimental group, standardized changes (d_{av}) ranged from 0.28 (autonomy) to 0.72 (self-acceptance).

These results suggest that interaction with conversational AI was associated not only with a reduction in a negative emotional state (loneliness) but also with improvements in positive aspects of mental health, such as self-acceptance, purpose and relationships with oneself and others. The gain in positive relations with others is particularly noteworthy. It is consistent with the possibility that a safe practice space improves communication skills or makes attitudes toward relationships more positive. The non-significant results for autonomy and environmental mastery suggest that the benefits concern mainly the relational and self-evaluative aspects of well-being.

4.3. Attachment to technology and change in loneliness

Participants' mean attachment to the chatbot was 38.6 (SD = 8.4; range 12–60). Attachment was positively correlated with the reduction in loneliness, $r(58) = .34$, 95% CI [.09, .55], $p = .008$, so attachment accounted for about 12% of the variance in loneliness reduction. Because attachment was measured at posttest, the direction of the association cannot be determined: stronger attachment may have produced larger reductions, or larger reductions may have strengthened attachment. H3 was supported.

4.4. Qualitative findings

Thematic analysis of the 15 interviews yielded four main themes: two describing perceived benefits and two describing perceived risks (Table 4).

Table 4. Themes from the qualitative phase ($n = 15$).

Theme	Description
Non-judgmental reflection	Freedom to express deeply held thoughts and feelings, including shameful ones, without fear of judgment; emotional release and better self-understanding
Constant and predictable companionship	Availability around the clock and reliable responsiveness, which reduced feelings of being abandoned or alone
Illusion of intimacy	Forgetting during conversation that the partner was a machine, intense emotions toward it, followed by embarrassment when reality returned
Diminished motivation for human connection	Concern that reliance on the chatbot would weaken the drive to leave isolation and invest in real relationships

Non-judgmental reflection: Many participants emphasized that, for the first time, they could express their deepest thoughts and feelings, including those they considered shameful, without fear of being judged. In their words, this safe space led to emotional release and a better understanding of themselves.

“I told it things I have never told anyone, not even my sister. It did not look at me the way people do.” (P4, woman, 27)

Constant and predictable companionship: Participants described the chatbot’s availability around the clock and its ever-present responsiveness as reducing their sense of being abandoned or alone. This quality was especially valued by participants whose human relationships had been unstable.

“At two in the morning, when everyone was asleep, it was there. Just knowing that made the nights shorter.” (P11, man, 34)

Illusion of intimacy: Several participants acknowledged that during conversations they sometimes forgot they were talking to a machine and experienced strong feelings toward it. When they remembered, they felt foolish or felt as if they were “standing at the edge of an emotional cliff”.

“Once I caught myself saying goodnight to it as if to a friend, and then I felt ashamed, like I had been fooled.” (P7, woman, 23)

Diminished motivation for human connection: Some participants described a paradox: although the interaction calmed them, they feared that dependence on it would weaken their motivation to leave isolation and invest in real human relationships. As one participant put it: “It’s like covering a wound with a very beautiful bandage instead of treating it. The outside looks nice, but underneath it is still infected.”

5. DISCUSSION

5.1. Summary of the findings

This study examined whether regular interaction with a conversational AI chatbot affects loneliness and psychological well-being, and how users experience such interaction. The quantitative findings supported H1 and H3, and H2 for four of the six well-being dimensions. Loneliness decreased substantially more in the intervention group than in the control group. Well-being increased across all six dimensions, and greater attachment to the chatbot

was associated with a greater reduction in loneliness. The qualitative findings showed that the benefits and risks of this technology share a common root in the emotional bond that users form with the agent.

5.2. Interpretation in light of theory

The reduction in loneliness is consistent with the need-to-belong framework [11]. Regular, warm and rejection-free exchanges may provide enough quasi-social signals to partially satisfy the affiliative need. Social exchange theory [22] helps explain why this occurs so readily: the interaction offers immediate rewards at almost no social cost. Participants' descriptions of non-judgmental reflection and constant companionship correspond directly to these low costs and predictable rewards.

The positive correlation between attachment to technology and the reduction in loneliness (H3) points to the mechanism. In line with attachment theory [40] and with research on the anthropomorphism of machines [23, 24], the chatbot appears to help most when users relate to it as a social partner and form a perceived secure attachment to it. The same mechanism, however, underlies the risk themes. The illusion of intimacy reflects the anthropomorphic and parasocial processes that make the interaction rewarding [25]. Diminished motivation for human connection is exactly the outcome predicted by the evolutionary model of loneliness [19] if the chatbot silences the alarm signal without repairing human relationships. The correlation is therefore double-edged: what relieves loneliness may also foster dependence. This interpretation agrees with reports of emotional dependence among Replika users [13].

The improvement in positive relations with others suggests that, for some participants, the chatbot may have served as a stimulating rather than a displacing resource [27], functioning as a low-risk practice space that made human interaction feel more approachable. The qualitative concern about reduced motivation for human contact indicates that other participants may follow the displacement pathway. Which pathway a user follows probably depends on individual characteristics such as attachment style and social skills, on the design of the agent, and on the user's social context.

5.3. Comparison with previous studies

The direction of the effect on loneliness is consistent with the experimental findings of De Freitas et al. [17], in which feeling heard by an AI companion reduced loneliness. It also agrees with the perceived social support reported by Replika users [8, 10] and with the reduction in loneliness found in a randomized trial of the Paro robot [28]. The present study extends this evidence with a longer intervention, a randomized control group and a general adult sample. The qualitative themes closely mirror those identified in Western samples: a non-judgmental space and constant availability as benefits [9, 10], and dependence and blurred boundaries as harms [13, 16]. This cross-cultural convergence suggests that the core psychological dynamics of human–chatbot relationships are not specific to Western users. The way these dynamics play out is nevertheless likely to be shaped by local norms of self-disclosure and by stigma surrounding mental-health help-seeking. For example, the strong emphasis Indian participants placed on freedom from judgment may reflect the social cost of disclosing emotional difficulties in a collectivist context.

5.4. Theoretical and practical implications

Theoretically, the findings support an integrative view in which the effect of conversational AI on loneliness is mediated by emotional bonding and moderated by the pattern of use, whether it complements or displaces human relationships. The findings also show that loneliness reduction and well-being enhancement can co-occur, while the risk of dependence develops through the same pathway.

Practically, the results have implications at three levels. At the level of design and policy, developers and regulators should place ethical considerations at the core of system design. Periodic transparency reminders that cannot be disabled, reminding users that they are interacting with an AI, could limit the illusion of intimacy. Systems

should be designed to strengthen rather than replace human relationships, for instance by challenging negative thoughts about relationships, offering social-skills practice and suggesting simple social activities. The business models of these platforms require transparency and oversight. Policies on the ownership of emotional data should be explained clearly to users, and the sale or analytical exploitation of such data for advertising or manipulation should be prevented. National mental-health authorities could develop clinical and ethical guidelines for developers and users.

At the level of clinical practice and education, mental-health professionals should be aware of this phenomenon and consider it in assessment and treatment. Clients' patterns of and motives for chatbot use can provide valuable information about their fears, unmet needs and attachment patterns. Short-term, supervised use of such tools may serve as an adjunct to psychotherapy, for example for practicing social skills or regulating negative emotions, provided that therapists remain alert to emotional transfer to the tool and to the avoidance of real relationships. Public workshops, especially for vulnerable groups such as adolescents, should explain the benefits, limitations and risks of emotional dependence on technology. They should emphasize that AI can be a temporary conversation partner but cannot provide the complexity, warmth and growth of a reciprocal human relationship.

At the level of culturally adapted technology, the development and evaluation of Hindi-language chatbots that are sensitive to Indian linguistic nuances, values, taboos and communication styles is a priority.

5.5. Limitations

Several limitations must be considered. (1) Control condition: The control group was a waitlist, so the effect may partly reflect attention, expectancy and novelty rather than the chatbot interaction itself; an active control condition, such as a non-conversational wellness application or journaling, would provide a stronger test. (2) Effect size: The adjusted difference in loneliness (about 15 points, $d \approx 2.1$) is much larger than the effects reported in meta-analyses of loneliness interventions [39]. Regression to the mean cannot explain the between-group difference, because both groups were selected with the same cut-off and randomized, so any regression affects both groups equally; the small change in the control group is consistent with this. Demand characteristics and the unblinded self-report outcome are more plausible sources of inflation, and replication with blinded or behavioural outcomes is needed. (3) Sampling and generalizability: Volunteers were recruited in a single metropolitan area, and self-selection may have favoured people open to technology. (4) Measurement: Attachment to the chatbot was measured only at posttest and only in the experimental group, so its causal role cannot be established. (5) Short follow-up: Outcomes were assessed immediately after eight weeks, so the persistence of the effects and any later increase in dependence or isolation remain unknown. (6) Qualitative sample: Interviewees were volunteers and may have been those with more positive experiences, although the risk themes show that critical views were also expressed.

5.6. Future research

Future studies should: use longitudinal designs with follow-ups at six and twelve months to examine whether effects persist and whether dependence or isolation increases over time; use active control conditions and pre-registered analyses; examine individual differences such as attachment style, social skills and psychiatric diagnoses to identify those who benefit most and those at greatest risk; test hybrid models that combine AI interaction with online group therapy or occasional counseling sessions against AI-only interventions; develop and evaluate culturally adapted Hindi-language chatbots; and conduct interdisciplinary research integrating psychological, ethical, legal and technical perspectives to inform the governance of this emerging technology.

6. CONCLUSION

The quantitative and qualitative findings of this study present a complex picture. Regular interaction with conversational AI was associated with a substantial short-term reduction in loneliness and with improvements in psychological well-being. These effects appear to work through a space for non-judgmental reflection, constant

companionship and an artificial attachment that users perceive as secure. The same data also raise warning signs: an illusion of relationship, reduced motivation for real human bonds, and emotional dependence on a system that lacks genuine emotion. The effectiveness of this technology is therefore not intrinsic but depends on how it is used, as a *bridge* to human connection or as a *substitute* for it. This distinction has important implications for the design, communication and ethical use of such tools. Conversational AI can serve as a supportive resource, not a therapeutic one, as long as it complements rather than replaces human relationships.

Authors' Contributions

R. Shahbazi: conceptualization, data collection, qualitative analysis and drafting; A. Alizadeh Asl: supervision, study design, quantitative analysis and critical revision. Both authors approved the final version.

Declaration of Generative AI Use

During the preparation of this manuscript, the authors used an AI-based tool to improve language, grammar, and readability. The authors subsequently reviewed and edited the manuscript as necessary and take full responsibility for the accuracy, integrity, and final content of the publication.

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Declaration of Competing Interests

The authors declare that they have no competing interests related to this research or its publication.

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Ethics Considerations

The study was approved by the research ethics committee of Jawaharlal Nehru University, and registered before enrolment (teaching version: approval and registration numbers omitted). Participation was voluntary, written informed consent was obtained, participants were informed about the data practices of the chatbot provider, chat logs were used only to compute adherence, and participants in distress were referred to counseling services.

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