Effectiveness of an Evidence-Based Practice Training Program for Nurse Educators:

A Cluster Randomized Controlled Trial

ABSTRACT

Background: Evidence-Based Practice (EBP), endeavours to integrate the best available evidence with clinical expertise and patient preference to enhance clinical outcomes. For the nurses to effectively demonstrate EBP, the concepts of EBP should be systematically incorporated into the nursing curriculum, and nurse educators play a pivotal role in this. However, the effect of EBP training programs on nurse educators remains largely unexplored.

Aim: To evaluate the effectiveness of an EBP training program on the knowledge, attitude, practice, and competency of nurse educators.

Methods: A pragmatic randomized controlled trial was conducted at a nursing education institution. Fifty-one nurse educators were cluster randomized into intervention and control groups. A 30-hour EBP training intervention was provided for nurse educators in the intervention group. The outcome variables were knowledge, attitude, practice, and competency regarding EBP and were evaluated using EBP knowledge and practice questionnaire, EBP attitude scale, and Fresno test. Data were collected at the baseline, at the end of five-months, and at the end of ten-months.

Results: Fifty-one eligible participants were enrolled for the study. The intervention and control group had three clusters each with 27 and 24 participants, respectively. Participants in both groups were comparable for variables such as age, years of experience, and

24   educational background ($p > 0.05$). Outcome variables between the groups were compared

25   using mixed linear multi-level modeling. Nurse educators who received the EBP training

26   program demonstrated statistically significant differences in knowledge ($p < 0.05$), attitude

27   ($p < 0.05$), practice ($p < 0.05$) and competency scores ($p < 0.05$), than that of the control

28   group, indicating the intervention effectiveness.

29   **Linking Evidence to Action:** EBP training programs are effective in improving the

30   knowledge, attitude, practice, and competency of nurse educators.

31   **Keywords:** evidence-based practice, evidence-based nursing, nursing education,

32   knowledge, attitude, practice, competency, randomized controlled trial

33

34   **BACKGROUND AND SIGNIFICANCE**

35   Evidence-Based Practice (EBP), the problem-solving approach to health care emerged four

36   decades ago, and it endeavours to integrate best available evidence with clinical expertise

37   and patient preference to enhance clinical outcomes (Melnyk & Fineout-Overholt, 2019).

38   Since then, nursing has embraced EBP to deliver quality care, and the momentum

39   continues to escalate. Recent reports reveal that EBP reduces health care costs, improve

40   the quality of nursing practice, minimize complications, and enhance job satisfaction of

41   nurses (Melnyk & Fineout-Overholt, 2019). Because of its multiple benefits, EBP is now

42   globally recognized as the gold standard for clinical decision making (Levin & Feldman,

43   2013).

44

45   The professional organizations, policymakers, and accreditation bodies have determined

46   EBP as a vital element to provide effective patient care (American Association of Colleges

47 of Nursing, 2008; Joint Commission, 2009; Institute of Medicine, 2009). Nonetheless, only

48 a small proportion of healthcare professionals are found to consistently use EBP in clinical

49 practice (Ruzafa-Martínez, López-Iborra, Armero Barranco, & Ramos-Morcillo, 2016). In

50 an extensive survey conducted in the United States, the majority (76.2%) of the nurses

51 expressed the need for more education and skill training to implement EBP (Melnyk,

52 Fineout-Overholt, Gallagher-Ford, & Kaplan, 2012). A significant hurdle for the low

53 utilization of EBP is attributed to the lack of knowledge and training in EBP (Brown,

54 Wickline, Ecoff, & Glaser, 2009; Shayan, Kiwanuka, & Nakaye, 2019).

55

56 Successful transition to EBP will largely depend on how professionals are trained in EBP.

57 For the nurses to effectively demonstrate EBP, the concepts of EBP should be

58 systematically and effectively incorporated into the nursing curriculum. However, this is

59 identified as a challenging task (D'Souza, George, Norohna, & Renjith, 2015; Levin &

60 Feldman, 2013). The institute of medicine, in its landmark summit, proposed EBP as an

61 essential competency to be incorporated into nursing and health professions education

62 (Institute of Medicine, 2003). Schmidt and Brown (2019) argue that the goal of nursing

63 education should be to develop the necessary competence to apply EBP clinical settings.

64 Similarly, the American Association of Colleges of Nursing (2008) considers the

65 possession of knowledge and skills to practice EBP as a crucial outcome for undergraduate

66 nursing education. Addressing these needs, nursing education programs across the world

67 are integrating EBP into the curriculum (Hung, Huang, Tsai, & Chang, 2015).

68

69   Nurse educators play a pivotal role in fostering EBP implementation in education (Hung et

70   al., 2015; Sin & Bliquez, 2017). Malik, McKenna, and Griffiths (2015) found that the EBP

71   awareness of student nurses will largely depend on the degree to which it is promoted by

72   the nurse educators, and how best the concepts are incorporated into the curriculum.

73   Currently, educators spend more time teaching students how to do rigorous research rather

74   than teaching how to utilize and translate the research evidence into clinical nursing

75   practice (Melnyk et al., 2012).

76

77   In the past, EBP related content was not taught in nursing academic programs. Therefore,

78   most of the nurse educators during their training did not learn about EBP. To incorporate

79   EBP in nursing education, the faculty must be first well prepared with essential

80   knowledge, skills, attitudes, and competencies to teach EBP confidently (Melnyk, 2013).

81   However, the competency of nurse educators to teach and incorporate EBP into nursing

82   education remains largely unexplored. The challenge to implement EBP in nursing

83   education is also attributed to a multitude of factors such as lack of training programs,

84   unfamiliarity with EBP, shortage of EBP qualified faculty, lack of robust intervention

85   studies (Häggman-Laitila, Mattila, & Melender, 2017; Hung et al., 2015; Saunders,

86   Vehviläinen-Julkunen, & Stevens, 2016). Several studies evaluate the effectiveness of

87   various interventions to improve the EBP of clinical nurses and nursing students (Kim et

88   al., 2017; Ruzafa-Martinez et al., 2016; Saunders et al., 2016). However, we could not

89   retrieve a high-quality randomized trial evaluating the effectiveness of EBP intervention

90   among nurse educators. This gap calls for designing and implementing EBP training

91   programs to build the capacity of nurse educators.

AIM

The aim of the study was to determine the effectiveness of an evidence-based practice

training program on the knowledge, attitude, practice, and competency of nurse educators.

CONCEPTUAL FRAMEWORK

This study incorporated the five-step model of EBP as the conceptual framework

(Heneghan & Badenoch, 2006). According to this model, implementing EBP in any setting

include five A's, namely, asking, acquiring, appraising, applying, and assessing. Asking,

the first step refers to formulating a clinical question; acquiring refers to the searching for

the best evidence, and appraising refers to the critical appraisal of the evidence. Applying

and assessing steps of the model relates to the implementation and evaluation of results.

The model provides a comprehensive progression from formulating a clinical question to

evaluating the results. The Sicily statement on evidence-based practice recommends that

the curriculum framework for EBP teaching and assessment should consider all five steps

of EBP (Dawes et al., 2005). Hence the model was deemed appropriate to underpin the

study.

METHODS

Study Design

This study was a pragmatic cluster-randomized controlled trial. We compared the

knowledge, attitude, practice, and competency of nurse educators regarding EBP between

114   the intervention and control group at the baseline (T_0), after five-months (T_1), and after

115   ten-months (T_2). Randomization was done at the cluster level to reduce contamination.

Participants and Setting

117   The participants in the study were nurse educators involved in teaching undergraduate and

118   postgraduate nursing education programs. The study was conducted at a nursing education

119   institution of an Indian university. The institution has six departments based on clinical

120   specialization. For the study, each department was defined as a cluster, and the six clusters

121   were medical surgical nursing, pediatric nursing, public health nursing, psychiatric

122   nursing, obstetrics and gynecology nursing, and foundations of nursing. The study

123   biostatistician randomly assigned three departments each into the intervention and control

124   groups using a randomization sequence. We used department-based clustering to facilitate

125   intervention delivery, ensure intervention compliance, reduce spillover, and optimize

126   follow-up. Nurse educators who were available during the study period and willing to

127   participate in the study were included. Those who had prior experience in implementing an

128   EBP program, and those who were planning to leave the organization within the follow-up

129   period were excluded. Because of the explicit nature of the intervention, we were unable to

130   blind the participants.

131

Sample Size

133   The sample size was calculated based on the primary outcome variable – EBP

134   competency. To achieve an 80% power, with 5% level of significance, a minimum

135   difference of 10% in EBP competency, a standard deviation of 26.7 (McCluskey &

136   Lovarini, 2005) and adjusting for design effect, a target size of 48 per group was found

137 appropriate (Cohen, 1988). However, due to the fixed number of subjects in the accessible

138 population, the researchers could not achieve the required sample size. Hence a complete

139 enumeration of eligible subjects was undertaken. We had 27 nurse educators in the

140 intervention group and 24 in the control group.

141

142 **Intervention**

143 The intervention development process had three stages - development of initial draft,

144 content validation and pilot testing.

145

146 Focus group discussions (FGDs) and review of literature were used to develop the initial

147 draft. Five FGDs were conducted. We had two FGDs with nurse educators (n=13), one

148 FGD each with clinical nurses (n=10), national experts in EBP (n=6) and international

149 experts in EBP (n=5). Based on the FGDs the learning needs were identified and the

150 information to be included in the EBP training were outlined. This was followed by a

151 systematic review of literature. The review revealed that the majority of EBP interventions

152 had components as per the five-step model of EBP (Mollon et al., 2012; Jalali-Nia, Salsali,

153 Dehghan-Nayeri, & Ebadi, 2011; Kim, Brown, Fields, & Stichler, 2009). Based on the

154 focus group discussion and the review of literature, a draft intervention was developed.

155 The intervention had relevant concepts from nursing and non-nursing models on EBP such

156 as Iowa model (Titler, et al., 2001), the Stetler model (Stetler, 2001), Johns Hopkins

157 Nursing EBP model (Newhouse, Dearholt, Poe, Pugh, & White, 2007), and Rosswurm and

158 Larrabee's model (1999).

159

160　The content of intervention was validated by a panel of ten experts from the field of

161　evidence-based nursing, evidence-based medicine, library sciences, and biostatistics. The

162　experts suggested to include addition examples and EBP activities. Based on these

163　comments the intervention was revised. The revised intervention was subjected to pilot

164　testing among five nurse educators from a similar educational setting. The feedback was

165　elicited, and the intervention was found to be appropriate, feasible, and acceptable. After

166　the pilot testing, the intervention was approved and finalized by the investigators. The

167　process of development of intervention is outlined in Figure 1.

168

169　The intervention consisted of a 30-hour intensive EBP training program, with a minimum

170　attendance requirement of 90% and spanned over four days. The intervention had an

171　introductory session on basic concepts of EBP followed by components such as - asking

172　focused questions, finding the evidence, appraising the evidence, integrating the evidence,

173　and evaluating the performance (Heneghan & Badenoch, 2006). The principal investigator

174　delivered the intervention to the participants. The teaching-learning strategies of the

175　training ensured the active participation of nurse educators. We had interactive lectures,

176　small group activity and presentation, reflective and critical thinking exercises, and skill-

177　building exercises. The activities focused on integrating EBP into both theory and clinical

178　teaching. Daily feedback was obtained, and the necessary modifications were incorporated.

179　The educators participated in the intervention maintained a logbook of EBP integration

180　activities they undertook during clinical and theory classes. Table 1 outlines the

181　components of the intervention.

182

183 **Control Condition**

184 The control group participated in the baseline evaluation (T_0), similar to that of the

185 intervention group. The participants in the control group did not receive the study

186 intervention. Control participants were followed-up at the fifth (T_1), and tenth month (T_2).

187 For ethical reasons and to ensure fairness, the participants in the control group were trained

188 in EBP after the completion of the study.

189

190 **Measurements**

191 The outcome variables of this trial were knowledge, attitude, practice, and competency

192 regarding EBP.

193

194 *EBP knowledge and practice.* EBP knowledge and practice were assessed using the

195 subscales of the self-reported evidence-based practice questionnaire (EBPQ) developed by

196 Upton and Upton (2006). The scale had six items on EBP knowledge scored on a seven-

197 point Likert scale from 1(never) to 7 (frequently). The overall knowledge scores range

198 from 6 to 42, with higher scores representing better knowledge. The EBP practice subscale

199 had 14 items scored on a seven-point Likert scale from 1(poor) to 7(best). The overall

200 practice scores range from 14 to 98, with higher scores denoting better practices. The

201 Cronbach's alpha reliability scores of the knowledge and practice subscales were 0.91 and

202 0.85, respectively (Upton & Upton, 2006). We obtained permission from the authors to use

203 EBPQ.

204

EBP attitude. Majority of the EBP attitude scales were found to assess attitude of clinical nurses or clinicians towards EBP. Since the study was exploring nurse educators' attitude towards EBP, it was felt appropriate to develop a tool. Hence a 21-item scale was developed by the research team to assess the attitude of nurse educators towards EBP. Each item was evaluated on a five-point Likert scale. The range of possible scores varied from 21 to 105, with higher scores representing favorable attitudes towards EBP. Ten experts established the content validity of the tool. The scale-content validity index (S-CVI) was 0.995. Reliability was determined by computing Cronbach's alpha, which was 0.904.

EBP competency. EBP competency of the nurse educators was the primary outcome variable for the trial and was evaluated using the modified version of Fresno test (Tilson, 2010). The Fresno test is widely used among general practitioners (Ramos, Schafer, & Tracz, 2003), occupational therapists (McCluskey & Lovarini, 2005), and nurses (Halm, 2018). The 13-item test had eight short-answer questions, two questions with mathematical calculations, and three fill-in-the-blank questions with an overall minimum score of zero and a maximum score of 224. The original version of the scale with physical therapy-specific case scenarios (eight short answer questions) was modified with nursing-specific case scenarios, based on the structure provided by original author of the tool (Tilson, 2010). A standardized grading rubric was used to score the Fresno test. The scenarios and grading rubric were validated by ten experts, and CVI of the scale was 1. The Cronbach's alpha reliability score was 0.86, indicating good internal consistency. The version of the Fresno test used in the study is provided as supporting information.

228

Research Ethics

We conducted the trial following the regulations as per the declaration of Helsinki (World

Medical Association, 2008). The institutional research committee approved the trial

protocol. Ethical approval was granted by the Institutional Ethics Committee (240/2012).

The trial was registered with the clinical trial registry – India (CTRI/2018/02/011679).

Organizational consent and administrative approvals were obtained. Participants read the

information sheet and provided the written informed consent. Privacy, anonymity, and

confidentiality of the research participants were ensured during data collection, analysis,

and reporting.

238

Data Analysis

The effect of the intervention is evaluated based on the change in knowledge, attitude,

practice, and competency scores from baseline (T_0) to follow up at fifth (T_1), and tenth

months (T_2). Data collected from the participants were coded and double-checked. The

statistical analyses for the trial were performed using SPSS version 20.0 for windows

(SPSS Inc., Chicago, IL, USA). Descriptive statistics were used for the summarization of

sociodemographic and baseline variables. The difference in sociodemographic variables

(age, years of experience, and educational background) between the intervention and

control group at baseline were analyzed using an independent t-test. To compare the

outcome variables between the groups, we used mixed linear multi-level modelling (Mixed

linear MLM). Multilevel modelling is a statistical method used to handle clustered or

grouped data (Campbell, Mollison, Steen, Grimshaw, & Eccles, 2000). In cluster

251 randomized trials, factors other than intervention might affect the outcome. The aim of

252 multi-level modelling technique is to adjust for these covariates and take into account, the

253 inherent correlation that exist within the clusters (Campbell et all. 2000; Gelman, 2006;

254 Snijders & Bosker, 2012). In the current study, the usage of Mixed Linear MLM is

255 justified as the data have correlated and nested nature. The repeated measurements of

256 outcome variable (follow-up 1 and follow-up II) makes the data correlated. The data is

257 nested as it arises from cluster of nurse educators. Statistical significance was set at p

258 <0.05.

259

260 **RESULTS**

261 The enrollment, allocation, and follow up of the participants are represented in the

262 consolidated standards of reporting trials (CONSORT) flow diagram (Figure 2). A total of

263 sixty-one participants were assessed for eligibility, and 56 participants were enrolled as six

264 clusters. There were 27 participants in the intervention group and 24 participants in the

265 control group. By the end of the tenth month, we had one drop out in the intervention

266 group and six dropouts in the control group.

267

268 **Characteristics of Study Participants**

269 The mean (SD) age of nurse educators in the intervention group was 34.8 (6.2) years, and

270 in the control group, it was 35.1(7.6) years. Majority of nurse educators were masters

271 qualified in the intervention (81.2%) and the control group (75%). Only two participants in

272 the intervention and control group had doctoral education. The mean (SD) years of

273 teaching experience in the intervention and control group were 9.52 (5.17) and 10.7 (6.56)

274   simultaneously. Participants in both groups were comparable for variables such as age,

275   years of experience, and educational background ($p > 0.05$) (Table 2).

276

277   **Effect of the Intervention**

278   *EBP knowledge*

279   The mean (SD) baseline knowledge scores of nurse educators in the intervention group

280   were 24.15 (10.44), and the control group was 26.13 (8.07). Both groups showed a gradual

281   increase in knowledge during follow-up I and follow-up II (Table 3). A comparison of the

282   overall EBP knowledge scores of nurse educators in the intervention group and the control

283   group was carried out using a mixed linear multi-level modeling. The result showed a

284   statistically significant change, $F(2, 91.65) = 4.11$, $p < 0.05$, indicating that the

285   intervention was effective in improving the knowledge of nurse educators.

286

287   *EBP attitude*

288   At baseline, the mean (SD) attitude score of nurse educators in the intervention group was

289   90.3 (10.9), and the control group was 94.09 (8.05). Attitude scores remained higher

290   among nurse educators in the intervention group across time points T_1 and T_2 (Table 3).

291   Analysis using Mixed linear MLM showed a significant change in the attitude of nurse

292   educators in the intervention group [$F(2,91.07) = 3.55$, $p < 0.05$].

293

294   *EBP practice*

295   The mean (SD) practice score of intervention and control groups at baseline was

296   58.07(20.56) and 53.79 (13.29), respectively (Table 3). After five months (T_1), the

297 intervention group showed an increase in practice scores as compared to the control group

298 (75.07 vs. 54.71). After ten months (T_2), Mixed linear MLM analysis showed a significant

299 improvement in practice scores of nurse educators in the intervention group [$F (2, 94.88)$

300 $= 6.21, p < 0.05$].

301

302 *EBP competency*

303 The mean (SD) competency scores of the intervention group improved from 20.30 (13.13)

304 at T_0 to 103.46 (27.87) at T_2, whereas control group scores changed marginally from 24.67

305 (11.39) to 28.78 (10.86) (Table 3). The difference across the groups showed a statistical

306 significance in Mixed linear MLM analysis [$F (2, 92.06) = 37.13, p < 0.05$], indicating

307 intervention effectiveness.

308

309 **DISCUSSION**

310 Training the trainers is essential to transfer the information to the trainees. Therefore, nurse

311 educators need to be trained in EBP so that the future generation of nurses will be able to

312 base their practice on evidence. This cluster-randomized trial examined the effectiveness

313 of an EBP intervention on knowledge, attitude, practice, and competency of nurse

314 educators. The results revealed that in comparison to a control group, the 30-hour EBP

315 training program significantly improved the knowledge, attitude, practice, and competency

316 of nurse educators.

317

318 There have been little published studies on EBP interventions among nurse educators;

319 nonetheless, many studies have conducted among nurses and nursing students. Our finding

320   that the EBP training intervention could improve the knowledge score is consistent with

321   previous work (Allen, Lubejko, Thompson, & Turner, 2015), where a web-based course

322   was found to improve the EBP knowledge. Earlier studies have consistently shown that the

323   EBP interventions could enhance the knowledge and practice of nursing students (Kim et

324   al., 2009; Zhang, Zeng, Chen, & Li, 2012) as well as the knowledge and attitudes of

325   clinical nurses (Hart et al., 2008; Munroe, Duffy, & Fisher, 2008; Rutledge & Skelton,

326   2011; Spiva et al., 2017).

327

328   In the current study, the intervention group had a remarkable improvement in EBP

329   competency as measured by the Fresno test. Substantial studies have used a version of

330   Fresno test and found that EBP interventions could improve the EBP competency of nurses

331   (Halm, 2018; Morris & Maynard, 2009). However, Morris and Maynard (2009) reported

332   only moderate improvements in the competencies of undergraduate nursing students. Other

333   outcome measures reported by similar studies were EBP utilization (Sortedahl, 2012), EBP

334   self-efficacy (Bissett, Cvach, & White, 2016) and EBP implementation behaviors (Levin,

335   Fineout-Overholt, Melnyk, Barnes, & Vetter, 2011)

336

337   Contradictory to the current study findings, a few studies reported that EBP intervention

338   did not impact change in EBP knowledge (Jalali-Nia et al., 2011; Mollon et al., 2012),

339   attitude (Kim et al., 2009; Larrabee, Sions, Fanning, Withrow, & Ferretti, 2007; Mollon et

340   al., 2012), and practice (Mollon et al., 2012). Two possible factors could have contributed

341   to this. First, there was heterogeneity in the intervention type, duration, intensity, and

342   mode of delivery across these studies. Second, the authors used different scales to assess

343   the outcome variables.

344

345   Our intervention was comprehensive and had integrated all the five steps of EBP

346   implementation (Heneghan & Badenoch, 2006). The overall duration of intervention was

347   30 hours, and the instructional strategies included lectures, small group discussions, and

348   skill-building activities. In an overview of systematic reviews, Young, Rohwer, Volmink,

349   and Clarke (2014) found that long term interventions incorporating approaches such as

350   lectures, computer lab sessions, and small-group discussions, lead to better improvement

351   of knowledge, attitude and practice when compared to short term interventions. Hence the

352   success of our intervention could be attributable to its comprehensiveness, duration, and

353   the use of diverse instructional strategies.

354

355   **STRENGTHS AND LIMITATIONS**

356   The study was set up in a pragmatic environment and was conducted as a cluster-

357   randomized trial design, the gold standard for intervention research. This could have

358   potentially reduced the effects of known and unknown confounders. The intervention was

359   broad, and it covered all aspects of integrating EBP in nursing education. The use of

360   diverse instructional strategies could have added robustness to the study intervention. A

361   comprehensive evaluation of outcome variables is an added strength of the study. Since the

362   study was conducted at a single setting, there were potential chances for information

363   exchange between the participants. To minimize this, a learning contract was obtained

364   from participants in the intervention arm, stating that they will not be sharing or

365 transferring the information to the participants in the control group. Additionally, measures

366 like cluster randomization, and contamination checking, were incorporated into the

367 methodology to minimize and evaluate the contamination of intervention. Because of the

368 explicit nature of intervention, we were unable to blind the study participants (Renjith V,

369 2017). Even though the findings of the study are positive, some limitations should be

370 acknowledged. Most of the outcome variables were self-reported, and this might have

371 overestimated the intervention effects. Data were collected from a single academic setting,

372 and therefore care should be exercised when generalizing the findings to diverse settings.

373 Another problem that might have obscured the intervention effect could be Hawthorne

374 effect. The participants could have modified their behavior as they were being followed

375 up. The current study assesses outcomes at the individual participant level; however, the

376 effect of the intervention on outcomes at the organizational level, such as organizational

377 readiness and organizational culture, would have been meaningful.

378

379 **IMPLICATIONS TO PRACTICE**

380 Integrating EBP into nursing education has become vital in today's evolving health care

381 environment. The training program had a positive impact on improving the knowledge,

382 attitude, practice, and competency of nurse educators. One of the significant barriers to

383 implementing EBP in nursing education is the lack of knowledge of EBP among nurse

384 educators (Stichler, Fields, Kim, & Brown, 2011). Hence, implementing similar

385 interventions are critical in building the capacity of nurse educators.

386

387 **CONCLUSIONS**

388   The field of evidence-based nursing is still in a developing stage in India. To the extent of

389   our knowledge, this is the first trial from the country to evaluate the effect of an EBP

390   intervention for nurse educators. We found that the EBP training program improved the

391   knowledge, attitude, practice, and competency of nurse educators. As nurse educators

392   increase their understanding of EBP, they can confidently create more opportunities to

393   incorporate EBP in the teaching-learning process.

394

395   **LINKING EVIDENCE TO ACTION**

396   • EBP training programs are effective in improving the knowledge, attitude, practice,

397   and competency of nurse educators.

398   • The EBP training interventions should incorporate multiple teaching-learning

399   strategies, as this will have a positive impact on the outcomes.

400   • Future research should focus more on multicenter educational trials in diverse

401   educational settings. Such works will widen the evidence base for integrating EBP in

402   the nursing curriculum.

403

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