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Young adults with vision impairment in India: Loneliness and social networks

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Abstract

Purpose: To examine the prevalence of loneliness and associated factors in young adults with vision impairment (VI), including quality of life (QoL) in India.

Methods: Two hundred and three VI young adults (18–35 years) and 219 age-matched non-VI (controls) adults completed the loneliness scale, WHOQOL-BREF, Social Network Index (SNI) (network diversity, people in network size and number of embedded network subscales) and questions regarding sociodemographic characteristics and independent mobility. Rasch analysis was used to validate the questionnaires and interval-level scores were generated. Generalised linear models were used to estimate independent associations of sociodemographic factors, VI characteristics, social networks and QoL with loneliness.

Results: The prevalence of moderate and severe loneliness in the VI group was 10% (95% CI: 6.5, 15.4) and 4.4% (95% CI: 2.0, 8.2), respectively, and higher than that of controls. The VI group had a worse loneliness score than controls (-1.66 ± 2.25 vs. -2.13 ± 1.85 logits; $p = 0.03$). Those with ≤12 years and >12 years of education had loneliness scores of -1.58 ± 2.45 and -1.82 ± 1.99 logits, respectively ($p = 0.01$). Compared with controls, the VI group reported fewer extended family members, neighbours and friends leading to significantly smaller networks and network diversity (all $p < 0.001$). Loneliness scores demonstrated a significant correlation with only two SNI subscales for both groups: people in network size ($r = -0.28$ for VI; $r = -0.30$ for non-VI; $p < 0.001$ for both) and number of embedded networks ($r = -0.22$ for VI; $r = -0.21$ for non-VI; $p = 0.002$ for both). Both education ($\beta = 0.45$; $p = 0.04$) and QoL ($\beta = -0.27$, $p = 0.02$) were predictors of loneliness.

Conclusions: Loneliness was commonly experienced by young VI adults and was higher among those with lower levels of education. Loneliness decreased with the presence of a larger number of people in network, suggesting that interventions to increase social activity and participation may be valuable in young VI adults.

KEYWORDS
loneliness, quality of life, social networks, vision impairment

INTRODUCTION

Visual impairment (VI) adversely impacts a person's participation in activities of daily living and visually intense tasks, increases the risk of depression and is associated with loneliness and a reduced quality of life (QoL).[1–4] People with VI face difficulty in perceiving an individual's visual cues and non-verbal movements resulting in limited social

interaction, and this is an important risk factor for loneliness among younger people.[5,6] This is expected given that vision is an important sensory modality for interpersonal interactions and social communication; therefore, the presence of VI may limit social interactions. Furthermore, individuals with VI have fewer opportunities to learn and modify social skills,[7] and all of these factors may have a negative impact on the person's social and emotional development.[8]

Loneliness is a perceived unpleasant feeling that arises from a lack of desired social connections and inconsistency between expected and experienced strength of social relationships, resulting in a deficit of the individual's social network.[9] Put simply, loneliness is experienced when an individual has fewer social relationships or less relationships of sufficient quality than they wish to have.[10] Although loneliness is often considered an adaptive and necessary aspect of human life, its beneficial aspects diminish when periods of loneliness are intense and prolonged. When that happens, it adversely impacts health[11] and mental well-being.[12,13] Furthermore, the impact of loneliness has been estimated to be comparable to that of smoking, and greater than obesity and physical inactivity.[14] Evidence also suggests that people who are socially isolated are more likely to die prematurely compared to those with extensive social networks.[15] Over the last few years, there have been reports suggesting that loneliness in younger people (young and middle-aged) is greater than among older people.[16] In addition to sociodemographic factors such as educational attainment, socioeconomic standing, marital status and gender, several social factors have been associated with loneliness including living alone,[12] having a smaller social network,[17] lacking social support and low frequency of social contacts, for example, seeing friends.[18] Social network refers to the relationships, such as friendship and collaboration, between individuals and organisations.[19] It is a social structure depicting the connections that individuals and organisations form with one another. Several physical and psychological health-related factors have been implicated that increase the likelihood of experiencing loneliness, including physical functioning impairment, chronic diseases, depression and well-being among others. Some factors may have a greater impact on loneliness in younger individuals than in the elderly, and vice versa. For example, it has been shown that poor health has a greater impact on loneliness among young adults, leaving them feeling misunderstood by their peers which places them at a greater risk for loneliness.[20,21]

Studies among people with VI have demonstrated that the ability to use computers and the Internet provides an opportunity to communicate with others, both at an individual level and with groups of people, and also allows for the development of a sense of community.[22] For some, it is also a means to overcome social isolation. Loneliness in younger adults is of significance given that it is associated with additional concerns, potentially impacting

Key points

- Loneliness is common in young, visually impaired adults in India, particularly those with profound visual loss, and screening individuals for loneliness in low vision rehabilitation programmes may help identify at-risk individuals.
- Young adults with visual impairment and lack of higher education after secondary school are at a greater risk of loneliness than those with post-school qualifications.
- Loneliness decreases with expanding social networks highlighting the importance of peer and family support for young adults with visual impairment.

educational attainment, employment outcomes and earnings, alongside health impacts.[23] In addition, loneliness has been associated with additional health care costs.[24] Given that loneliness has detrimental effects, not only on the individual with VI but also on society, it is recognised as a major public health concern.[12]

It is well known that the factors associated with loneliness vary across the life span and yet, most research until now has focussed on adolescents or older adults (aged 65 years and over).[25–27] Even so, the existing studies among adults (19–65 years) tend to include broad age groups.[6,18,28–30] Thus, investigations of loneliness that exclusively focus on young adults (18–35 years) with VI are scarce, and the understanding of the relationship between loneliness and factors such as visual status remains limited. Surprisingly, this gap in the literature on loneliness research remains despite the recognition of greater loneliness in younger adults. In addition, there is a lack of research that examines factors associated with loneliness in narrower age groups.[6,18] The identification and understanding of these factors is necessary to recognise adults in different phases of life who suffer from loneliness. While there is evidence that loneliness is detrimental to one's QoL and life satisfaction,[4] analysis has not been extended to investigate the resulting overarching relationship between loneliness and VI, and does not consider the effects of loneliness and social networks on the QoL of persons with VI. To further our understanding on the role of social networks and loneliness among young adults with VI in India, the present study was conducted with three aims: (1) to assess the prevalence of loneliness in young adults with VI; (2) to describe the association of loneliness with sociodemographic factors and VI characteristics and (3) to describe the association between loneliness, social network and QoL. A better understanding of the predictors of loneliness in individuals with VI is important and could be useful for targeting

professional help to those who need it. For the present study, we hypothesised that individuals with less robust social networks (smaller, less intimate, etc.) will have higher levels of loneliness and poorer QoL.

METHODS

Design and participants

This cross-sectional study comprised young adults (18–35 years) who were provided low vision rehabilitation care at the Institute for Vision Rehabilitation, L V Prasad Eye Institute (LVPEI), Hyderabad, India, between August and November 2021. Participants were excluded if they were younger than 18 years, had an additional disability, for example, hearing or speech impairment, and/or if they could not converse in one of two local languages (Telugu and Hindi) or English. In order to establish the comparative impact of VI on loneliness and QoL, a convenient sample of age-matched (matched to within 5 years where possible) and gender-matched controls with no ocular disease or self-reported VI (control or non-VI group) were recruited. These participants were either friends or relatives who accompanied the patients to the Institute for Vision Rehabilitation visit. In addition, to increase enrolment, we recruited age- and gender-matched LVPEI staff with no known ocular disease or self-reported VI. The Institutional Review Board of the LVPEI, Hyderabad, India, approved the study methods. Written informed consent was obtained from all eligible participants and the study methods adhered to the tenets of the Declaration of Helsinki.

Procedures

Demographic variables

Prior to administration of the questionnaires (described later in this section), we collected sociodemographic data from each participant: age, sex, marital status, living arrangements (alone or with family/friends), duration of VI (≤20 years or >20 years), number of years of education (≤12 or >12), occupational status (working or not working) and self-reported visual difficulty (mild, moderate, severe or unable to see at all). Socioeconomic status (SES) was assessed using the modified Prasad BG scale for Indian families.[31] This scale consists of five categories (lower class, lower middle class, middle class, upper middle class and upper class). However, for the purposes of the present study, we combined the intermediate categories resulting in three categories (upper, middle and lower). We collected the visual acuity data from the medical record and graded the severity of VI into mild, moderate, severe and profound.

Measures

The loneliness scale

The 20-item scale to measure loneliness was developed by Russell et al. and designed to measure subjective feelings of loneliness and social isolation.[32] Participants rated each item using three categories: O ('I often feel this way'), S ('I sometimes feel this way') and R ('I rarely feel this way'). The scale has been previously demonstrated to possess adequate measurement properties in terms of internal consistency, validity and test–retest reliability.[32] Higher scores on the scale indicated greater levels of loneliness.

Social network index

Social network includes all of a person's social contacts. It can be described along structural and interactional dimensions including size, source of ties, member homogeneity, frequency of contacts and opportunity for reciprocal exchange of support.[33]

The Social Network Index (SNI) developed by Cohen et al. consists of 12 questions that assess participation in 12 social relationships.[34] These include relationships with a spouse, parents, parents-in-law, children, friends, workmates, etc. The Index measures three aspects of social networks: network diversity, number of people in the network and number of embedded networks. Participants reported their participation in 12 social relationships and how many members of these relationships they communicate with at least once every 2 weeks. The SNI was scored per recommendation of the developers.[34]

Scoring in the network diversity subscale was derived from the number of social roles in which the participant had regular contact (at least once every 2 weeks) with at least one person. These include relationships with a spouse, parents, parents-in-law, children, other close family members, close neighbours, friends, workmates, schoolmates, fellow volunteers (e.g., charity or community work), members of groups without religious affiliations (e.g., social, recreational or professional) and members of religious groups. One point is assigned for each relationship (maximum score of 12) for which participants indicated that they speak to (in person or on the telephone) at least once every 2 weeks. The scoring in the number of people in network subscale is derived from the total number of people with whom the participant has regular contact (at least once every 2 weeks). The scoring in the number of embedded networks is derived from the number of different network domains in which a participant is active, and the maximum possible score is eight. They are family, friends, church/temple, school, work, neighbours, volunteering and groups.

Rasch-scaled modified WHOQOL questionnaire

We used the nine-item Rasch-scaled version of the modified World Health Organization Quality of Life (WHOQOL) questionnaire to assess the health-related quality of life (HRQoL) of our participants.[35] The questionnaire has been previously validated using Rasch analysis in our population.[35] Participants rated the nine items using a four-category rating scale and a lower questionnaire score indicated better HRQoL. For each patient, Rasch-scaled scores were obtained using the conversion provided in the earlier publication.[35]

Given that the 20-item loneliness scale and the SNI were not available in our two local languages, we translated them for the present study. We used standard guidelines for translation of questionnaires for each language version that consisted of two independent forward translations, reconciliation, back translation followed by cognitive debriefing in a representative sample of eight patients, using a multistage iterative process, prior to adapting it for local use.[36]

Psychometric assessment of loneliness scale

Rasch analysis was used to assess the psychometric properties of the loneliness scale. This was performed by using the Andrich rating scale model 23 with Winsteps software, version 5.5.0 (Winsteps.com).[37,38] The details of Rasch analysis have been described in detail previously.[39] Briefly, Rasch analysis converts raw questionnaire scores into data that approximate interval-level measurement expressed in log of the odds units (logits). A high (positive) person measure (in logits) indicated that a person possessed a high level of loneliness. Following minor amendments, including collapsing two response categories to dissolve thresholds and deleting three items iteratively (# 1, 3 and 6) due to misfit, the remainder of the 17 items fit the Rasch model and showed good fit statistics. The person separation reliability was 0.84 and targeting was −1.04 logits. Three categories of loneliness were formed based on the percentile logit scores: no loneliness (−5.01 to 0.70), moderate (>0.70 to 1.96) and severe (>1.96 to 4.99). There was no evidence of multidimensionality and none of the items displayed differential item functioning. The item 'I feel as if nobody really understands me' was most difficult to endorse and items 'I have nobody to talk to', 'there is no one I can turn to', 'I am no longer close to anyone', 'I feel completely alone', 'I am unable to reach out and communicate with those around me' and 'It is difficult for me to make friends' were least difficult to endorse. Ordinal ratings of the scale were then transformed to estimates of interval measures, which were used in subsequent regression analyses.

Statistical analysis

Statistical analyses were performed using SPSS software (version 28.0, ibm.com). Patients' demographics and baseline characteristics were summarised by means and SDs for normally distributed continuous data, and by counts and percentages for categorical data. Demographic and socioeconomic variables considered were age, sex, number of years of education, marital status, living arrangements, occupational status and SES. We used chi-square statistics and an independent sample test to compare group differences between VI and non-VI participants. Bivariate analyses were performed between the various sociodemographic variables, SNI scores from three subscales (network diversity, people in network and number of embedded networks), QoL and loneliness. A generalised linear model was used to determine the combined influence of all independent variables (sociodemographic variables, group allocation, SNI [using scores separately from each of the three subscales]) on loneliness. Categorical variables such as sex (male vs. female), number of years of education (≤12 vs. >12), occupational status (working vs. not working), marital status (single vs. married), living arrangement (alone vs. with others), SES (lower vs. higher) and group allocation (VI vs. non-VI) were entered as fixed factors. Age, the three subscale scores of SNI and WHOQOL-BREF score were included as covariates. In addition to the main effects, we included interaction terms in the model between group allocation and each of the three subscales of SNI (group*SNI score) because we hypothesised that the SNI may have different impacts on the VI and non-VI participants. If the interaction term was found to be significant, further analyses were performed to determine the significance of SNI scores between the two groups. Statistical significance was set at $p < 0.05$.

RESULTS

Participant characteristics

We included 422 adults in this study. Of these, 203 (48%) had VI and 219 (52%) were in the age-matched non-VI group. There were some significant differences between the two groups in terms of sex, marital status, occupational status and living arrangements (Table 1). Compared to the non-VI group (non-VI), there was a preponderance of males, a higher proportion of those who were unmarried, not working and living with family/friends among the VI group. Slightly less than two-thirds of those in the VI group ($n = 124$, 61%) reported the duration of VI as more than 20 years and about one-half of them reported facing moderate visual difficulties in their daily lives. Lack of independent mobility was reported by 20% of young VI adults.

TABLE 1 Participant characteristics.

Characteristics	Group		p Value
	Vision impairment ($n = 203$), N (%)	Non-vision impairment ($n = 219$), N (%)	
Age (years)			
Mean ± SD	25.5 ± 5.07	25.1 ± 4.67	0.11
Sex			
Male	156 (77)	110 (50)	**<0.001**
Female	47 (23)	109 (50)	
Education (no. of years)			
12 or less	80 (39)	83 (38)	0.83
More than 12	123 (61)	136 (62)	
Marital status			
Unmarried	160 (79)	150 (68)	**0.02**
Married	43 (21)	69 (32)	
Socioeconomic status			
Upper	34 (17)	35 (16)	0.71
Middle/lower	169 (83)	184 (84)	
Occupational status			
Working	99 (49)	131 (60)	**0.02**
Not working[a]	104 (51)	88 (40)	
Living arrangement[b]			
Alone	11 (6)	29 (14)	**0.007**
With family/friends	184 (94)	183 (86)	
Self-reported visual difficulty			
Mild	44 (22)		
Moderate	100 (49)		
Severe	53 (26)		
Unable to see at all	6 (3)		
Severity of vision impairment			
Mild	43 (21)		
Moderate	77 (38)		
Severe	53 (26)		
Profound	30 (15)		
Loneliness severity (logits)			
No loneliness	173 (85)	212 (97)	**<0.001**
Moderate	21 (10)	7 (3)	
Severe	9 (4)	0	
Social network Index subscales[c], Mean ± SD			
Network diversity	4.52 ± 1.37	5.57 ± 2.12	**<0.001**
People in network size	17.76 ± 8.15	22.67 ± 11.31	**<0.001**
Number of embedded networks	1.59 ± 1.14	2.22 ± 1.42	0.09

Note: Bold values (*p*-value) indicate statistical significance.

Abbreviation: SD, standard deviation.

[a]Includes students, homemakers and unemployed or searching for job.

[b]Data missing for eight and seven patients in VI and normal group, respectively.

[c]Higher scores indicate better network on all three subscales.

Prevalence of loneliness

The prevalence of moderate and severe loneliness in the VI group was 10% (95% CI: 6.5, 15.4) and 4.4% (95% CI: 2.0, 8.2), respectively. The rates of loneliness were consistently higher among the VI group compared with the control group (Table 1).

Types of social contacts

Regardless of the group assignment, the participants' most frequent regular and active contacts were their parents, spouse, friends and neighbours (Figure 1). However, participants in the non-VI group reported significantly higher numbers of regular and active contacts with religious groups and other volunteers (during volunteering activities) in their network when compared with the VI group ($p < 0.0001$ for both). The differences between the groups in the number of active contacts regarding various relationships such as parents-in-law, other students and people at work could be attributed to differences in the demographics.

Compared with the non-VI group, those with VI reported having fewer extended family members, neighbours and friends resulting in a significantly smaller network and network diversity in the SNI (Table 1). However, it should be noted that participants with VI were less likely to be married and this may partly explain this difference in the network size and diversity between the two groups. Nonetheless, there was no significant difference in the number of embedded networks between the two groups of participants.

Association between SNI, QoL and loneliness

On univariate analyses, participants with VI had a significantly higher proportion of moderate and severe loneliness compared with non-VI participants (Table 1). Also, the VI group had worse loneliness score than the non-VI group (-1.66 ± 2.25 vs. -2.13 ± 1.85 logits; $p = 0.03$). Those with ≤12 years of education had significantly worse loneliness scores than those with >12 years (-1.58 ± 2.45 vs. -1.82 ± 1.99 logits; $p = 0.01$). None of the other sociodemographic variables showed any significant association with loneliness.

The associations between social network, QoL and loneliness are shown in Table 2. Overall, we found a significant correlation between loneliness and QoL scores ($r = -0.16$, $p = 0.001$). However, subgroup analysis revealed a significant correlation for the non-VI group ($r = -0.24$, $p < 0.001$) and lack of a significant correlation for the VI group ($r = -0.06$, $p = 0.38$). Loneliness scores demonstrated a significant correlation with two of the three SNI subscales for the VI group as well as the non-VI group. We found an interaction between group allocation and only one of the SNI subscales (people in network size; $\beta = -0.09$, $p = 0.002$) suggesting that the loneliness score across this subscale was dependent on whether the participant belonged to the VI or non-VI group (Table 3). Further subgroup analysis indicated that participants in the VI group had significantly smaller number of people in their network compared to those in the non-VI group (Table 1), resulting in greater loneliness. However, there was no significant interaction between group allocation and the remaining two subscales of SNI (network diversity subscale; $\beta = 0.07$, $p = 0.47$ and number of embedded networks; $\beta = 0.16$, $p = 0.48$)
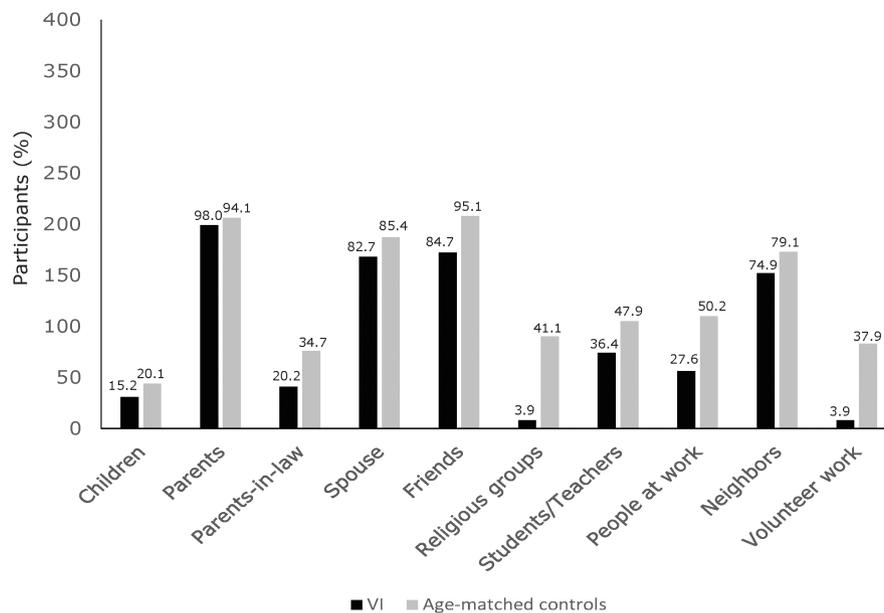
FIGURE 1 Distribution of active social network of young adults (aged 18–35 years) with vision impairment (VI) and an age-matched non-VI group.

TABLE 2 Associations between social network, quality of life (QoL) and loneliness in vision impaired and non-vision impaired groups.

Variable	Loneliness score, r^a (p)	SNI[b]—people in network size, r (p)	SNI—network diversity, r (p)	SNI—Number of embedded networks, r (p)	Quality of life score, r (p)
Vision impaired					
Loneliness score	1	**−0.28 (<0.001)**	0.06 (0.42)	**−0.22 (0.002)**	−0.06 (0.38)
SNI—People in network size	**0.28 (<0.001)**	1	0.03 (0.64)	**0.82 (<0.001)**	0.12 (0.09)
SNI—Network diversity	0.06 (0.42)	0.03 (0.64)	1	0.02 (0.84)	−0.04 (0.53)
SNI—Number of embedded networks	**−0.22 (0.002)**	**0.82 (<0.001)**	0.02 (0.84)	1	0.09 (0.20)
Quality of life score	−0.06 (0.38)	0.12 (0.09)	0.09 (0.20)	−0.04 (0.53)	1
Non-vision impaired					
Loneliness score	1	**−0.30 (<0.001)**	0.05 (0.47)	**−0.21 (0.002)**	**−0.24 (<0.001)**
SNI—People in network size	**−0.30 (<0.001)**	1	0.01 (0.85)	**0.85 (<0.001)**	**0.14 (0.04)**
SNI—Network diversity	0.05 (0.47)	0.01 (0.85)	1	0.01 (0.84)	−0.07 (0.33)
SNI—Number of embedded networks	**−0.21 (0.002)**	**0.85 (<0.001)**	0.01 (0.84)	1	0.08 (0.23)
Quality of life score	**−0.24 (<0.001)**	0.14 (0.04)	0.07 (0.33)	0.08 (0.23)	1

Note: Bold *p*-values indicate statistical significance.
[a]Pearson correlation.
[b]SNI, Social network index (see text for details).

suggesting that the loneliness score across these two SNI subscales was not significantly different between the VI and non-VI groups (Table 3).

Within the main effects, number of years of education ($\beta = 0.45$, $p = 0.04$) and QoL score ($\beta = -0.22$, $p = 0.02$) were found to be significant predictors, while the interaction effect of 'group by people in network size subscale of SNI' was also a predictor ($p < 0.001$) (Table 3).

DISCUSSION

This study is of particular interest because very few investigations have conducted empirical research into loneliness and social networks of young adults with VI. Loneliness is an important determinant of long-term health and functioning. These results show that nearly one in seven young adults with VI in India experienced moderate or severe loneliness, which was significantly higher than in the non-VI group. This is much lower than the reported prevalence of 52.2% of loneliness (moderate and severe) in a Norwegian young VI population (18–35 years).[4] Nonetheless, apart from the geographical variation between the two studies, there are other differences that should be borne in mind while drawing any comparisons. First, it should be noted that loneliness was assessed using a different measure (three-item loneliness scale). Second, their VI sample was drawn from the Norwegian Association of the Blind and Partially Sighted, while data for the controls were

extracted from the Life course Gender and Generation study (nationally representative sample of adults aged 18–79 years). Finally, the mode of questionnaire administration: telephonic in their study compared with in-person in the present investigation. Although there are no published reports of loneliness among VI individuals from India, a lower prevalence of loneliness (albeit in the general population) has been reported for collectivist countries such as India, compared with relatively higher prevalence in individualistic cultures.[16] In a population-based study of community-dwelling middle-aged and older adults (45 years and older) in India, the reported prevalence of moderate and severe loneliness was 20.5% and 13.3%, respectively.[40] Loneliness was, however, assessed using a single question from the Center for Epidemiologic Studies Depression Scale. Single-item scales are problematic given their suboptimal measurement properties, especially poor measurement precision (reliability).[41] By comparison, we used a multi-item scale (20 items) to assess loneliness, and more importantly, we validated it using Rasch analysis in our population. Consequently, we generated interval-level loneliness scores (rather than raw ordinal questionnaire scores) that were legitimate for use in parametric statistical tests.[42]

Given that vision is a key sensory modality in interpersonal interactions, people with VI are especially prone to loneliness and may have reduced social support than the general population.[43] In the present study, those with profound VI had significantly higher (worse) loneliness scores

TABLE 3 Association between socio-demographics, health-related variables and loneliness.

Variable	Beta coefficient (95% CI)	p Value
Sex, male[a]	0.26 (−0.18, 0.71)	0.25
Age, years	0.03 (−0.02, 0.003)	0.27
Number of years of education, up to 12 years[b]	0.45 (0.03, 0.86)	**0.04**
Employment status, working[c]	0.09 (−0.31, 0.49)	0.66
Marital status, single[d]	0.37 (−0.21,0.94)	0.21
Living arrangement, alone[e]	−0.07 (−0.76, 0.62)	0.85
Socioeconomic status, middle and high[f]	−0.11 (−1.94, 1.71)	0.90
Group, vision impaired[g]	0.52 (−0.97, 1.99)	0.49
Group[h] social network index—network diversity scale	0.07 (−0.12, 0.26)	0.47
Group[h] social network index—people in network size	−0.09 (−0.15, −0.03)	**0.002**
Group[h] social network index—number of embedded network	0.16 (−0.29, 0.61)	0.48
WHOQOL score	−0.22 (−0.41, −0.03)	**0.02**

Note: Bold values (*p* values), statistically significant.

Abbreviation: WHOQOL, World Health Organization Quality of Life-BREF questionnaire (Rasch-scaled version, see text for details).

[a]Versus female.
[b]Versus more than 12 years.
[c]Versus not working.
[d]Versus married.
[e]Versus with others.
[f]Versus low.
[g]Versus non-vision impaired.
[h]Interaction effects.

than those with moderate VI. Moreover, lack of independent mobility was reported by 20% of young VI adults. People who have severe VI or are totally blind have fewer opportunities to acquire appropriate social skills and may be vulnerable to adverse interpersonal events which may result in loneliness.

Furthermore, these results showed that the risk of loneliness was higher among those with relatively lower levels of education. That is, those with 12 years or less education reported feeling significantly greater loneliness than those with more than 12 years of education. In the Norwegian study, it was reported that adults with VI with 11–13 years of education were significantly lonelier than those with ≥14 years of education.[4] Taken together, these results suggest that education perhaps acts as a buffer against loneliness in young adults with VI.

Although we did not collect data regarding childhood history in terms of the participant's relationship with their peers and a history of bullying, these have been shown to

be associated with loneliness.[4] These are important variables and should be considered in future studies and any other such experiences in childhood that may shape a person's vulnerability to loneliness. While loneliness is likely to be an adversity that can occur among people from a diverse range of socioeconomic and family backgrounds, we did not find the SES to influence the loneliness scores in our study population. Perhaps the homogeneity in the SES of our sample, with nearly three-quarters of our participants belonging to the middle-income category, could be one of the reasons for the lack of influence of SES. Moreover, emotional problems or difficulties with peer relationships in childhood may be predictive of greater feelings of loneliness in young adulthood.[5] Given this, it is important to investigate these potential risk factors in future studies which can help to identify groups of children who are particularly vulnerable to becoming lonely in adulthood and to identify targets for preventative interventions.

In the present study, loneliness scores were negatively correlated with the two SNI subscales for both the VI and non-VI groups. Loneliness decreased with a larger number of people in the network and a greater number of embedded networks in both groups. These findings are in accordance with existing research that has documented the key role that social networks play in guarding against loneliness.[17,44] Social networks play an important role in providing access to resources such as information and social support, which can also impact health-related behaviours and act as a buffer during periods of stress.[45] Moreover, having more confidants or very close ties in one's network has been reported to be associated with lower levels of loneliness.[17] That is, higher network density has been shown to help guard against loneliness.[44] Although loneliness decreased with a larger number of people in their network, there was a significantly differential impact on the two groups; more in the non-VI group. This difference could be explained by the relatively small number of people in the network of the VI group. There was no such difference in the impact regarding 'the network diversity' and 'number of embedded networks' subscales of SNI across the two groups of participants. Taken together, these findings suggest that there may be a tendency for loneliness to reduce as a function of social network, albeit through the 'size of the network'. Nonetheless, it should be borne in mind that loneliness and social network (number of contacts with members in network) are two different concepts; while loneliness is a subjective feeling, the number of contacts is an objective measurement.[46,47] Although previous studies have reported that subjective experience of loneliness is more harmful to a person's health than the number of contacts in his/her network, we believe that any intervention to increase social activity may be warranted and valuable in young adults with VI. We found that regardless of the group assignment, the participants' most frequent regular and active contacts were their parents, spouse, friends

and neighbours. However, participants in the non-VI group reported significantly higher numbers of regular and active contacts with religious groups and other volunteers (during volunteering activities) in their network when compared with the VI group.

The significant association between loneliness and QoL shows that loneliness is a marker of poor functioning across many different domains of overall well-being and QoL. To reduce the public health burden of loneliness in later life, the experience of feeling lonely in this age group merits particular consideration. Of specific interest to clinicians is that limited social networking, in combination with general information deprivation, means that young adults with VI could experience more problems accessing eye care services as well as being less likely to receive optimal health care. Health professionals should be aware of the specific challenges of VI and the importance of good communication and information.

There is inconclusive evidence in the literature regarding sociodemographic and VI-related characteristics as risk factors for loneliness. For example, the association between gender and loneliness has been inconsistent with some studies showing that females are lonelier than males[48,49] and others showing the opposite.[50,51] We did not find a correlation between gender and the loneliness score, perhaps indicating that loneliness among young adults with VI is equally experienced by men and women. Similarly, the loneliness scores were comparable across factors such as marital status, occupational status, living arrangements and duration of VI. Previous studies have demonstrated an association between psychological health and loneliness in different age groups.[52] However, we did not assess the psychological health of our study sample. Low vision rehabilitation for persons with VI should incorporate psychological, social and vocational services, and the person's ability to understand and adapt to the sequelae of vision loss must be addressed by the team of low vision rehabilitation service providers.

The strengths of this study include a large sample size, use of validated instruments, an age-matched control (non-VI) group and assessment of a broad spectrum of measured covariates in young adults with VI. Nevertheless, the study had some limitations. First, as loneliness was measured cross-sectionally, the directionality of the associations could not be tested. Further longitudinal research is needed to advance causal hypotheses about the observed associations. Second, it was not possible to investigate the stability of loneliness from childhood to adulthood. Different trajectories of loneliness during childhood and adolescence may predict different outcomes.[53] Third, our sample was recruited from a single centre in South India and may not be representative of the entire country. More importantly, these results may not be transferable to other countries. Also, there may have been a selection bias in that the non-VI participants were people who accompanied the patients to the clinic, which indicates that patients with VI had at least one person (family member, relative,

colleague, friend) in their social network who could escort them to important places in case of need. However, it is difficult to know whether the support was limited to escorting the patient with VI or whether this was extended to other occasions as well. While such support could have reduced the amount of loneliness, we cannot be certain about this given the lack of additional data (such as extent and type of support provided). Furthermore, the same explanation also applies to non-VI participants as they had at least one person (patient with VI) in their network. The inclusion of staff of LVPEI in the non-VI group may also be a biased sample, as they have many work colleagues in their social network. The lack of a randomised control group is a major limitation of this study. Despite our efforts to recruit age- and gender-matched participants in the non-VI (control) group, there is a chance that the significant differences observed between study groups could be due to the recruitment strategy that was applied, as randomisation was not conducted.

In conclusion, loneliness was commonly experienced by young VI adults compared to their healthy peer group, and the risk of loneliness was higher among those with relatively lower levels of education. Loneliness decreased with having a larger number of people in the network, and the tendency for loneliness scores to decrease as a function of social network suggests that any intervention to increase social activity (e.g., removing social and cultural barriers to participation and integration through public awareness campaigns to address general attitudes) and participation may be valuable in young adults with VI.

AUTHOR CONTRIBUTIONS
Vijaya K. Gothwal: Conceptualization (lead); data curation (lead); formal analysis (lead); funding acquisition (supporting); investigation (equal); methodology (equal); project administration (equal); software (lead); supervision (lead); validation (lead); visualization (lead); writing – original draft (lead); writing – review and editing (lead). **Jahnavi Kanchustambam:** Data curation (supporting); investigation (supporting); methodology (supporting); project administration (supporting); supervision (supporting); visualization (supporting); writing – review and editing (supporting). **Krishnapriya Kodavati:** Data curation (supporting); investigation (equal); methodology (equal); project administration (equal); supervision (equal); visualization (supporting); writing – review and editing (equal). **Ahalya Subramanian:** Conceptualization (equal); data curation (supporting); funding acquisition (lead); methodology (supporting); resources (supporting); validation (supporting); writing – original draft (supporting); writing – review and editing (supporting).

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CONFLICT OF INTEREST STATEMENT

The authors report no conflict of interest and have no proprietary interest in any of the materials mentioned in this article.

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