# Determination and evaluation of Sense of Coherence in women in semi-urban Nepal: A part of the Heart-health Associated Research, Dissemination, and Intervention in the Community (HARDIC) Trial

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## Abstract

### Background

Sense of coherence (SOC) is a core concept of salutogenesis which relates to individuals' overall life orientation. Stronger SOC associates with better coping strategies, better health, and better quality of life. Although the SOC-questionnaire is validated in many cultures and languages, it has not, to date, been applied in Nepal.

### Objective

To determine and evaluate women's SOC before and after a health education intervention.

### Method

This study was conducted as a part of the Heart-health Associated Research, Dissemination, and Intervention in the Community in the semi-urban Jhaukhel-Duwakot Health Demographic Surveillance Site in Nepal. Jhaukhel and Duwakot were selected as the control and intervention areas, respectively. Participants were women with children aged 1–7 years. 857 women before and 1,268 women after the health education intervention participated in the study. The statistical analysis was carried out with chi-square tests and one-way uni-variate ANOVA.

### Results

Women's total SOC mean values at baseline were 51.1-57.4 and at follow up 54.4-54.9 in the intervention and control area, respectively. At baseline, SOC was significantly weaker in the

intervention area compared to the control area ($p < 0.001$). At follow-up three months later, SOC was significantly stronger in the intervention area than in the control area ($p < 0.001$).

**Conclusion**

Nepalese women had weaker SOC than women in high-income countries, but comparable to neighboring country India with similar cultural features. Empowerment of women through community participation and health education strengthened SOC. The SOC-13-questionnaire in its Nepali version is recommended to be further evaluated.

**Keywords**

Sense of coherence, health promotion, quality of life, non-communicable disease, health education

## Introduction

Salutogenesis represents an orientation and resource perspective that focuses on improving and maintaining health and well-being, rather than on factors that cause disease.[1] Sense of coherence (SOC) is the core concept of salutogenesis, and reflects people's overall ability to deal with and cope with a range of challenging life events.[2] Consequently, strong SOC is a predictor of health,[3] psychosocial well-being, quality of life [4-6] and good perceived emotional health.[7] Strong SOC positively associates with better general health,[8-10] better mental health and well-being,[11] an individual's coping abilities and stress tolerance [12,13] as well as lower stress levels.[14]

Our research group earlier developed the Heart-health Associated Research, Dissemination, and Intervention in the Community (HARDIC) trial to address cardiovascular health in the Jhaukhel-Duwakot Health Demographic Surveillance Site (JD-HDSS) in Nepal.[15, 16] Interestingly, the health education intervention improved women's knowledge, attitude, and practice (KAP)

regarding dietary habits and physical activity and thereby empowered omen.[17] Understanding SOC, and how a health education intervention may influence SOC levels, provides insights into women's coping abilities with different life events and contributes to a deeper understanding of how health education can affect SOC.

The SOC-questionnaire is validated in different cross-cultural settings worldwide.[18-21]To our knowledge, no studies have determined and evaluated SOC in the Nepalese context. Therefore, our study aimed to determine and evaluate women's SOC before and after a health education intervention.

# Methods

## Study design and participants

This study was conducted in parallel and as part of the HARDIC community-based trial – a trial focusing on health education on diet and physical activity to promote cardiovascular health in JD-HDSS [15]. Details of the trial are described elsewhere; [22] trial registration number NCT03639402 at ClinicalTrials.gov. CONSORT checklist was followed to report this study (appendics 1).

In the current SOC-study, criteria for inclusion were mothers with at least one child aged 1–7 years who lived in the JD-HDSS and were willing to participate in the SOC determination. Eligible mothers were enrolled in either the intervention area (Duwakot) or the control area (Jhaukhel), based on the study setting for HARDIC as outlined below. SOC was determined twice through a Nepali version of the SOC-13 questionnaire. First, before the HARDIC trial started (baseline) with 419 and 438 mothers in Duwakot and Jhaukhel, respectively. Second, after the HARDIC trial (follow-up) with 619 and 649 mothers in Duwakot and Jhaukel, respectively (Figure 1).

67 **Study setting**

68 JD-HDSS is located in a semi-urban area outside Kathmandu, Nepal.[15]In the HARDIC trial, two
69 similar villages (Duwakot and Jhaukhel) were randomly selected as the intervention and control
70 areas for the health education intervention. Both communities consist of nine administrative wards.
71 [23]The current SOC-study was conducted in the same wards in each community as in HARDIC.

72 **Data collection**

73 Data were collected using the SOC-13 questionnaire, which contains 13 items with a 7-point Likert
74 response scale that ranges from "very often" to "very seldom or never". [9] First, we translated the
75 English version of SOC-13 into Nepali. Second, two independent assistants back-translated it into
76 English. Third, we verified the validity of the translation by pretesting the questionnaire in a setting
77 similar to JD-HDSS among 25 women with different education levels. Following the pretest, we
78 made only minor adjustments. Finally, our research team trained enumerators (high school
79 graduates) and supervisors (Bachelors of Science in Public Health) on how to answer the translated
80 version of the SOC-13 questionnaire so that they could assist the respondents if necessary during
81 the data collection.

82 We collected SOC baseline data in September–October 2016, concurrently with the start of
83 the HARDIC intervention. HARDIC applied the peer education concept, as described in Oli et al.
84 [22] The peer mothers answered the SOC-questionnaire just before their HARDIC educational
85 training started. Fellow mothers completed the questionnaire during their first class, which was
86 conducted by the peer mothers. In the intervention area, three supervisors interviewed both peer
87 and fellow mothers during data collection, based on the SOC-questionnaire. In the control area,
88 nine enumerators collected SOC-data from eligible mothers through door-to-door visits. When

more than one eligible mother was present in the household, a lottery system was applied to select one mother per household for interview. [24]

**Follow-up**

The follow-up for SOC was conducted January–February 2017 and coincided with the HARDIC follow-up three months after the health education intervention. A total of nine enumerators and three supervisors collected the SOC-data during the follow-up through door-to-door visits in both the intervention and control areas. As these were door-to-door visits, one eligible mother per household was included. The numbers for enrolment, intervention, and follow-up of mothers are shown in Figure 1.

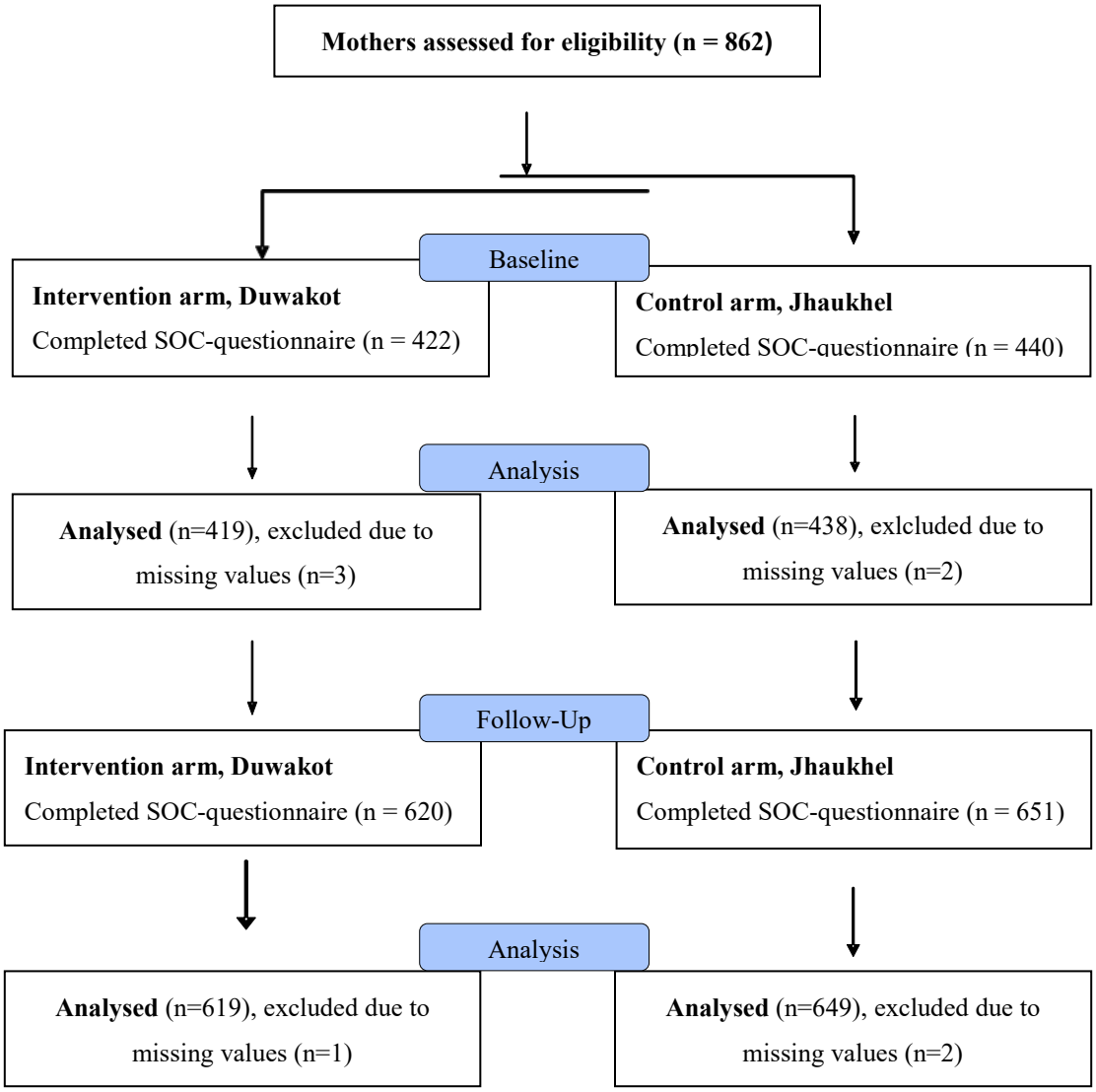


**Figure 1.** Enrollment, follow-up, and allocation of the participants for SOC determination at baseline and follow-up.

## Statistical analyses

Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 24). The range for individual items on the SOC-13 scale is 1–7, giving a total score for the scale of 13–91. We calculated SOC-scores as mean (m) and standard deviation (SD), according to the total score obtained. Chi-squared tests were applied on categorized data and one-way uni-variate ANOVAs to

130 determine the association between age, income, and educational level and total SOC-score as an
131 outcome. Further, we identified and replaced missing values in each group of questions as imputed
132 mean values.[25] We assumed that missing values were randomly distributed and verified this
133 assumption by creating a dummy-variable 0 for missing values and 1 for other values.
134 Questionnaires missing more than two responses in each sub-group of the SOC were excluded from
135 the analysis. We excluded eight women altogether from baseline and follow-up in the final analysis
136 because of missing values in their SOC questionnaires. Hence, 1,038 women from the intervention
137 area and 1,087 women from the control area were included in the final analysis.

138 **Additional analyses**

139 The lack of a panel follow-up setting was compensated for by the inclusion of interaction terms for
140 the area (intervention vs. control) x time (before vs. after the intervention) in a multiple variable
141 ANOVA. In the model, income and educational level were included as covariates. We extended
142 the analysis by randomly deleting a number of participants equal to the number by which both the
143 intervention and control groups had increased.

144 **Ethical Considerations**

145 Ethical permission was granted by the Nepal Health Research Council (Ref. 2418, 14 July, 2016).
146 Information about the study was given orally in Nepali before the study, and all participants
147 provided verbal consent. Study participants were also informed that they could leave the study at
148 any time. All data were secured in locked cabinets to ensure participants' confidentiality, without
149 access by any external person. During baseline measurement, peer mothers received a boxed lunch
150 and travel allowance; fellow mothers received 200 Nepalese rupees (NPR) (1 USD=117.05 NPR)
151 per woman. During follow-up measurement, all participants received 300 NPR as an incentive.

152

# Results

The final analyses at baseline included 857 eligible mothers, 419 from the intervention area and 438 from the control area. At follow-up, 1,268 eligible mothers with 619 from the intervention and 649 from the control area were included in the final analyses (Figure 1 and Table 1).

## Sociodemographic characteristics of the women

The sociodemographic characteristics of participants in Duwakot and Jhaukhel are described in Table 1. At baseline, before the intervention, participants in the control area were significantly better educated ($p < 0.001$), older ($p < 0.001$), had lower incomes ($p = 0.001$) and exhibited a different professional distribution ($p < 0.001$) compared with participants in the intervention area (Table 1). At follow-up, we observed a significantly higher educational level ($p < 0.001$) and different professions ($p < 0.001$) in the intervention area as compared to the control area (Table 1).

**Table 1:** Sociodemographic characteristics of the study participants in the intervention and control areas at baseline and follow-up

| | **Baseline** | | | | **Follow-up** | | |
|---|---|---|---|---|---|---|---|
| | | **Duwakot, Intervention n=419 (%)** | **Jhaukhel, Control n=438 (%)** | ***P*-value[1]** | **Duwakot, Intervention n= 619 (%)** | **Jhaukhel, Control n=649 (%)** | ***P*-value[1]** |
| **Educational level** | Illiterate | 34 (8.1) | 50 (11.4) | < 0.001 | 45 (7.3) | 10 (1.5) | < 0.001 |
| | ≤ 5 grade | 86 (20.5) | 63 (14.4) | | 178 (28.8) | 235 (36.2) | |
| | 6–10 grade | 149 (35.6) | 164 (37.4) | | 200 (32.3) | 204 (31.4) | |
| | 11–12 grade | 65 (15.5) | 79 (18.0) | | 137 (22.1) | 134 (20.6) | |
| | >12 grade | 20 (4.8) | 77 (17.6) | | 46 (7.4) | 51 (7.9) | |
| | Missing | 65 (15.5 ) | 5 (1.1) | | 13 (2.1) | 15 (2.3) | |
| **Age group** | ≤ 26 years | 84 (20.0) | 101 (23.1) | < 0.001 | 159 (25.7) | 167(25.7) | 0.121 |
| | 27–36 years | 182 (43.4) | 294 (67.1) | | 374 (60.4) | 419 (64.6) | |
| | > 36 years | 91 (21.7) | 36 (8.2) | | 64 (10.3) | 49 (7.6) | |
| | Missing | 62 (14.8) | 7 (1.6) | | 22 (3.6) | 14 (2.2) | |
| **Income (NPR)[2]** | ≤ 15000 | 165 (39.4) | 229 (52.3) | 0.001 | 266 (43.0) | 271 (41.8) | 0.271 |
| | 15001–30000 | 114 (27.2) | 110 (25.1) | | 259 (41.8) | 287 (44.2) | |
| | 30001–45000 | 16 (3.8) | 18 (4.1) | | 34 (5.5) | 34 (5.2) | |
| | ≥ 45001 | 31 (7.4) | 17 (3.9) | | 32 (5.2) | 41 (6.3) | |
| | Missing | 93 (22.2) | 64 (14.6) | | 28 (4.5) | 16 (2.5) | |
| **Profession** | Housewife | 196 (46.8) | 297 (67.8) | <0.001 | 487 (78.7) | 409 (63.0) | <0.001 |
| | Employed[3] | 25 (6.0) | 82 (18.7) | | 48 (7.8) | 67 (10.6) | |
| | Agriculture | 100 (23.9) | 33 (7.5) | | 22 (3.6) | 94 (14.5) | |
| | Business | 39 (9.3) | 22 (5.0) | | 17 (2.7) | 34 (5.2) | |
| | Other | 5 (1.2) | 2 (0.5) | | 34 (5.4) | 38 (5.9) | |
| | Missing | 54 (12.9) | 2 (0.5) | | 11 (1.8) | 7 (1.1) | |

1. *P*-values are based on chi-squared tests for comparison of the situation before and after the intervention.
2. (NPR) Nepalese rupees, (1 USD = 119.44 NPR).
3. Employment in both the private and public sectors.

## Total SOC score at baseline and follow-up

The women's total SOC in the intervention and control areas at baseline and follow-up ranged from 26–88 and 19–85, respectively (Table 2). In a univariate ANOVAs analysis, the mean (SD) SOC-score for all participants at baseline was 51.1 (8.6) to 57.4 (9.2) and during follow-up, 54.4 (9.2) to 54.9 (8.9) in the intervention and control areas, respectively.

191 At baseline, SOC was significantly weaker in the intervention area compared to the control
192 area ($p < 0.001$). At follow-up, SOC was stronger in the intervention area ($p < 0.001$) and weaker
193 in the control area ($p < 0.001$) (Table 2). However, the SOC level was not significantly different at
194 follow-up between Duwakot and Jhaukhel ($p = 0.315$). In univariate ANOVAs, total SOC at
195 baseline (for the responses from both the intervention and control areas) was not associated with
196 educational level but was positively associated with higher age ($p < 0.01$). Moreover, an analysis
197 of interaction terms for area x time of the multiple variable ANOVA, adjusted for income and
198 educational level, showed the strongest relative significant increase of SOC scores in the
199 intervention area as compared to the control.

200 **Table 2:** Total SOC and differences between intervention and control area at baseline and follow-up
201

| | | **Baseline** | | **Follow-up** | |
|---|---|---|---|---|---|
| | | **Duwakot (Intervention) n=419** | **Jhaukhel (Control) n=438** | **Duwakot (Intervention) n=619** | **Jhaukhel (Control) n=649** |
| | | | | | |
| | Mean | 51.1 | 57.4 | 54.9 | 54.4 |
| | SD | 8.6 | 9.6 | 8.9 | 9.2 |
| **95% CI for mean** | Lower Bound | 50.3 | 56.5 | 54.2 | 53.7 |
| | Upper Bound | 52.0 | 58.3 | 55.6 | 55.1 |
| | Minimum | 26 | 32 | 27 | 19 |
| | Maximum | 85 | 88 | 81 | 85 |
| **Significant differences (p)[1]** | Between groups | $p < 0.001$ | | $p = 0.315$ | |
| | | $p < 0.001$ between Duwakot, at baseline and follow-up<br>$p < 0.001$ between Jhaukhel, at baseline and follow-up | | | |

202 CI= Confidence interval, SD= Standard deviation
203 [1]p-values are based on the ANOVA test by comparing total SOC for both areas.
204

205

## Demographic characteristics of women in relation to total SOC

Table 3 describes women's total SOC in relation to their demographic characteristics at baseline and follow-up.

**Table 3:** Women's total SOC in relation to their sociodemographic characteristics at baseline and follow-up

| Demographic characteristics | Baseline | | | | Follow-up | | |
|---|---|---|---|---|---|---|---|
| | | Duwakot, Intervention n=419 Mean (SD) | Jhaukhel, Control n=438 Mean (SD) | p-value | Duwakot, Intervention n=619 Mean (SD) | Jhaukhel, Control n=649 Mean (SD) | p-value |
| **Educational level** | Illiterate | 51.24 (7.0) | 56.27 (9.6) | 0.011 | 55.42 (9.5) | 57.10 (7.8) | 0.605 |
| | Grade ≤5 | 51.08 (7.3) | 55.82 (10.1) | 0.001 | 55.57 (8.8) | 54.64 (8.7) | 0.284 |
| | Grade 6–10 | 50.73 (8.0) | 58.06 (10.1) | <0.001 | 53.91 (9.1) | 55.06 (9.2) | 0.207 |
| | Grade 11–12 | 49. 98 (9.6) | 57.51 (8.5) | <0.001 | 55.34 (8.4) | 53.61 (9.3) | 0.108 |
| | > 12 grade | 50.61 (10.9) | 58.16 (8.7) | 0.001 | 53.99 (8.8) | 51.71 (11.1) | 0.268 |
| | Missing | 53.35 (10.1) | 57.20 (13.3) | 0.423 | 57.19 (8.7) | 55.20 (9.9) | 0.580 |
| **Age group** | ≤26 years | 52.29 (6.0) | 56.92 (9.9) | <0.001 | 53.82 (8.0) | 54.17 (8.6) | 0.717 |
| | 27–36 years | 49.65 (9.1) | 57.72 (9.6) | <0.001 | 55.52 (9.1) | 54.39 (9.6) | 0.085 |
| | >36 years | 51.32 (8.3) | 56.94 (7.9) | 0.005 | 54.02 (9.3) | 55.08 (7.5) | 0.419 |
| | Missing | 52.39 (5.4) | 56.33 (8.4) | 0.294 | 51.45 (8.4) | 50.75 (11.6) | 0.849 |
| **Income (NPR)** | ≤ 15000 | 50.27 (8.3) | 57.79 (9.4) | <0.001 | 54.76 (9.2) | 53.92 (9.6) | 0.339 |
| | 15001-30000 | 51.13 (8.0) | 57.71 (9.9) | <0.001 | 55.30 (8.6) | 54.28 (9.0) | 0.140 |
| | 30001-45000 | 50.83 (7.0) | 56.74 (7.5) | 0.026 | 54.33 (8.7) | 55.60 (7.4) | 0.818 |
| | ≥45001 | 50.40 (7.0) | 54.94 (9.9) | 0.070 | 53.41 (8.7) | 55.37 (9.5) | 0.319 |
| | Missing | 51.60 (9.9) | 56.65 (9.7) | 0.005 | 53.57 (8.7) | 58.20 (7.7) | 0.096 |

NPR= Nepalese rupees (1 USD = 117.05 NPR)

### At baseline

At baseline, total SOC was weaker in the intervention area compared to the control area in relation to educational level, age group, and income level (Table 3).

### At follow-up

There were no significant differences between the intervention and control areas regarding total SOC according to participants' education level, age, and income at follow-up.

## Discussion

We determined and evaluated women's SOC in JD-HDSS, a semi-urban area of Nepal using a Nepali version of the SOC-questionnaire. Total SOC mean values of women ranged between 51 and 57. In our study, women's SOC levels increased significantly after a health education intervention. To our knowledge, the present study is the first to determine and evaluate SOC in Nepal and to show that health education is able to strengthen SOC in this context.

The mean score for women's total SOC was weaker in our study than women's SOC in high-income countries, with a mean SOC score in Finland of 66, [26] in Sweden of 61 to 74, [27] and in Germany of 64.[28] Such comparisons with different cultures and countries are essential as SOC associates with both internal and external resources for health [9] and strong SOC associates with better health [3] and healthy lifestyle choices. [29] Interestingly, mothers in India exhibit a total SOC mean score of 54. [30] Similarly, students in India have a total SOC mean score of 52. [31]Like India, a lower-middle income country with a similar cultural context, Nepalese women in our study also exhibit a weaker SOC. Thus, it is reasonable that weaker SOC levels may be attributed to the cultural differences between countries with different income levels. This may explain why Nepalese women have similar SOC level to their counterparts in neighboring India.

Our study demonstrates that a health education intervention is able to strengthen Nepalese women's SOC, particularly considering the analysis of the interaction terms and despite the lack of a panel follow-up setting. In contrast, the women's total SOC score was stronger in the control

area at baseline but weaker during follow-up. We found that women in the control area at baseline were older and had a higher education level. This may explain the stronger SOC in the control area at baseline, as previous research has demonstrated that older age is associated with stronger SOC. [32] However, at follow-up, we found that total SOC was higher in the intervention area. Several factors may have influenced the changes in SOC over this time. Changes in participants' sociodemographic characteristics in the intervention and control areas partially explain the significant changes between baseline and follow-up (e.g., education, age, and income). However, the analysis of interaction terms shows that the significant and relatively high increase in SOC scores cannot be attributed merely to differences in initial sociodemographic characteristics as these variables were included as co-variates in the multivariate ANOVA. Neither could this increase be attributed to changes in these background factors during follow-up.

Our study determined SOC with a relatively short follow-up period of three months. We are therefore unable to predict any long-lasting effects of the health education intervention on SOC. An earlier study from Finland indicates that an intervention that includes long-term follow-up (6 months) can strengthen SOC [33]. However, despite the follow-up period being only three months, we identified stronger SOC in the intervention area compare to the control area after the HARDIC intervention with focus on diet and physical activity to promote cardiovascular health.

Interestingly, a study conducted in Iran found that an intervention focusing on empowerment and self-management increased the SOC level among CVD patients.[34] This suggests that training with understandable information and encouragement can involve patients in decision making about their health and thereby strengthen their SOC. [34] Another prospective longitudinal study in patients with morbid obesity from Norway shows that education has a positive effect on SOC as well as health-related quality of life, which persists at a 12-month follow-up.[35] Taken

262 together, it is evident that health education strengthens SOC, regardless of cultural context.
263 However, the health education intervention in our study was not primarily designed to influence
264 SOC but rather to increase the mothers' knowledge of healthy food and lifestyles affecting
265 cardiovascular health and to strengthen KAP. [23] The increased SOC in the intervention area can
266 therefore be explained by the empowerment of women through HARDIC which increased
267 knowledge and strengthened KAP regarding cardiovascular health. [24]

268 **Limitations**

269 Like other community-based studies, our study has some limitations. A panel follow-up setting
270 was not possible in our study. First, there is no proper tracking system in Nepal as people do not
271 have a personal identification number; second, there is an absence of street and house numbers. It
272 was therefore not possible to identify the same participants at baseline and follow-up. However,
273 we measured SOC at the group level by comparing the communities rather than the individual
274 level.

275 Additionally, the total number of households with eligible participants had increased to a similar
276 extent in both intervention and control area at follow-up. Internal migration in Nepal is common
277 [36], and the major earthquake in 2015 has resulted in substantial movement and migration of people.
278 Since follow-up with the same mothers was not possible, this may have affected the results.
279 However, a strength of our study is that additional statistical analysis confirmed that the changes
280 in the mothers' SOC did not occur because of the increased number of mothers or due to changes
281 in their sociodemographic data. Thus, the results indicated significant differences between the
282 control and intervention areas. As the SOC is a core concept within the theory of salutogenesis [7],
283 the determination and evaluation of SOC among women in Nepal despite the methodological

challenges is also a major strength of this paper. Our research has, therefore, opened a new route for future salutogenic research in Nepal.

The SOC questionnaire is a pretested and validated instrument from a cultural perspective and has been used in different cultures and languages in several countries and is psychometrically sound. [37] However, despite back-translation, evaluation, and pretesting of the SOC-13 Nepali questionnaire, and the help of enumerators and supervisors, some respondents reported difficulties in understanding the questions. Such challenges in understanding the questionnaire may have contributed to some of the missing values in our study. Indeed, during baseline, several items were left unanswered despite the presence of supervisors and enumerators who facilitated the mothers' understanding of the questionnaire through clarification when needed. Having identified this issue at baseline, the enumerators were more conscious of the problem during follow-up which resulted in fewer unanswered questions/missing values. Indeed, earlier studies report that cultural origin can influence SOC response patterns and understanding of SOC, leading to missing values. [38] Thus, the Nepali version of SOC-13 would benefit from further evaluation to explore the challenges and difficulties experienced by respondents.

## Conclusions

Nepalese women have weaker SOC (total SOC mean values 51-57) than women in high-income countries, but comparable to neighboring country India with similar cultural features. Empowerment of women through community participation and health education strengthens SOC. However, we recommend that the Nepali version of the questionnaire be further evaluated to explore identified methodological challenges.

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## Conflict of interests

The authors declare that there is no conflict of interest.

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