1   **Impact of a music therapy program on mental health and school attendance among**

2   **female adolescents in Kasai Central province, Democratic Republic of Congo**

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8 **ABSTRACT**

9 *Background:* To assess whether a music therapy program improved children's mental health

10 and school attendance following economic and conflict-associated insecurity in the Democratic

11 Republic of Congo (DRC).

12 *Methods:* This study included 483 girls aged 10-14 who participated in a music therapy program

13 supported by World Vision and Make Music Matter in 2 sites within Kasai-Central province,

14 DRC. The organizations implemented Make Music Matter's Healing in Harmony (HiH) program.

15 Participants completed a pre-test, a post-test, and up to two follow-up interviews after

16 completing the program. Interviews ascertained information on depression, anxiety, self-esteem

17 and school attendance. Generalized estimating equations were used to estimate mean change

18 in mental health and school attendance scores and relative risks (RRs) for screening positive.

19 *Results:* Before starting the HiH program, 36.0% (95% CI=31.7%- 40.3%) and 60.5%

20 (CI=56.1%- 64.8%) screened positive for depression and anxiety, respectively. The probability

21 of screening positive for anxiety declined by about half post-participation in HiH compared to the

22 pre-test (RR=0.46, 95% CI=0.41-0.53). The probability of screening positive for depression

23 declined by about 75% (RR=0.27, 95% CI=0.22-0.32). These declines were sustained for up to

24 17 months at follow-up interviews. The mean score for self-esteem increased significantly by

25 3.93 points (95% CI=3.22, 4.64, p<0.001) from the pre-test to the post-test. Program

26 participants had an average absenteeism rate of 10% (95% CI=7.2%, -12.6%) at the pre-test,

27 which decreased significantly to 5.4% at the post-test (RR=0.54, 95% CI=0.40, 0.73),

28 representing a 46.6% reduction.

29 *Conclusion*: Participation in the HiH program was associated with significant improvement in

30 children's mental health, as measured by depression and anxiety sustained up to 17 months

31 after completion of the program. In addition, the HiH program was associated with a significant

32 improvement in self-esteem and school attendance rates. These data provide additional

33   evidence supporting the value of providing psychological care for children and adolescents in

34   the context of ongoing humanitarian crises and provide initial insights into the role of mental

35   health interventions in improving school attendance.

36

37   **IMPACT STATEMENT**

38   This study advances the global understanding of effective interventions to improve mental

39   health among children in conflict settings. Exploring the impact of Healing in Harmony, a music

40   therapy program, on mental health outcomes as well as school attendance provides critical

41   insights into addressing the unique needs of trauma-affected children exposed to conflict in low-

42   and middle-income country contexts. This paper contributed to the evidence base for effective

43   programming in these vulnerable populations. The study was carried out in the Kasai Central

44   province in the Democratic Republic of Congo (DRC) among 10–14-year-old girls. We found

45   that participating in the Healing in Harmony program was associated with significant

46   improvement in the children's mental health. Moreover, these positive benefits were observed to

47   last up to 17 months after girls complete the program.

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49   Key Words: Anxiety, Depression, School Attendance, Humanitarian Crisis, Mental Health,

50   Democratic Republic of Congo, Music Therapy

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51 "I start to walk alone
52 The desire for suicide crosses my mind
53 In the group with whom I now sing
54 I have been encouraged, and I am moving forward."
55 (Dinanga Enfants Solidaires, 2022, Ndi Muana Mubanda Mupongo)
56
57 **Introduction**

58 An estimated 142 million children live in conflict areas, 24 million of whom will require mental

59 health support because of the trauma they experience (Cowley et al., 2019). This is the reality

60 for hundreds of thousands of children in Kasai Central province of the Democratic Republic of

61 Congo (DRC). Following the civil wars in 1996-1997 and 1998-2003, several provinces in the

62 eastern DRC continued to experience economic and conflict-related instability (Warren, 2011),

63 with their populations suffering from conflict-associated trauma (Campbell et al., 2009; Chen et

64 al., 2010; Ba & Bhopal, 2017; Dossa et al., 2014). Additional conflicts in 2016 and 2017 within

65 Kasai Central Province caused more than 3,300 deaths, 1.4 million internally displaced persons,

66 and the destruction of over 400 schools (UN Human Rights Council, 2018). Children within the

67 area had their school disrupted for up to two years (UNICEF, 2017), the challenges of which

68 were compounded by the COVID-19 pandemic. Providing evidence-based psychological

69 services to children and adolescents to reduce the mental health consequences of trauma in the

70 context of ongoing humanitarian crises is critical to healing trauma and improving resiliency

71 (Ceccarelli, C., 2024; Bangpan et al., 2024; Purgato et al., 2018; Murray et al., 2018; Bass et al.,

72 2013).

73

74 While data on the effectiveness of mental health interventions in humanitarian crises is limited

75 (Kamali et al., 2020), emerging evidence supports their value in low- and middle-income

76 countries (LMICs) (Ceccarelli et al., 2024; Alozkan-Sever et al., 2023; Uppendahl et al., 2019;

77 Bangpan et al., 2024; Purgato et al., 2018; Morina et al., 2017). Two recent meta-analyses

78 focused on adults. One found that psychotherapy reduced PTSD and depression in survivors of

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79   mass violence (Morina et al., 2017), while the other showed that mental health services reduced

80   PTSD and improved functioning in adults affected by humanitarian crises in LMICs (Bangpan et

81   al., 2019).

82

83   Three recent meta-analyses have included studies that enrolled children and adolescents. One

84   meta-analysis (7 studies, n=130) found PTSD improved post-treatment, but the effect was not

85   sustained at four months (Purgato et al., 2018). In contrast, a larger meta-analysis (13 studies,

86   n=2626) of psychological interventions in LMICs found cognitive-behavioral therapy and group-

87   based approaches effectively reduced PTSD, depression, and anxiety (Alozkan-Sever et al.,

88   2023; Uppendahl et al., 2020). A third meta-analysis of 43 randomized clinical trials also

89   reported that cognitive-behavioral therapy improved depression symptoms in children and

90   adolescents affected by humanitarian emergencies (Bangpan et al., 2024). Another review

91   highlighted that most studies focused on program implementation rather than the impact on

92   mental health outcomes (Ceccarelli et al., 2024).

93

94   The relationship between mental health and schooling in LMICs is increasingly recognized

95   (Aston et al., 2023). Schools, which play a crucial role in providing health education and

96   services where healthcare systems are lacking (Sawyer, 2021), are exploring how school-based

97   interventions can enhance mental health and well-being (Partap et al., 2023; Grande et al.,

98   2023). Despite limited research on the impact of mental health interventions on school

99   attendance, two recent meta-analyses have highlighted the link between anxiety and

100   absenteeism or truancy (Dalforno et al., 2022; Finning et al., 2019).

101

102   Emerging evidence suggests that music therapy that is coupled with lyrical music training can

103   be effective in reducing anxiety, depression, and PTSD (Carr et al., 2012; Carr et al., 2013;

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104 Landis-Shack et al., 2017; Erkkilä et al., 2011; Aalbers et al., 2017). As music has been shown

105 to stimulate brain areas related to traumatic memory and sensory-emotional processing

106 (Koelsch, 2009), research suggested that music can facilitate the accessing and processing of

107 severe past trauma (Johnson, 1987; Bensimon et al., 2012; Carr et al., 2012) especially given

108 the photographic versus linguistic nature of traumatic memories (Johnson, 1987; Bensimon et

109 al., 2012). Thus, the symbols and metaphors present in music and lyric writing can help

110 survivors verbalize and process trauma. McFerran et al. proposed that musical therapy

111 approaches can be organized into four categories -- stabilizing, entrainment, expressive, and

112 performative (McFerran et al., 2020). Performative approaches recognize the societal context of

113 trauma, enabling survivor's identities to be reconstructed and 'brought to life' through song and

114 public musical performance.

115

116 Healing in Harmony (HiH) is an innovative music therapy program (Make Music Matter, 2020)

117 centered around a locally built professional recording studio designed to provide therapy to

118 trauma survivors. Working with a trained therapist and professional music producer, participants

119 engage in therapy and develop their musical artistry, approaching the healing process by

120 writing, recording, and professionally producing songs about their emotions and experiences. As

121 described elsewhere (Cikuru et al., 2021), this therapeutic approach, based on cognitive

122 behavioral therapy (Rothbaum et al., 2000), aims through group therapy and lyrical music to

123 help participants verbalize their trauma and initiate the assessment and cognitive stages of the

124 healing process, as a producer composing an instrumental accompaniment for the emerging

125 narrative. The goal is for participants to emerge as confident artists and advocates.

126

127 In a prior evaluation of the HiH program, the mental health of women living in an insecure rural

128 area who had suffered conflict-related trauma and /or conflict-related sexual violence was also

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129   observed to improve following their participation in the HiH program (Cikuru et al., 2021). The

130   proportion screening positive for anxiety, depression and PTSD declined by 40%, 50% and

131   50%, respectively, with results sustained through 6 months of follow-up. Also, self-perceived

132   stigma, feelings of unworthiness, and unhappiness declined while reporting a sense of

133   happiness and feeling proud of and liking oneself increased substantially.

134

135   World Vision engaged Make Music Matter to implement HiH as a component of their

136   programming in the Democratic Republic of Congo (DRC), including in the Equality for Girls

137   Access to Learning (EGAL) project, an inclusive, gender-transformative initiative designed to

138   enhance girls' agency, resilience in fragile contexts, and independent decision-making. The

139   project sought to enhance girls' agency, increase their resilience in fragile contexts, create

140   education opportunities, and improve their power for independent decision-making. Within that

141   framework, the HiH program aimed to reduce barriers, specifically psychosocial stress, that

142   prevent girls from accessing education.

143

144   This study aimed to assess whether participation in HiH was associated with a decrease in

145   symptoms of depression or anxiety or an increase in self-esteem in children who experienced

146   trauma because of the prolonged violent conflict in the area. In addition, the study examined

147   how school attendance changed over the life of the program and whether shifts in school

148   attendance were correlated with depression, anxiety, or self-esteem.

149

150   **Methods**

151   This study utilized a pre-post design with longitudinal follow-up (Shadish et al., 2002) to assess

152   an HiH program rolled out as part of a World Vision education project which aimed to reduce

153   barriers to education for girls, aligned to the objectives of GAC's G7 Charlevoix funding for girls'

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154   education in fragile contexts. The project was implemented in two districts in the Kasai-Central

155   province (hereafter referred to as District 1 and District 2), which are areas of ongoing conflict,

156   violence, and instability. The study included the catchment areas of 22 primary and 2

157   secondary schools participating in the World Vision project.

158

159   *The Healing in Harmony Program.* The HiH program was implemented by the Make Music

160   Matter (MMM) program team for community members located within World Vision programming

161   sites. The program was overseen by a qualified psychologist and technical lead based in

162   Bukavu. In each district, the MMM program team recruited a psychologist and a music producer

163   to run the HiH sessions and facilitate the songwriting and production. World Vision assisted HiH

164   program staff with logistics and acted as a bridge between the community and the program,

165   often liaising with local schools. The therapeutic approach is more fully described elsewhere

166   and summarized in Supplementary Table S1(Cikuru et al., 2021).

167

168   HiH program participants were identified after a large-scale community sensitization initiative

169   that reached diverse members of the target community, including school authorities, parent

170   committees, students, and parents within the school communities. However, the EGAL program

171   targeted girls and participation in the HiH program was designed to be inclusive of the broader

172   community based on community input. Project staff identified 1392 program participants from

173   District 1 and 1275 in District 2 through this process. Five cohorts of participants per district

174   were enrolled in the HiH program between April 2021 and January 2023. Each cohort included

175   200-300 participants, a mix of both boy and girl children as well as adult women. For facilitation,

176   participants were organized into groups of 25-30 who participated in the therapy program

177   together. The first cohort participated in HiH programming over 5 months, with one session held

178   per week. Cohorts 2-5 took part in the usual program cycle of 12 weeks per cohort, with

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179   sessions held twice per week, followed by a period of performing and sharing their music with

180   the community. Overall, the HiH program had a completion rate of 74.7%, with a higher

181   completion rate in District 2 (83.9%) than in District 1 (70.9%). Completion rates differed by age

182   category. Only 49.1% of those over 18 completed the program, compared with completion rates

183   of 86.4% for children under 9, 83.8% for children 10-14 years of age, and 67.7% for 15- to 17-

184   year-olds.

185

186   *Data Collection.* Two research teams gathered data to use for this analysis. The first team

187   consisted of two HiH program staff, and the local psychologists ran the intervention

188   programming and collected pre-and post-tests for all program participants. MMM carried out

189   programmatic and data collection training for this first team over a period of five days. HiH

190   program staff were trained to complete the pre- and post-assessments for all program

191   participants, completing pre- and post-interviews for the first three cohorts and pre-interviews for

192   the fourth cohort.

193

194   Subsequently, a second team, Informed International (hereafter referred to as Informed), was

195   hired by World Vision to carry out an independent evaluation of the HiH component of World

196   Vision's EGAL project, which, as noted above, focused on enhancing girl's agency. Thus, this

197   component of the data collection focused on girls aged 10-14. Informed employed enumerators

198   identified by the University of Kananga Kasai's Dean of Social Sciences Psychology as strong

199   4th year students and graduate assistants. Over 6 days, Informed trained 20 enumerators, 16 of

200   whom were hired for data collection. Informed undertook data collection in October 2022 and

201   January 2023. For a random sample of 10-14-year-old girls, Informed conducted the post-

202   interview and a 4-month follow-up interview for cohort 4 and the pre and post-interviews for

203   cohort 5. During each data collection period, Informed also collected follow-up interviews with a

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204   random sample of 10-14-year-old girls in cohorts 13 at 4, 10, and 14 months and 8, 14 and 18

205   months, respectively. Follow-up interviews included a caregiver survey of one caregiver for each

206   study participant.

207

208   *Study participants.* This research focused on girls because this study was funded as part of

209   World Vision's EGAL project. EGAL aimed to develop effective strategies to help girls in the

210   DRC cope with trauma from gender-based violence, reduce anxiety, depression, and PTSD and

211   improve school attendance. The evaluation was limited to the 10-14-year age group as funding

212   was limited, and only this age group was well-represented across all five rounds of the HiH

213   program implementation.

214

215   A total of 1214 school-going girls aged 10-14 years old were enrolled in the HIH program. The

216   pre-post evaluation reported here focused on a random subsample of the 1018 (83.8% of the

217   1214) girls aged 10-14 who completed the HiH program. Study participants were identified by

218   random sample and stratified by cohort and district. Of the 507 enrolled, the study team

219   observed a 4.7% loss to follow-up between data collection periods and completed the study with

220   483 girls 10-14 years of age.

221

222   We utilized data collected by the HiH staff for the pre-and post-assessments for eligible study

223   participants in cohorts 1 to 3 and the pre-assessment for cohort 4, and data collected by

224   Informed's study team for the post-assessment for cohort 4 in October 2022 and the pre and

225   post assessments for cohort 5 in October 2022 and January 2023, respectively. The two follow-

226   up interviews with sampled participants in cohorts 1-3 were collected during the October and

227   January data collection periods, and the one follow-up interview for cohort 4 during the January

228   data collection period is described in Figure 1.

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230   The study was approved by the Ethics Committee Republique Democratique du Congo– Comité

231   National d'Ethique de la Sante (CNES), CNES 001/DPSK/1922.2022. Consent was obtained

232   from each child's parent or guardian, and assent was obtained from each girl child for each

233   interview. Child interviews were carried out at the schools, while caregiver interviews were

234   conducted at the World Vision HiH program facilities in French and Tshiluba.

235

236   *Measures*. Each cohort was administered a mental health screening shortly before (pre-test/

237   time 0) and immediately after completing (post-test/ time +1) their HiH Program. The interval

238   between the pre-test (time 0) and the post-test (time +1) is the same for all cohorts except for

239   cohort 1 due to the constraints of the COVID-19 pandemic. Follow-up interviews were

240   conducted 3.5 to 17 months post-treatment (see Table 3). In addition to assessing mental

241   health, interviews obtained information on demographic characteristics, risk factors, and school

242   participation.

243

244   *Mental Health Assessment.* Measures included the Birleson Depression Self-Rating Scale

245   (DSRS) for Children (Birleson et al., 1987); the Hopkins Symptom Checklist (HSCL) (Parloff et

246   al., 1954) to assess anxiety and the Rosenberg Self-Esteem Scale (Rosenberg, 1965). This

247   depression scale has been applied across diverse cultural settings, including among children in

248   Afghanistan and Nepal (Panter-Brick et al., 2009; Kohrt et al., 2011). The HSCL has been used

249   extensively in high-conflict, cross-cultural contexts to assess mental health symptoms (Tay et

250   al., 2017), Including in a study among adolescents in conflict-affected regions of Eastern DRC

251   (Mels et al., 2010). Similarly, the Self-Esteem scale is a well-established measure for assessing

252   adolescents, most notably in a study among adolescent refugee girls in Ethiopia (Stark et al.,

253   2018). To ensure the cultural appropriateness of these measures, we undertook a translation

254   and adaptation process, including forward and backward translation by bilingual experts,

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255   reconciliation of discrepancies, and pilot interviews with a sample of participants to assess

256   comprehension and cultural relevance.

257

258   The 18-item Birleson was asked of each child, with children responding for each item whether it

259   was experienced most of the time (2), sometimes (1), or never (0) over the last week. The

260   responses were summed, and students scoring at or above 18 were classified as screening

261   positive for depression, as validated in a similar context among children in Burundi (Ventevogel,

262   2014). For anxiety, children were asked to indicate the frequency they had experienced each of

263   a 10-item inventory of anxiety symptoms in the Hopkins Symptom Checklist, including not at all

264   (0), a little (1), quite a bit (3), and extremely (4) in the last month. The responses were summed

265   across all items, and a mean score was calculated. Children were classified as screening

266   positive for anxiety if their mean score was greater than or equal to 1.85 (Strand et al., 2003).

267   The self-esteem scale is a 10-item inventory, with each question using a 1- to 4-point Likert

268   scale. Scores were summed such that higher values indicate higher levels of self-esteem,

269   ranging from 10-40.

270

271   *School Participation.* Information on a child's enrollment status and attendance at school over

272   the last 4 weeks was gathered from both the child respondent and caregiver, as well as from

273   school records. Absenteeism rates were determined by examining school attendance records

274   for the 4 weeks preceding data collection. Schools were open between 20 and 26 days in the 4

275   weeks prior to data collection, depending on the school. Data from school records on enrolment

276   and attendance were used in the primary analyses and supplemented by the child and caregiver

277   survey data regarding reasons for school absence.

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279   *Demographic characteristics and risk factors.*   Demographic characteristics included age,

280   although it should be noted that age is often not precisely known, such as grade in school,

281   socio-economic status, and disability status. Both age and grade were gathered by child self-

282   report, and grade level was considered more reliable than age data. To determine socio-

283   economic status, children were asked whether their household owned any of the 12

284   possessions, such as a radio, mobile phone, electricity, bicycle, car, or toilet (UNICEF, 2019).

285   The number of possessions was summed, and then the summation was divided into three

286   groups. Disability status was determined based on the Washington Group Short Set on

287   Functioning (WG-SS), a set of six questions the girl's caregiver asked regarding difficulties

288   seeing, hearing, walking or climbing stairs, remembering or concentrating, self-care, and

289   communication (expressive and receptive). Each question has four response categories to

290   assess the severity to which the difficulty is experienced: no difficulty, some difficulty, a lot of

291   difficulty, and it cannot be done at all (Altman, 2016). Girls were identified as disabled if at least

292   one domain is coded as a lot of difficulty or cannot do at all.

293

294   *Statistical analysis*. We calculated the mean and standard deviation of each continuous

295   variable and the frequencies for each categorical variable at each time point for each cohort.

296   To assess change over time, a time variable was defined in relation to the start of the therapy (0

297   = start of therapy, +1 = end of therapy, +2= first follow-up and +3= second follow-up). We

298   calculated descriptive statistics and constructed box plots for depression, anxiety, and self-

299   esteem scores at each time point, overall and by cohort. Also, we calculated the percentage and

300   95% CIs for scoring positive for depression and anxiety at each time point.

301   We constructed generalized estimating equation (GEE) models with unstructured covariance

302   and a normal distribution to estimate mean differences in continuous scores. To estimate

303   relative risks (RRs), proportions were modeled using GEE with an unstructured covariance and

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304   Poisson distribution (Zou & Donner, 2013). We summarized the HiH program effects by

305   collapsing time into pre-test (time 0) and post-test (time + 1, +2, or +3) periods. We adjusted all

306   models for the design variable cohort and district, grade, and socioeconomic status.

307   Observations with missing data were excluded from the regression models. As a sensitivity

308   analysis, we also ran models for each cohort separately. Statistical significance was defined at

309   alpha < 0.05. Analyses were performed using Stata/MP 15.1.

310

311   **Results**

312   The 483 girls ranged in age from 10 to 14, with a median age of 12. Table 4 provides

313   information on the distribution of participant characteristics overall and by cohort. Two-thirds of

314   participants were in District 2 (67.9%). Cohort 2 tended to be older, with 65.2% of participants

315   being 13-14 years old. Almost all (99.8%) participants were enrolled in school with a median

316   grade of 6. Few (4.8%) of participants screened positive for a disability, according to the WG-

317   SS. Over half (57.6%) were in the low SES category based on possessions. Cohorts 1 and 5

318   had the greatest proportion of participants in the low SES category.

319

320   *Mental Health Measures.* Boxplots of the scores for anxiety, depression and self-esteem by time

321   are provided in Figure 2. Similar boxplots by Cohort are provided in Supplementary Figure S2.

322   At the pre-test (time 0), median scores for depression were 17; (interquartile range (IQR)=13-

323   20) declining to 14 (IQR=8-18) at the post-test assessment (time +1) while scores for anxiety

324   were 20 (IQR=15-25) declining to 13 (IQR=11-17) and for self-esteem were 27 (IQR=24-29)

325   increasing to 30 (IQR=28-32) over the same period. After the HiH program, median scores for

326   depression declined more substantially to 11 (IQR=7-14) at the first and 9 (IQR=7-11) at the

327   second follow-up. Anxiety fluctuated, increasing to 18 (IQR=12-23) at the 1st follow-up and

328   decreasing again to 12 (IQR=11-15) at the 2nd follow-up.

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329

330   The proportion of girls who screened positive for depression and anxiety, as well as average

331   self-esteem score, is presented in Table 5 by time and cohort. At the pre-test (time 0), 36.0%

332   screened positive for depression and 60.5% for anxiety. 20.1% screened positive for both

333   conditions at the pre-test time. At the post-test (time +1), 18.0% screened positive for

334   depression, 20.3% positive for anxiety, and 2.9% screened positive for both conditions.

335

336   As evidenced in Table 4, anxiety spiked at Time +2 for Cohorts 1-3, Time +1 for Cohort 4, and

337   Time 0 for Cohort 5, which coincided with the food insecurity observed in October, as discussed

338   in the methodology.

339   *School attendance measures.* According to school records, 99.8% of the girls in the research

340   study were officially enrolled in school. Overall, for the 4-weeks prior to data collection, girls

341   missed an average of 2.0 days at follow-up 1 and 1.4 days at follow-up 2, with absenteeism

342   rates of 8.2% and 6.1%, respectively, after accounting for the number of days the school was

343   open during that period (ranging 20 to 26 days). Reasons for missing school were most often

344   illness, followed by chores or lack of money. Figure 3 shows that although the median

345   absenteeism rate is relatively low, the average absenteeism rate improvement came from

346   outliers with very high absenteeism rates at pre-test. At the pre-test, 21 of the 176 (11.9%) study

347   participants in cohort 5 missed 5 or more days in the last 4 weeks of school. This number

348   decreased to 6 (3.4%) participants by post-test.

349

350   *Multivariable regression analyses for mental health measures.*

351   Table 5 presents the multivariable regression results for anxiety and depression adjusting for

352   cohort, district, grade level, and socio-economic status. Anxiety and depression scores

353   decreased significantly from pre-test to post-treatment by an average of 4 to 5 points. The

354   probability of screening positive for anxiety declined by about half post-participation in HiH

355   compared to the pre-test (RR=0.46, 95% CI=0.41,0.53). The probability of screening positive for

356   depression declined by about 75% (RR=0.27, 95% CI=0.22,0.32).

357

358   *Multivariable regression analyses for self-esteem and education measures among Cohort 5.*

359   Table 6 presents multivariable regression results for self-esteem and school absenteeism

360   among cohort 5 program participants. Models were adjusted for district, grade level, and socio-

16

361   economic status. From the pre-test to the post-test, program participants increased their self-

362   esteem score by an average of about 4 points (ß = 3.93, 95% CI=3.22, 4.64). Program

363   participants had an average absenteeism rate of 10% on the pre-test, which significantly

364   decreased to 5.4% on the post-test (RR=0.54, 95% CI=0.40, 0.73), representing a 46.6%

365   reduction.

366

367   **Discussion**

368   We evaluated the impact of the Healing in Harmony music therapy program (Cikuri et al., 2021)

369   on adolescent mental health and school attendance within communities supported by World

370   Vision development programming in Kasai-Central province, DRC. Prior to the start of the

371   program, one-third of the adolescent girls participating screened positive for depression, while

372   60% screened positive for anxiety. Immediately following the HiH program, the probability of

373   screening positive for depression declined to one-fifth and for anxiety to 40%. After completion

374   of the HiH program, median scores for depression continued to decline, whereas anxiety

375   fluctuated, increasing at the first follow-up and decreasing again at the second follow-up.

376   Improvements in mental health occurred in the context of ongoing trauma and insecurity and

377   were sustained for up to 17 months following the program. Self-esteem improved from pre- to

378   post-participation in the HiH program, while frequent absenteeism declined.

379

380   These findings are consistent with prior research documenting that psychotherapy reduces

381   depression and anxiety when provided in the context of humanitarian crises (Bangpan et al.,

382   2019; Purgato et al., 2018; Morina et al., 2017). Although the literature is limited, a meta-

383   analysis of eleven studies of mental health and psychosocial support (MHPSS) programs or

384   interventions aimed at addressing common mental health disorders or challenges in

385   humanitarian contexts among adults, the standardized mean differences in (SMD) anxiety and

17

386 depression, were -0.69 and -0.71, respectively (Bangpan et al., 2019), comparable to results of

387 our study, which were -0.65 and -0.91 for anxiety and depression. Two meta-analyses of 13

388 studies and 43 randomized controlled studies examining psychological and psychosocial

389 interventions for children and adolescents in LMICs also found that interventions involving

390 cognitive-behavioral therapy and group-based approaches were effective in reducing PTSD

391 anxiety and depression (Uppendahl et al., 2020) and depression (pooled SMD = -0.15; 95% CI

392 (-0.29, -0.01) (Bangpan et al., 2024). Notably, we documented that levels of depression

393 continued to improve following completion of the program up through 17 months. However,

394 approximately 17% of the children continued to screen positive for at least one of the two

395 conditions 17 months after completing the program. Further research is needed to identify risk

396 factors and appropriate interventions for chronic mental health problems in conflict settings.

397

398 The HiH program was implemented in a school-based program. Over 85% of the participants

399 completed the program, providing additional evidence of schools' role in improving adolescents'

400 access to mental health interventions (Partap et al., 2023; Grande et al., 2023). We found that

401 frequent absenteeism declined among program participants, suggesting a potential added

402 educational benefit of providing school-based mental health services.

403

404 Interpretation of results requires reflection on food insecurity during the data collection period.

405 Leading into the period of Informed's data collection, villages in the area experienced significant

406 inflation and a surge in market price from 0.5 USD per kilo to 2 USD per kilo for corn flour

407 (maize meal), the main food staple between June and October 2022 (FEWS NET, 2022).

408 Qualitative interviews carried out in December 2022 suggested higher prices, up to 10 USD per

409 kilo, and participants identified food insecurity as impacting their mental conditions and

410 increasing tension within and between families. This highlights the importance of food security

18

411   for mental health and suggests the importance of integrating programs and coordinating across

412   agencies and non-governmental organizations to more effectively address mental health in the

413   context of ongoing humanitarian crises.

414

415   We observed heterogeneity across cohorts in the timing of improvement in depression scores,

416   with cohorts 1-3 showing improvement only in the follow-up interviews, while cohorts 4 and 5

417   showed improvement from the pre- to the post-test. This heterogeneity could be due to

418   differences in the security contexts at the time of the intervention, differences in the time it took

419   individuals to integrate the skills learned in the intervention, or to increasing familiarity and skill

420   of the program psychologists in delivering the intervention across time. It is also possible that

421   the administration of the depression scale differed across the two data collection teams.

422   However, as discussed above, extensive efforts were made by the Informed team to ensure

423   testing comparability.

424

425   This study had limitations. The program lacked clear inclusion criteria for program participation.

426   This led to differences in age distribution by cohort, which cannot fully be accounted for by

427   adjustment. The global COVID-19 pandemic led to an alteration in programming for cohort 1,

428   which only received one HiH session per week, while cohorts 2-5 had two sessions per week.

429   This difference in dosage could not be fully accounted for in the analysis. Although the program

430   design intended to include children not enrolled in school, the research team learned that

431   partway through the program, implementation was narrowed to include only children enrolled in

432   school. This limited the research's ability to examine the impact of MHPSS on school enrollment

433   rates. The shift in the data collection team (from HiH program staff to Informed evaluators) may

434   have led to inconsistent measurement; however, Informed made every effort to replicate training

435   processes from the original team. As efforts to conduct follow-up interviews to evaluate the

19

436   longer-term impacts of participation in HiH were only undertaken once Informed began data-

437   collection, time since completion of the program varied across cohorts. Thus, we cannot assess

438   whether the shorter and longer-term impacts differed across cohorts. The research study only

439   included participants who completed the HiH program; therefore, selection bias is possible.

440   Finally, we were not able to include a pre-treatment comparison group to approximate a step-

441   wedged design.

442

443   The study also has several strengths, including a large sample and multiple assessments per

444   child. Information on mental health status was obtained prior to and up to 17 months after the

445   program's completion, providing new information about the importance of longer-term follow-up

446   in children to allow time for the integration of skills learned. Standardized instruments were

447   used, and instruments were translated into Tshiluba. The study contributes to the scientific

448   understanding of the value of psychosocial services in the context of ongoing insecurity.

449

450   In conclusion, this study found that the HiH music therapy program was associated with

451   improvements in girl's depression and anxiety, with the most notable changes observed several

452   months after program completion. In addition, we observed increases in participants' self-

453   esteem and improved school attendance. These results align with previous research on the HiH,

454   an integrated music and psychological care program, demonstrating its value in ongoing

455   humanitarian crises. Further research should consider clinical comparative trials to evaluate the

456   program's effectiveness. Additionally, exploring the societal impact of participants' songs and

457   community engagement—such as potential reductions in stigma or increased social inclusion—

458   would provide valuable insights (McFerran et al., 2020). These promising findings support

459   scaling up the intervention, with the success of such expansion dependent on recruiting

460   sufficient numbers of qualified psychologists to deliver the program.

20

471

472   *Author Contribution Statement*

473   L.Z. and S.H. developed the study and carried out the study design. A.B. contributed to the

474   study design, trained enumerators, oversaw data collection, and contributed to data

475   interpretation. M.H. led the data analysis methodology while L.Z. carried out the data analysis.

476   S.H. led the outline of the manuscript, while L.Z. led the manuscript writing. All authors

477   discussed the results and contributed to the final manuscript, which included review, revision,

478   and edits.

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486   *Ethical Standards*

487   The authors assert that all procedures contributing to this work comply with the ethical

488   standards of the relevant national and institutional committees on human experimentation and

489   with the Helsinki Declaration of 1975, as revised in 2008.

490

491   *Data Availability Statement*

492   The data supporting this study's findings are available from World Vision Canada. Restrictions

493   apply to the availability of these data, which were used under license for this study. Data are

494   available directly from World Vision Canada or the authors with permission from World Vision

495   Canada.

496

497   FIGURE LEGENDS

498   Table 1: HiH cohort enrollment, completion, study sampling, and attrition (10-14 year old

499   females only).

500

501   Figure 1: Illustration of the study design. The HiH program was implemented sequentially across

502   5 time periods (grey): April to August 2021, October to December 2021, April to June 2022,

503   August to October 2022, and November 2022 to January 2023, with data collection occurring at

504   the start and end of each program (white stars) in addition to October 2022 and February 2023

505   (black stars).

506   Table 2: Data collection schedule.

507   Table 3: Demographic and education characteristics of girls enrolled in the study.

508

509   Figure 2: Boxplots of depression, anxiety, and self-esteem average scores by time.

22

510

511   Table 4: Proportion (and 95% CIs) of girls who screened positive for depression and anxiety,

512   average self-esteem score by time and cohort.

513   Figure 3: Boxplot of days absent over the last 4 weeks for Cohort 5 by pre-test and post-test.

514   Table 5: Regression models for anxiety and depression, all cohort (N=438; observations=1462).

515   Table 6: Regression models for self-esteem and Poisson link model for school absenteeism,

516   Cohort 5 only.

517

518

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683 Table 1. HiH Cohort Enrollment, Completion, Study Sampling, and Attrition (10–14-year-old females
684 only)

Cohort #	District 1				District 2			
	Enrolled in HiH	Completed HiH	Data Collection Oct 2022	Data Collection Jan 2023	Enrolled in HiH	Completed HiH	Data Collection Oct 2022	Data Collection Jan 2023
1	92	49	17	12	105	103	51	50
2	58	48	19	16	23	13	7	7
3	182	152	56	55	158	132	62	64
4	43	41	22	19	199	165	94	82
5	190	178	62	53	164	137	127	125
Total	565	468	166	155	649	550	341	328

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689 Table 2. Data collection schedule

Cohort	Program Pre-Test *Time 0*	Program Post-Test *Time +1*	Follow-up (Oct 2022) *Time +2*	Follow-up (Jan 2023) *Time +3*
#1	April 2021	August 2021	13.5 months post program	17 months post program
#2	Oct 2021	Dec 2021	9.5 months post program	13 months post program
#3	April 2022	June 2022	3.5 months post program	7 months post program
#4	August 2022	October 2022	*N/A*	3.5 months post program
#5	Nov 2022	Jan 2023	*N/A*	*N/A*

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693 Table 3. Demographic and education characteristics of girls enrolled in the study

		Cohort						
		Overall N =483	1 N=62	2 N=23	3 N=119	4 N=101	5 N=178	*p* value
District								<0.001[a]
	District 1	155 (32.09%)	12 (19.35%)	16 (69.57%)	55 (46.22%)	19 (18.81%)	53 (29.78%)	

District 2	328 (67.91%)	50 (80.65%)	7 (30.43%)	64 (53.78%)	82 (81.19%)	125 (70.22%)
Age						<0.001[b]
10	122 (25.26%)	23 (37.10%)	0 (0.00%)	39 (32.77%)	20 (19.80%)	40 (22.47%)
11-12	207 (42.86%)	24 (38.71%)	8 (34.78%)	60 (50.42%)	35 (34.65%)	80 (44.94%)
13-14	154 (31.88%)	15 (24.19%)	15 (65.22%)	20 (16.81%)	46 (45.54%)	58 (32.58%)
Grade						<0.001[a]
1-5	226 (46.79%)	24 (38.71%)	6 (26.09%)	51 (42.86%)	34 (33.66%)	111 (62.36%)
6	185 (38.30%)	25 (40.32%)	4 (17.39%)	57 (47.90%)	32 (31.68%)	67 (37.64%)
7-12	70 (14.49%)	13 (20.97%)	11 (47.82%)	11 (9.24%)	35 (34.65%)	0 (0.00%)
Missing	2 (0.41%)	0 (0.00%)	2 (8.70%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Disability						0.006[b]
No	445 (92.13%)	59 (95.16%)	21 (91.30%)	107 (89.92%)	95 (94.06%)	163 (91.57%)
Yes	23 (4.76%)	1 (1.61%)	2 (8.70%)	0 (0.00%)	6 (5.94%)	14 (7.87%)
Missing	15 (3.12%)	2 (3.23%)	0 (0.00%)	12 (10.08%)	0 (0.00%)	1 (0.56%)
Socio-Economic Status						0.001[a]
Low	278 (57.56%)	39 (62.90%)	12 (52.17%)	54 (45.38%)	53 (52.48%)	120 (67.42%)
Middle	109 (22.57%)	17 (27.42%)	7 (30.43%)	29 (24.37%)	21 (20.79%)	35 (19.66%)
High	96 (19.88%)	6 (9.68%)	4 (17.39%)	36 (30.25%)	27 (26.73%)	23 (12.92%)

694 [a]Chi-square

695 [b]Fisher's Exact

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699 Table 4. Proportion (and 95% CIs) of girls who screened positive for depression and anxiety, average self-
700 esteem score by time and cohort

	Time 0	Time +1	p value[a] Time 0 v. +1	Time +2	Time +3
Cohort 1 (N=62)					
Depression	12.9% (4.3 – 21.5)	17.7% (8.0-27.5)	0.450	0.3% (-1.3 – 7.7)	11.3% (3.2 – 19.4)
Anxiety	32.3% (20.3 – 44.2)	1.6% (-1.6 – 4.8)	<0.001	66.1% (54.0 – 78.2)	17.7% (8.0-27.5)
Cohort 2 (N=23)					
Depression	30.4% (10.1 – 50.8)	39.1% (17.6 – 60.7)	0.5463	4.3% (-4.7 – 13.4)	4.3% (-4.7 – 13.4)
Anxiety	69.6% (49.2 – 90.0)	8.7% (-3.8 – 21.2)	<0.001	78.3% (60.0 – 96.5)	13.0% (-1.8 – 27.9)
Cohort 3 (N=119)					
Depression	43.7% (34.7 – 52.7)	45.4% (36.3 – 54.5)	0.7953	5.0% (1.1 – 9.0)	1.7% (-0.6 – 4.0)
Anxiety	53.8% (44.7 – 62.9)	1.7% (-0.7 – 4.0)	<0.001	68.9% (60.5 - 77.3)	6.7% (2.2 – 11.3)
Cohort 4 (N=101)					
Depression	68.3% (59.1 – 77.5)	8.9% (3.3 – 14.6)	<0.001	1.0% (-0.9 – 3.0)	
Anxiety	40.6% (30.9 – 50.3)	74.3% (65.6 – 82.9)	<0.001	8.9% (3.3 – 14.6)	
Cohort 5 (N=178)					
Depression	21.3% (15.3 – 27.4)	2.2% (0.1 – 4.5)	<0.001		

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Anxiety	84.8% (79.5 – 90.2)	10.1% (5.6 – 14.6)	<0.001		
Self-Esteem	27.0 (26.4 – 27.5)	30.9 (30.5 – 31.3)	<0.001		
Overall					
Depression	36.0% (31.7 – 40.3)	18.0% (14.6 – 21.5)	<0.001	3.3% (1.3 – 5.3)	4.9% (1.9 – 7.9)
Anxiety	60.5% (56.1 – 64.8)	20.3% (16.7 – 23.9)	<0.001	49.2% (43.5 – 54.8)	10.8% (6.5 – 15.1)

701 ᵃMcNemar's Chi-Square Test

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705 Table 5. Regression models for anxiety and depression, all cohorts (N = 438; observations = 1462)

	Score		Screened positive	
	Anxiety B	Depression B	Anxiety RR	Depression RR
Post-Treatment	-4.20***	-5.61***	0.46***	0.27***
Cohort 1 (ref)				
Cohort 2	-0.69	0.35	1.15	2.02**
Cohort 3	-0.12	1.46***	1.00	2.27***
Cohort 4	1.23*	1.21**	1.32***	2.08***
Cohort 5	1.80**	-1.98***	1.20*	0.73
District 1 (ref)				
District 2	-1.51***	0.20	0.70***	1.06
Less Grade 6 (ref)				
Grade 6	-0.11	0.03	0.93	.1.01
Greater Grade 6	0.26	0.12	0.98	0.98
SES - Low	0.72	0.54	1.10	1.44***
SES – Medium	0.28	0.63	1.10	1.43**
SES – High (ref)				

*** p<.001, ** p<.05, * p<.01

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712 Table 6. Regression models for self-esteem and Poisson link model for school absenteeism, Cohort 5
713 only

	Cohort 5 Only	
	Self-Esteem B	Absenteeism Rates % change
Post-Treatment	3.93***	-46.6***
District 1 (ref)		

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District 2	0.12	-6.1
Less Grade 6 (ref)		
Grade 6	-0.05	-40.2
SES - Low	0.66	98.0**
SES – Medium	0.40	113.1**
SES – High (ref)		
Observations	356	351

*** p<.001, ** p<.05, * p<.01

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716   Figure 1

	2021									2022													2023	
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Cohort 1	*				*														*				*
Cohort 2							*		*										*				*
Cohort 3													*		*				*				*
Cohort 4																	*		*				*
Cohort 5																				*		*	

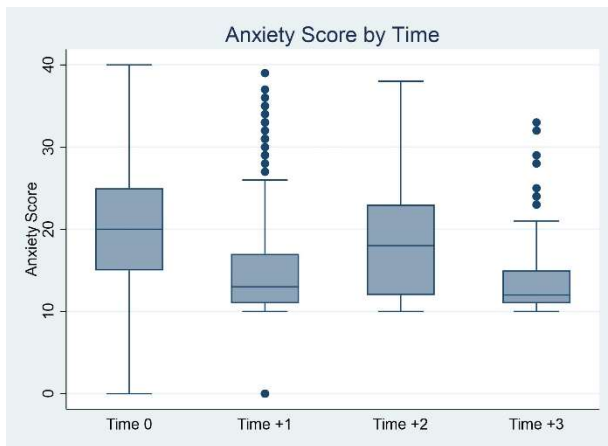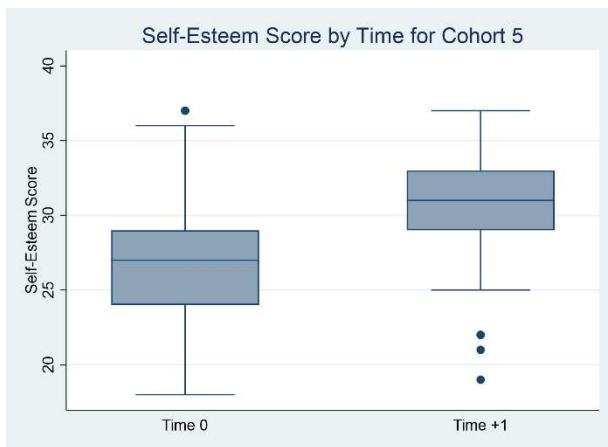| HiH Program		* Pre-Test, assessed by HiH staff		* Post-Test, assessed by HiH staff	* Follow up, assessed by consultant team

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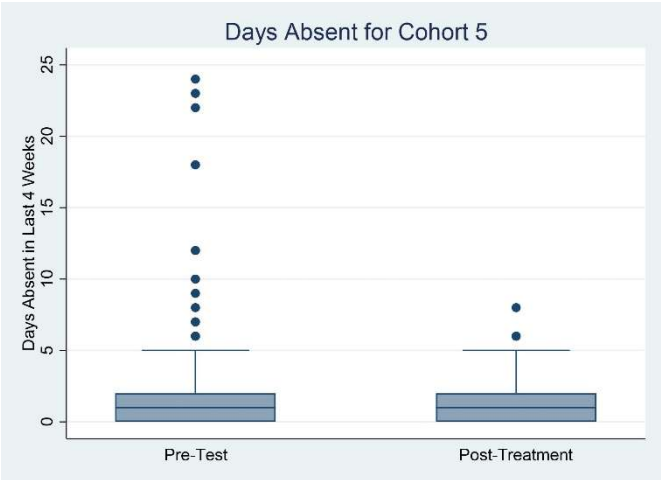719

720   Figure 2
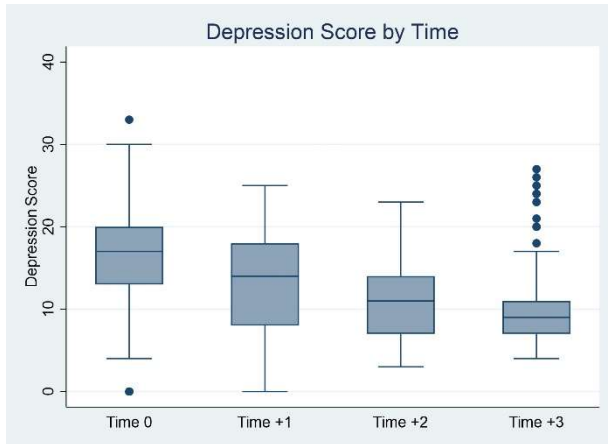
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725 Figure 3

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Impact of a music therapy program on mental health and school attendance among female adolescents in Kasai Central province, Democratic Republic of Congo

Background

- Evaluated the impact of music therapy on children's mental health and school attendance in a conflict setting.

- The program, Healing in Harmony (HiH), integrates musical artistry and cognitive behavioral therapy to help participants manage triggers and develop coping skills.

- Implemented by World Vision Canada in partnership with Make Music Matter.

Methods

- Participants: 483 girls (ages 10-14)

- Assessment: pre-test, post-test, & follow-ups (up to 17 months after the completion of the program)

- Measures: Depression, anxiety, self-esteem, school attendance

- Analysis: Generalized estimating equations

Results

Mental Health Improvements:

Proportion of Children Screening Positive
■ Pre-Test ■ Post-Test

Depression — 36% / 18%
Anxiety — 61% / 20%

- Effects were sustained up to 17 months after the conclusion of the program.

- Significant improvements in self-esteem and school attendance over the life of the program.

Conclusion

This study found that the HiH music therapy program was associated with improvements in children's depression and anxiety, the most significant changes observed several months after the program completion. In addition, we observed increase in participants self-esteem and improved school attendance during the life of the program. These results align with previous research on the HiH, an integrated music and psychological care program, demonstrating its value in ongoing humanitarian crises.

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