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The level of adherence to best-practice guidelines by interprofessional teams with and without acute care nurse practitioners in cardiac surgery: a study protocol
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Full Title:	The level of adherence to best-practice guidelines by interprofessional teams with and without acute care nurse practitioners in cardiac surgery: a study protocol
Short Title:	Adherence to best-practice guidelines by interprofessional teams with and without nurse practitioners
Corresponding Author:	Li-Anne Audet, MSc McGill University Faculty of Medicine and Health Sciences Montreal, Quebec CANADA
Keywords:	Acute care nurse practitioner, best-practice guidelines, cardiac surgery, interprofessional teams, quality of care
Abstract:	Background Acute care nurse practitioners (ACNP) have been implemented in postoperative cardiac surgery settings and have shown to provide significant benefits to patients and organizations. To explain these associations, recent studies have suggested that ACNP increase the level of adherence to best-practice guidelines by interprofessional teams. However, it is unknown if interprofessional teams with ACNP are associated with higher levels of adherence to best-practice guidelines compared to interprofessional teams without ACNP. Furthermore, no extraction tool is available to measure the level of adherence to best-practice guidelines by interprofessional teams in postoperative cardiac surgery settings. This project aims to examine the level of adherence to best-practice guidelines of interprofessional teams with and without ACNP in a postoperative cardiac surgery setting in Québec, Canada. Methods A retrospective observational study will be conducted of 300 patients hospitalized between January 1, 2019 and January 31, 2020 in a postoperative cardiac surgery unit in Québec, Canada. Data will be collected from patient health records and electronic databases. An extraction tool will be developed based on systematic review of the literature, and will include best-practice guidelines and confounding variables related to patient and interprofessional teams' characteristics. Content and criterion validation, and a pilot-test will be conducted for the development of the tool. A multivariate linear regression model will be developed and adjusted for several confounding variables, in order to examine the association between interprofessional teams with and without ACNP, and the level of adherence to best-practice guidelines. Discussion This project represents the first study to examine the level of adherence to best-practice guidelines by interprofessional teams with and without ACNP in a postoperative cardiac surgery setting. The findings of this project will generate empirical data focusing on the contribution of ACNP within interprofessional teams, and ultimately enhance the delivery of high quality and evidence-based care for patients and families.
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	Éric Tchouaket, PhD
	Kelley Kilpatrick, PhD
Response to Reviewers:	September 13th, 2022

To the Editor of Plos One,

We thank the reviewer and the editor for their thoughtful comments and have summarized our modifications to the manuscript addressing their questions and suggestions in the table attached with our submission.

Please do not hesitate to contact us if you require any additional information or have any further questions.

We will look forward to hearing from you.

Sincerely,

Li-Anne Audet

Additional Information:	
Question	**Response**
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The level of adherence to best-practice guidelines of interprofessionnel teams with and without adult care nurse practitioner in postoperative cardiac surgery: a retrospective observational study (IPSSA chirurgiecardiaque / 2022-8094)
MUHC REB Co-Chair for the CTGQ panel: Me Marie Hirtle

Dear Dr. Lavoie-Tremblay,
Thank you for submitting your responses and corrections for the research project indicated above, as requested by the McGill University Health Centre (MUHC) Research Ethics Board (REB).
The MUHC REB, more precisely its Cells, Tissues, Genetics & Qualitative (CTGQ) research panel provided conditional approval for the research project after a delegated review provided by its member(s).
On 2021-09-15, a delegated review of your responses and corrections was provided by member(s) of the MUHC REB. The research project was found to meet scientific and ethical standards for conduct at the MUHC.

The following documents were approved or acknowledged by the MUHC REB:
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2 **The level of adherence to best-practice guidelines by interprofessional teams**
3 **with and without acute care nurse practitioners in cardiac surgery: a study**
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40 **The level of adherence to best-practice guidelines by interprofessional teams**

41 **with and without acute care nurse practitioners in cardiac surgery: a study**

42 **protocol**

43 **Short title**

44 Adherence to best-practice guidelines by interprofessional teams with and without acute

45 care nurse practitioners

46 **Abstract**

47 **Background**

48 Acute care nurse practitioners (ACNP) have been implemented in postoperative cardiac

49 surgery settings and have shown to provide significant benefits to patients and

50 organizations. To explain these associations, recent studies have suggested that ACNP

51 increase the level of adherence to best-practice guidelines by interprofessional teams.

52 However, it is unknown if interprofessional teams with ACNP are associated with higher

53 levels of adherence to best-practice guidelines compared to interprofessional teams

54 without ACNP. Furthermore, no extraction tool is available to measure the level of

55 adherence to best-practice guidelines by interprofessional teams in postoperative

56 cardiac surgery settings. This project aims to examine the level of adherence to best-

57 practice guidelines of interprofessional teams with and without ACNP in a postoperative

58 cardiac surgery setting in Québec, Canada.

59 **Methods**

60 A retrospective observational study will be conducted of 300 patients hospitalized

61 between January 1, 2019 and January 31, 2020 in a postoperative cardiac surgery unit

62 in Québec, Canada. Data will be collected from patient health records and electronic

63 databases. An extraction tool will be developed based on systematic review of the

64 literature, and will include best-practice guidelines and confounding variables related to

65 patient and interprofessional teams' characteristics. Content and criterion validation,

66 and a pilot-test will be conducted for the development of the tool. A multivariate linear

67 regression model will be developed and adjusted for several confounding variables, in

68 order to examine the association between interprofessional teams with and without

69 ACNP, and the level of adherence to best-practice guidelines.

70 **Discussion**

71 This project represents the first study to examine the level of adherence to best-practice

72 guidelines by interprofessional teams with and without ACNP in a postoperative cardiac

73 surgery setting. The findings of this project will generate empirical data focusing on the

74 contribution of ACNP within interprofessional teams, and ultimately enhance the

75 delivery of high quality and evidence-based care for patients and families.

76 **Keywords**

77 Acute care nurse practitioner, best-practice guidelines, cardiac surgery,

78 interprofessional teams, quality of care

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Background

Cardiac surgeries are one of the leading types of surgical procedures performed

internationally. In 2017, approximately 1 million patients throughout the world underwent

a cardiac surgery (1). Most cardiac surgeries are performed in developed countries (1).

In 2018, the Society of Thoracic Surgeons (STS) reported 287,872 cardiac surgeries

and procedures performed in the United States (2). In Canada, 42,989 coronary artery

bypass grafts (CABG) and 7,186 valve repairs were performed between 2013 and 2016

(3, 4).

In the postoperative phase after the surgery, many patients are at high risk of

developing adverse events and postoperative complications such as myocardial

infarction and wound infection (5). These complications are associated with higher risk

of mortality and development of comorbidities (e.g., heart failure), as well as a decrease

in the well-being and quality of life of patients and families (6). For healthcare

organizations, adverse events and postoperative complications are associated with a

longer length of stay at the hospital, higher rates of readmission in intensive care units,

higher rates of surgical re exploration, and an increase in cost (7, 8).

To prevent the risk of adverse events and postoperative complications for

patients and families, international healthcare organizations and research teams have

developed best-practice guidelines (7, 9). Best-practice guidelines are defined as

evidence-based practice of care, and aim to ensure the performance of

interprofessional teams, enhancing the quality and safety of the care given to patients

and families. In postoperative cardiac surgery settings, best-practice guidelines related

to the pharmacotherapy, laboratory tests, clinical indicators, and lifestyle promotion

108   (e.g., diet, cardiac rehabilitation) have been developed and implemented in healthcare

109   centres (2).

110   A consensus in the literature supports the importance of a high level of

111   adherence by interprofessional teams to best-practice guidelines, in order to ensure

112   their efficacy (7, 10). Adherence to best-practice guidelines is defined as the

113   achievement of the guideline, as well as the associated interventions performed by

114   clinicians (11). In surgical settings (e.g., neurosurgery, orthopedic surgery) international

115   research teams (12-15) have developed composite scores to examine the level of

116   adherence to best-practice guidelines by interprofessional teams. Their findings

117   suggested that a higher level of adherence is associated with a higher quality of care

118   given to patients and families.

119   In postoperative cardiac surgery settings, recent studies (5, 16) identified a

120   significant association between a high level of adherence to best-practice guidelines by

121   interprofessional teams and a lower risk of postoperative complications and adverse

122   events for patients. Other studies (5, 16, 17) have shown a significant association

123   between a lower level of adherence to best-practice guidelines by interprofessional

124   teams and a higher risk of postoperative complications and adverse events for patients.

125   Larrazzet et al. (2014) conducted a longitudinal study of 144 patients who died after

126   cardiac surgery. The authors identified a significant association between a lack of

127   adherence to best-practice guidelines by interprofessional teams, and a higher risk of

128   mortality, highlighting the importance of the high adherence to best-practice guidelines

129   by interprofessional teams (17).

130   Internationally, there is variability in the scope of practice and level of autonomy

131   of ACNPs (18,19). Recent studies have examined the practice of nurse practitioners

132   (NP) within primary and acute care settings, and suggested that their practice could

133   increase the level of adherence to best-practice guidelines by interprofessional teams

134   (18, 19). The NP's support of the practice of different care providers in the team with a

135   focus on best evidence is believed to underpin providers' adherence to best-practice

136   guidelines focused on pharmacotherapy, clinical indicators, and lifestyle promotion. NPs

137   also enhance collaboration and communication among teams' members and facilitate

138   continuity of care, contributing to the higher adherence to best-practice guidelines by

139   interprofessional teams (18, 20).

140   Based on the International Council of Nurses guidelines, the NP is an advanced

141   practice nursing role, based on a graduate or postgraduate education and an in-depth

142   nursing and medical expertise (21-23). In several acute care settings, including

143   postoperative cardiac surgery, acute care nurse practitioners (ACNP) have been

144   implemented in interprofessional teams and performed activities such as the clinical and

145   psychosocial assessment of patients, the prescription and management of

146   pharmacotherapy, laboratory tests and clinical interventions, lifestyle promotion,

147   teaching of coping strategies, preparation for hospital discharge, and the management

148   of consultations and external resources (24). International research teams (23, 25) have

149   examined the practice of ACNPs within postoperative cardiac surgery settings. They

150   identified significant associations between the ACNPs' practice and higher patient

151   satisfaction, higher participation of patients to cardiac rehabilitation, and lower length of

152   stay at the hospital after the cardiac surgery. However, other research teams (21, 26)

153   did not identify significant associations between ACNP practice and patient and

154   organizational outcomes within postoperative cardiac surgery settings. More

155   specifically, the authors suggested that the difficulty of recruiting participants, the high

156   attrition rate, the small sample sizes, and the inability to adjust the data analysis for

157   confounding variables related to the patient and interprofessional teams' characteristics

158   were important limits contributing to the non-significant findings (21,26).

159   Systematic reviews of randomized controlled trials (RCT) (21, 23) have been

160   conducted to understand the inconsistent findings in the current literature. These

161   systematic reviews have identified three important limits contributing to the inconsistent

162   findings of the current literature. Firstly, although several RCT of the current literature

163   focus on the efficacy of ACNP for patients and healthcare organizations, less attention

164   has been paid to the efficacy of these providers for interprofessional teams. The

165   qualitative study of Reich et al. (2018) suggested that the implementation of ACNP

166   within interprofessional teams increases the level of adherence of those teams to best-

167   practice guidelines in postoperative cardiac surgery settings, and represents an

168   underlying factor contributing to the efficacy of NP (19). However, these propositions

169   have not been subjected to statistical validation, thus it is unknown if interprofessional

170   teams with ACNP are associated with higher levels of adherence to best-practice

171   guidelines, compared to interprofessional teams without ACNP. Moreover, until today,

172   no validated extraction tool is available to measure the level of adherence to best-

173   practice guidelines of interprofessional teams with and without ACNP in postoperative

174   cardiac surgery settings.

175   Secondly, systematics reviews have highlighted the difficulty in adequality

176   controlling confounding variables in the existing RCT (21, 23). Confounding variables

177   represent important factors influencing the efficacy of ACNP on patient and

178   organizational outcomes in postoperative cardiac surgery settings. Methodological limits

179   of the existing RCT, such as the small sample size and high attrition rate, limit the

180   capacity of research teams to develop robust multivariate statistical models adjusted for

181   confounding variables related to patient, interprofessional teams, and organizational

182   characteristics (21, 23). Interestingly, retrospective observational studies have shown to

183   be a relevant alternative to examine the association between ACNP and patient and

184   organizational outcomes in postoperative cardiac surgery settings. Existing studies (27-

185   30) have used retrospective observational studies to gather a large cohort of patients,

186   limit attrition, and develop statistical models adjusted for many confounding variables.

187   These studies (6, 27-29) have identified significant associations between ACNP within

188   interprofessional teams, and lower risks of mortality and decreased costs in

189   postoperative cardiac surgery settings.

190   Thirdly, the majority of the RCT focus on ACNP practice within primary care

191   settings (e.g., in-home care, rehabilitation clinic) after the cardiac surgery. Less

192   attention has been paid to ACNP practice in acute care settings; however, within these

193   settings, ACNP works in collaboration with cardiac surgeons, nursing teams,

194   rehabilitation teams, social workers, and other members of the interprofessional teams

195   to ensure the patient optimal recovery after the surgery and prevents the risk of adverse

196   events and postoperative complications. Moreover, for patients and families, the acute

197   care hospitalization after the surgery represents a crucial phase of their postoperative

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198   recovery and is associated with several physical, psychosocial, and emotional stressors

199   (30). Future studies are needed to substantiate the contribution of ACNP in

200   interprofessional teams within acute care settings, and identify the benefits of their

201   practice for patients, families, interprofessional teams, and healthcare organizations.

202   Consequently, the aim of this project is to examine the level of adherence to

203   best-practice guidelines of interprofessional teams with and without ACNP in acute

204   postoperative cardiac surgery settings in Québec, Canada.

205   **Study hypothesis and objectives**

206   The hypothesis of this study is:

207   H1: This study will verify if interprofessional teams with ACNP are associated

208   with a higher level of adherence to best-practice guidelines compared to

209   interprofessional teams without ACNP, after controlling for the patient and

210   interprofessional team characteristics.

211   The objectives of this study are as follows:

212   1. Develop and pilot-test an extraction tool to measure the level of adherence to

213   best-practice guidelines of interprofessional teams within postoperative cardiac

214   surgery setting.

215   2. Describe the patient and interprofessional teams' characteristics, as well as the

216   level of adherence to best-practice guidelines, of patients under the care of

217   interprofessional teams with and without ACNP.

218   3. Examine the association between interprofessional teams with ACNP and the

219   level of adherence to best-practice guidelines, compared to interprofessional

220   teams without ACNP, after adjusting patient and interprofessional team

221   characteristics in postoperative cardiac surgery setting.

222   **Methods and design**

223   **Study design**

224   A retrospective observational study (31, 32) will be conducted. De-identified data will be

225   extracted from the UHC data warehouse, and the patient health records to assemble

226   the retrospective cohort of patients and conduct the data collection. Ethics approval was

227   obtained from the McGill University Health Centre Research Ethics Board on

228   September 15, 2021 (IPSSA chirurgie cardiaque/2022-8094). This project uses the

229   guidelines from *Strengthening the Reporting of Observational Studies in Epidemiology*

230   *(STROBE) Statement: Guidelines for Reporting Observational Studies* (32) were used

231   for this project (SA appendix).

232   **Study setting**

233   This study will be conducted at a University healthcare centre (UHC) in Québec,

234   Canada. Annually, this healthcare centre performs approximately 1,000 cardiac

235   surgeries and has a 36-bed postoperative cardiac surgery unit.

236   After cardiac surgery, patients are admitted to the intensive care unit (ICU), and

237   are under the care of ICU teams. At the time of data collection, the ICU teams in

238   Québec, Canada do not include ACNP. On average, patients are hospitalized for 24

239   hours in the ICU before being transferred to the postoperative cardiac surgery unit.

240   Patients readmitted to the ICU are under the care of ICU teams.

241   Upon admission to the postoperative cardiac surgery unit, patients are assigned

242   to the care of interprofessional teams with or without ACNP. Team assignment depends

243   on the current workload of each team, and the availability of the beds in the unit.

244   Interprofessional teams with ACNPs are assigned 16 of the unit's beds (44%) and

245   interprofessional teams without ACNP are assigned 20 of the unit's beds (56%).

246   Patients are followed by their respective teams from their admission to the cardiac

247   surgery unit, until the hospital discharge or death. On average, the length of stay at the

248   hospital after the surgery ranges from 9 to 11 days (33).

249   Interprofessional teams with and without ACNP include the following: cardiac

250   surgeons and residents nursing teams, skin care and wound therapists,

251   physiotherapists, nutritionists, respiratory therapists, social workers, and medical and

252   other specialists. Interprofessional teams with and without ACNP ensure the daily

253   follow-up of patients, the assessment of the patient's clinical and psychosocial condition,

254   the management of pharmacotherapy, clinical intervention, laboratory tests, lifestyle

255   promotion, and the preparation of patients upon hospital discharge.

256   **The practice of acute care nurse practitioners in postoperative cardiac surgery**

257   **unit**

258   Since 2017, seven ACNPs practice in postoperative cardiac surgery, based on a

259   monthly rotation system. Two ACNP simultaneously practice within interprofessional

260   teams and collaborate with other clinicians to ensure the daily follow-up of the patients

261   after cardiac surgery. ACNP practice includes the assessment of the clinical and

262   psychosocial condition of the patient and families, the management of the

263   pharmacotherapy, clinical interventions, and laboratory tests. The ACNP also teaches

264   coping strategies, lifestyle promotion, cardiac rehabilitation, preparation of the patients

265   and families for the in-home recovery after discharge. The ACNP supports the

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266 preparation for hospital discharge (e.g., prescription of the patient medication after

267 discharge, summary for the family physician, etc.) (34).

268 **Study population and sample**

269 A dynamic cohort of patients will be assembled from hospitalized patients at the

270 postoperative cardiac surgery unit between January 1, 2019, and January 31, 2020.

271 This timeframe will avoid the recruitment of patients during the COVID-19 pandemic, a

272 window of time during which the practice of ACNP within the unit was inconsistent.

273 Patients will be selected, based on three inclusion criteria: 1) patient admitted for a

274 diagnosis of CABG and/or valve repair, 2) patient age is over 18 years old, and 3)

275 patient has been hospitalized for at least 24 hours in the postoperative cardiac surgery

276 unit. The minimum 24-hour criteria will allow our team to examine the hospitalization of

277 the patient in the postoperative cardiac surgery unit, which is the setting where ACNPs

278 practice in Québec (35). Patients will be identified from the electronic databases of the

279 UHC and the diagnostic codes of the Canadian Institute for Health Information (36) (SB

280 appendix).

281   A sample size calculation was conducted in G*power (37). This project will

282 include 15 variables, including one independent variable, one dependent variable, and

283 13 confounding variables. The variables selected for this project are described in the

284 next section. To perform one multivariate linear regression model and detect an effect

285 size of f^2=0.15 with a power of 0.80 and a standard error of 5%, a minimum sample size

286 of 183 patients was estimated.

287   A total of 300 patients will be selected, based on the sample size calculation and

288 an over-estimation of at least 20%, to consider the risk of error from the presence of

289   missing data and incomplete patient health records (38, 39). A systematic random

290   selection of 150 patients under the care of interprofessional teams with ACNP will be

291   conducted and matched with 150 patients under the care of interprofessional teams

292   without ACNP. Three criteria (40-43) will be used to match each pair (1:1): 1) age (i.e., a

293   five-year gap will be tolerated) 2) sex, and 3) type of cardiac surgery (i.e., CABG, valve

294   repair, or CABG/valve repair).

295   Patients will be followed from their admission to the ICU after the cardiac

296   surgery, until the occurrence of the following events, whichever occurs first: 1)

297   discharge from the hospital, 2) death, or 3) the cumulation of 14-days in hospital after

298   the surgery. The 14-days' timeframe will allow our team to capture the acute phase of

299   the patient hospitalization after the cardiac surgery (33). The total length of stay for

300   patients hospitalized longer than 14-days will be measured.

301   **Variables under study**

302   A systematic review of RCTs (24) and an extensive search in the literature and

303   international healthcare organizations (e.g., American Heart Association, Society of

304   Thoracic Surgeons) was conducted to retrieve best-practice guidelines for

305   interprofessional teams in postoperative cardiac surgery settings, and confounding

306   variables related to patient and interprofessional teams' characteristics. A total of 12

307   best-practice guidelines and 13 confounding variables were identified and presented in

308   Figure 1. The operationalization of each variable is presented in SC appendix.

309   *Independent variable: interprofessional teams with and without acute care nurse*

310   *practitioner*

311   A dichotomous variable will be created to measure the inclusion of at least one ACNP

312   within the interprofessional team. For patients under the care of an interprofessional

313   team with ACNP, an additional descriptive variable will measure the number of days

314   where the ACNP was implicated in the daily follow-up of the patient, on the entire

315   hospitalization at the postoperative cardiac surgery unit.

316   *Dependant variable: the level of adherence to best-practice guidelines by*

317   *interprofessional teams*

318   A composite score will be developed to measure the level of adherence to best-practice

319   guidelines by interprofessional teams. An individual composite score will be calculated

320   per patient per day of hospitalization at the postoperative cardiac surgery unit. A total of

321   12 best-practice guidelines will be included in the composite score (Figure 1). Each

322   best-practice guideline will be scored on two points based on the following: 1) the

323   achievement of the guideline recommendation (e.g., prescription of beta blocker) and 2)

324   the associated interventions performed by clinicians (e.g., follow-up of the blood

325   pressure). All best-practice guidelines are divided into three categories: 1)

326   pharmacotherapy (n=4), 2) laboratory tests (n=4), and 3) postoperative assessment

327   (n=4).

328   Four best-practice guidelines are included in the category of pharmacotherapy.

329   These guidelines are the prescription and monitoring of medications including: 1)

330   anticoagulants, 2) beta blockers, 3) lipid-lowering agents, and 4) anti-platelets, during

331   hospitalization and at hospital discharge of the patient. For each best-practice guideline,

332   two additional descriptive variables will be collected, including the type of medication

333 prescribed and the presence of a contraindication, which precludes the possibility of

334 achieving the guideline recommendation (e.g., allergy).

335 Four best-practice guidelines on laboratory tests are included, recommending the

336 prescription and monitoring of the following: 1) potassium (K+), 2) magnesium (Mg+), 3)

337 serum glucose, and 4) international normalized ratio (INR) by interprofessional teams

338 during the patient's hospitalization in the postoperative cardiac surgery unit. The

339 achievement of each best-practice guideline recommendation will be confirmed if the

340 laboratory result falls under the normal range supported by the current literature. An

341 additional variable called "no INR needed" will be added specifically for the best-practice

342 guideline related to the prescription and management of INR, to take into consideration

343 patient who don't need a strict INR follow-up (e.g., administration of direct acting oral

344 anticoagulant (DAOC)). A pilot test will be performed to assess the characteristics of the

345 patients hospitalized at the post-operative cardiac surgery unit and the feasibility of the

346 data collection. The following three additional descriptive variables will be measured for

347 each guideline: 1) number of prescriptions requested by interprofessional teams, 2)

348 proportion of abnormal values below or above normal range, and 3) average of all

349 values of laboratory tests.

350 Four best-practice guidelines are included in the category of the postoperative

351 assessment performed by interprofessional teams. A daily assessment of the patient's

352 level of pain, surgical wound(s), nutrition, and mobilization will be measured. For each

353 best-practice guideline recommendation, the achievement of the guideline will be

354 confirmed if at least one postoperative assessment per day is performed by the ACNP

355 or other members of the interprofessional teams during the patient's hospitalization in

356   the postoperative cardiac surgery unit. Two additional descriptive variables will be

357   measured for each best-practice guideline, including: 1) the total number of

358   postoperative assessments performed by interprofessional teams during the

359   hospitalization, and 2) the type of associated interventions conducted by clinicians (e.g.,

360   non-pharmacological, consultation, etc.).

361   *Confounding variables related to patient characteristics*

362   Eleven confounding variables related to patient characteristics will be measured. For

363   each patient, sociodemographic characteristics (e.g., sex, age) will be measured. The

364   total length of stay at the hospital will be measured, which includes the stay in the ICU

365   and postoperative cardiac surgery unit. The type of cardiac surgery will be collected

366   from a categorical variable with three categories: 1) CABG, 2) valve repair, and 3)

367   CABG/valve repairs. Comorbidities will be measured and operationalized from the

368   Charlson Comorbidity Index (CCI) (44, 45). A total score of 24 points will be calculated

369   for each patient based on the 17 clinical conditions included in the CCI (SD appendix).

370   The length of stay in the postoperative cardiac surgery unit will be collected for each

371   patient. The hospital 30-days readmission at the postoperative cardiac surgery unit after

372   discharge will be measured for each patient from a dichotomous variable.

373   Four confounding variables related to the patient characteristics in the ICU

374   setting will be measured. The total number of hours hospitalized in the ICU will be

375   measured from the time (in hours) of admission to the ICU after the surgery and the

376   time (in hours) of discharge of the patient. The postoperative prolonged mechanical

377   ventilation will be measured from a dichotomous variable. A prolonged mechanical

378   ventilation will be confirmed if the time under mechanical ventilation exceeds 24 hours.

16

379　The failed extubation of the patient and reintubation after first extubation will be

380　measured with a dichotomous variable. The number of episodes of ICU readmission

381　after initial discharge will be measured for each patient.

382　*Confounding variables related to interprofessional teams' characteristics*

383　Two confounding variables related to interprofessional teams' characteristics will be

384　measured. First, the cardiac surgeon who performed the surgery and ensured the

385　follow-up of the patient's recovery will be noted. A confidential code will be created for

386　each surgeon practising in the UHC. Second, a discrete variable will be created to

387　measure the number of consultations conducted by clinicians from different expertises

388　(e.g., nutrition, rehabilitation team) during the patient's hospitalization in the

389　postoperative cardiac surgery unit. A categorical descriptive variable will be created to

390　measure each clinician's expertise, including the following: 1) rehabilitation team (e.g.,

391　physical therapist, occupational therapist), 2) respiratory therapist, 3) social worker, 4)

392　skin and wound care therapist, 5) nutritionist, and 6) speciality consultation (e.g.,

393　internal medicine, nephrology).

394　**Data collection**

395　An extraction tool will be developed and pilot-tested, based on the best-practice

396　guidelines and the confounding variables related to the patient and interprofessional

397　team characteristics (Figure 1). One extraction will be completed per patient per day

398　during the hospitalization in the postoperative cardiac surgery unit, by the first author or

399　a research assistant. The development of the extraction tool followed the Consensus-

400　based Standards for the selection of health measurement instrument (COSMIN)

17

401   guidelines (46) and will include three stages: the content validation; the criteria

402   validation; and the pilot-test.

403   *Data collection for the content validation*

404   Content validation will be performed following two steps (46). First, an expert committee

405   will be recruited from clinicians, managers, and researchers who have expertise in

406   postoperative cardiac surgery. The identification and recruitment of experts will be

407   conducted by our research team and will include experts in Canada. A total of 10

408   experts will be recruited, including at least the following five: 1) an ACNP who worked a

409   minimum of one year within a postoperative cardiac surgery unit outside of our

410   associated UHC, 2) a cardiac surgeon or fellow in cardiac surgery who worked at least

411   two years in an acute care centre outside of our associated UHC, 3) a nurse manager

412   who manages, at least one year, a postoperative cardiac surgery unit, within our

413   associated UHC, 4) a healthcare professional who worked in the data warehouse of our

414   associated UHC for at least one year, and 5) a researcher in nursing or healthcare

415   sciences with an expertise in measurement instruments and/or cardiac surgery.

416   Second, an electronic survey (47) will be created and composed of all items of

417   the extraction tool (best-practice guidelines and confounding variables). For each item,

418   experts will assess its relevance using a 5-points Likert scale (48, 49). Additional

419   spaces for qualitative comments and suggestions will be included in the survey. Two

420   rounds of revision are planned. After the first round, our team will update the extraction

421   tool and revise any unclear items based on the experts' recommendations, and an

422   updated version will be resubmitted to the expert committee.

423   *Data collection for the criterion validation*

424 The criterion validation of the extraction tool will follow three consecutive steps. Firstly,

425 the best-practice guidelines of The Society of Thoracic Surgeons (STS) have been

426 selected as the gold standard of comparison for this study. For many years, the STS

427 has been a leading healthcare organization in the development and validation of best-

428 practice guidelines and performance measures in the care of patients in cardiac surgery

429 settings (10). In 2007, the STS developed and validated 21 performance measures for

430 the delivery of high quality of care for patients who underwent CABG, valve repair, and

431 CABG/valve repairs (50, 51). For this project, five performance measures were

432 selected, including: 1) prolonged mechanical ventilation higher than 24 hours in the ICU;

433 2) a 30-day readmission rate at the postoperative cardiac surgery unit after hospital

434 discharge; and prescription of the 3) anti-platelet, 4) beta blocker, 5) and lipid-lowering

435 agent, during the hospitalization at the postoperative cardiac surgery unit and at

436 discharge. Each performance measure is operationalized as the proportion of patients

437 who achieved the outcome (e.g., proportion of patients who were under prolonged

438 mechanical ventilation) over the total sample size (46, 47).

439   Secondly, 30 patient health records will be reviewed independently by two

440 reviewers on two occasions, including the first author and a research assistant. For the

441 first round of revision, the patient's health record will be reviewed with the extraction

442 tool. For the second round of revision, the records will be reviewed with the five

443 performance measures from the STS.

444 *Data collection for the pilot-test*

445 A pilot-test will be conducted to assess the feasibility of the tool, standardize data

446 collection among reviewers, examine the quality and accessibility of the retrospective

447   data, and update the tool if needed. Four iterative steps will be included in the pilot-test

448   (52-55). First, two reviewers will conduct the pilot-test and data collection. Training

449   sessions and documentation will be given to the reviewers.

450   Secondly, 30 patient health records from hospitalized patients in the

451   postoperative cardiac surgery unit between January 1, 2019, and January 31, 2020, will

452   be randomly selected. These patients will not be included in the retrospective cohort.

453   Data will be collected by the two reviewers with the extraction tool. Inter-rater reliability

454   will be assessed and a Cohen kappa higher than 0.60 will be targeted (55).

455   Thirdly, a triangulation of the available data will be performed to assess the

456   quality and accessibility of the data. Multiple data sources will be screened between the

457   electronic databases and patient health records. Items from the extraction tool with a

458   high quantity of missing data or low quality of available data will be modified or

459   removed.

460   Finally, frequent meetings among all research team members will be conducted

461   to discuss divergences, reinforce convergences, and establish a consensus. The

462   extraction tool will be updated after the pilot-test if needed (52).

463   During data collection from the retrospective cohort of patients, an additional 30

464   patient health records will be reviewed by two independent reviewers to ensure the

465   standardization of the data collection (49, 50). Inter-rater reliability will be assessed and

466   a Cohen Kappa value higher than 0.60 will be targeted (55).

467   **Data analysis**

468 Statistical analysis will be conducted to meet objectives one, two and three. The unit of

469 observation will be the patient-level and the unit of analysis will be the interprofessional

470 team-level.

471 *Objective 1*

472 The content validation of the extraction tool will include two rounds of revisions, with

473 additional rounds if needed (56, 57). For each round of revision, a Fleiss Kappa will be

474 calculated and a value between 0.60 and 0.80 will be targeted (48, 49). The content

475 validity index (CVI) of each individual item of the extraction tool will be calculated from

476 the proportion of experts who rated a score of 4 or 5 on the Likert scale (58). A CVI of

477 0.80 will be targeted for each item and items with a value below 0.80 will be removed or

478 modified. Then, the proportion of items with a CVI value above 0.80 will be calculated to

479 determine the overall CVI of the extraction tool. A value higher than 0.80 for the overall

480 CVI of the extraction tool will be targeted (46). Qualitative comments and

481 recommendations by experts will be analyzed by content analysis (59).

482 The criteria validation will be assessed using 30 patient health records. Five

483 performance measures developed by the STS will serve as the gold standard for the

484 comparison (10). First, the proportion of patients who achieved each performance

485 measure over the total sample size (n=30) will be calculated, from the measures

486 collected with the gold standard, as well as the measures collected with the extraction

487 tool. Second, Spearman correlation will be calculated to assess the correlation between

488 the proportions obtained from the measures of the gold standard, and the proportions

489 obtained from the measures of the extraction tool. Values of Spearman correlation

490 higher than 0.70 will be targeted (48, 49).

491 *Objective 2*

492 Descriptive analysis will be performed to assess the level of adherence by

493 interprofessional teams with and without ACNP, as well as the confounding variables for

494 patients under the care of both teams (60). An analysis of missing data will be

495 conducted to examine the quality and distribution of missing data within patient health

496 records and electronic databases. Team meetings and consultations with clinicians and

497 statisticians will be held to discuss and identify potential causes of missing data, as well

498 as to conduct a statistical analysis to manage them (61).

499   A composite score will be developed to measure the level of adherence to best-

500 practice guidelines by interprofessional teams with and without ACNP. A composite

501 score per patient per day of hospitalization in postoperative cardiac surgery will be

502 developed and based on four consecutive steps. Firstly, for each best-practice

503 guideline, a score on a scale of two will be created and points will be attributed for: 1)

504 the achievement of the best-practice guideline recommendation, and 2) the associated

505 intervention performed by clinicians. Points will be given based on the information

506 contained in the patient health record and electronic databases. A missed intervention

507 will be considered as a lack of adherence to best-practice guidelines, and no point will

508 be given.

509   Secondly, all best-practice guidelines are divided into three categories: 1)

510 pharmacotherapy, 2) laboratory tests, and 3) postoperative assessments. The sum of

511 the individual score of each best-practice guideline will be calculated for each category.

512 More specifically, each category includes four best-practice guidelines, and will be

513 based on a total score ranging from zero to eight.

22

514   Thirdly, an overall composite score will be calculated from the sum of all the

515   scores of the three categories, ranging from zero to 24. The overall composite score will

516   be transformed into a value in percentage (0 to 100%) and an increase of the score will

517   be associated with an increase of the level of adherence to best-practice guidelines by

518   interprofessional teams. An overall score will be calculated per patient per each day

519   hospitalized in the postoperative cardiac surgery unit.

520   Finally, an average composite score will be calculated from the average of all

521   overall scores during the patient's hospitalization at the postoperative cardiac surgery

522   unit. An average composite score will be calculated for all patients included in the

523   retrospective cohort. A graphic illustration will be created from all average scores to

524   visualize the tendency and distribution of the scores of the cohort.

525   *Objective 3*

526   Bivariate analysis will be conducted, and the statistical significance will be based on a *p-*

527   value of 0.05 (60). The Bonferroni correction will be applied for the examination of each

528   confounding variable related to the patient and interprofessional teams' characteristics

529   (62).

530   A multivariate linear regression model will be developed to examine the

531   association between interprofessional teams with and without ACNP and the level of

532   adherence to best-practice guidelines (63-65). An examination of the distribution of the

533   data will be performed. In the case of an abnormal distribution of the data, a

534   transformation will be conducted to adjust the statistical model based on the observed

535   data. The independent variables will include the interprofessional teams with and

536   without ACNP, as well confounding variables. A correlation matrix will be developed,

537   and tolerance value lower than 0.2 and a variance inflation factor (VIF) value higher

538   than 5 will be used to identify multicollinearity between independent variables (63-65).

539   Independent variables with multicollinearity will be removed one at the time and a new

540   regression will be calculated. The dependent variable of the regression model will be

541   the average composite score (%) of the level of adherence to best-practice guidelines.

542   Statistical significance will be based on a *p*-value of 0.05. Sensitivity analysis will be

543   conducted based on a selection of confounding variables related to the characteristics

544   of the patient (e.g., length of stay, ICU readmission). The selection of these confounding

545   variables will be based on the observed data and descriptive analysis. The residual

546   analysis and the analysis of the R^2 will be conducted to assess the goodness-of-fit of

547   the multivariate linear regression model.

548   **Interpretation of the findings**

549   Consultations with clinicians and managers practising in postoperative cardiac surgery

550   settings in Québec and Canada will be conducted to gain an in-depth understanding of

551   the findings. These consultations will allow our team to explore potential underlying

552   factors and mechanisms which could influence the level of adherence to best-practice

553   guidelines by interprofessional teams with and without ACNP. Field notes will be taken

554   during these consultations and analyzed using content analysis (45).

555   **Ethical considerations**

556   Ethics approval was obtained prior to the beginning of the study. No identifying

557   information will be collected during the content validation with the expert committee and

558   the data collection within electronic databases and patient health records. A confidential

559   pairing system will be created to match the patient identification with a random number

560   (66). The database of the project will be kept in a secure server, protected by a

561   confidential numeric code known only by the research team. During the dissemination of

562   the findings, data will be shared in an aggregated form and the identity of the UHC, as

563   well as the identity of the patients and clinicians, will remain confidential.

564   **Discussion**

565   ACNPs hold an important place within interprofessional teams caring for patients and

566   families following cardiac surgery. For patients and families, ACNPs contribute to the

567   management of pharmacotherapy, clinical and psychosocial conditions, as well as

568   lifestyle promotion and teaching of coping strategies. For interprofessional teams,

569   ACNPs enhance the collaboration and communication among team members and

570   reinforce continuity of care. Until now studies examined the efficacy of ACNP on patient

571   and organization outcomes within postoperative cardiac surgery settings; however, less

572   attention has been paid to underlying factors contributing to the effect of ACNPs on

573   these outcomes.

574   The findings of this study will further our understanding of the contributions of

575   ACNPs in interprofessional teams practising in postoperative cardiac surgery settings in

576   Québec, Canada and internationally. This project will generate empirical data to

577   support and document the practice of ACNPs within interprofessional teams in four

578   important ways. Firstly, as part of this project, a systematic review of randomized

579   controlled trials was published to retrieve the current literature on the efficacy of ACNP

580   and advanced practice nursing roles in postoperative cardiac surgery settings, and to

581   examine their adherence to best-practice guidelines (40). Secondly, an extraction tool

582   focusing on the level of adherence to best-practice guidelines by interprofessional

583 teams in postoperative cardiac surgery will be available for the field of cardiac surgery

584 research and the scientific community more broadly. Thirdly, for patients under the care

585 of interprofessional teams with and without ACNP, the findings will provide a description

586 of the patient and interprofessional team characteristics as well as the adherence to

587 best-practice guidelines. Finally, this study will examine the effect of ACNPs on the

588 adherence to best-practice guidelines in settings where ACNPs are incorporated within

589 inter-professional teams, and provide empirical data for those settings looking to

590 introduce such roles in a postoperative cardiac surgery setting.

602 **Competing interest**

603 None to declare.

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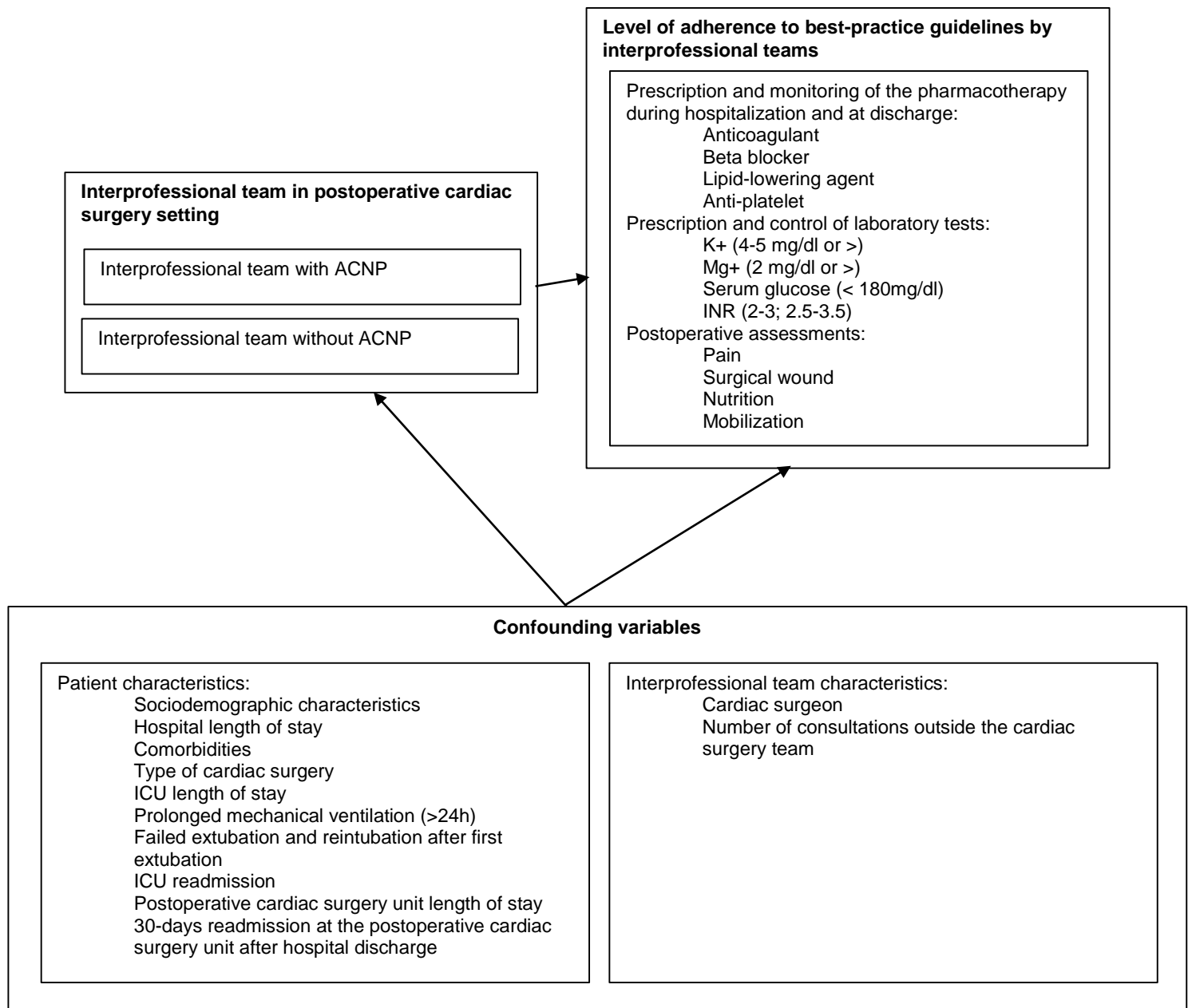882 Computer. 2010;43(10):77-81.

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Figure 1. The confounding variables and the level of adherence to best-practice guidelines by interprofessional teams with and without acute care nurse practitioners in cardiac surgery

Level of adherence to best-practice guidelines by interprofessional teams

Prescription and monitoring of the pharmacotherapy during hospitalization and at discharge:
   Anticoagulant
   Beta blocker
   Lipid-lowering agent
   Anti-platelet
Prescription and control of laboratory tests:
   K+ (4-5 mg/dl or >)
   Mg+ (2 mg/dl or >)
   Serum glucose (< 180mg/dl)
   INR (2-3; 2.5-3.5)
Postoperative assessments:
   Pain
   Surgical wound
   Nutrition
   Mobilization

Interprofessional team in postoperative cardiac surgery setting

Interprofessional team with ACNP

Interprofessional team without ACNP

Confounding variables

Patient characteristics:
   Sociodemographic characteristics
   Hospital length of stay
   Comorbidities
   Type of cardiac surgery
   ICU length of stay
   Prolonged mechanical ventilation (>24h)
   Failed extubation and reintubation after first extubation
   ICU readmission
   Postoperative cardiac surgery unit length of stay
   30-days readmission at the postoperative cardiac surgery unit after hospital discharge

Interprofessional team characteristics:
   Cardiac surgeon
   Number of consultations outside the cardiac surgery team

supporting information

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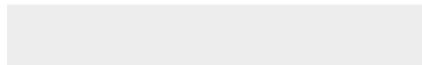
The level of adherence to best-practice guidelines by interprofessional teams with and without acute care nurse practitioners in cardiac surgery: a study protocol

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The level of adherence to best-practice guidelines by interprofessional teams

with and without acute care nurse practitioners in cardiac surgery: a study

protocol

Short title

Adherence to best-practice guidelines by interprofessional teams with and without acute

care nurse practitioners

Abstract

Background

Acute care nurse practitioners (ACNP) ~~have been implemented~~ in postoperative cardiac

surgery settings ~~and have shown to~~ provide significant benefits to patients and

organizations. ~~To explain these associations,~~ recent studies have suggested that ACNP

increase the level of adherence to best-practice guidelines by interprofessional teams.

However, it is unknown if interprofessional teams with ACNP are associated with higher

levels of adherence to best-practice guidelines compared to interprofessional teams

without ACNP. Furthermore, no extraction tool is available to measure the level of

adherence to best-practice guidelines by interprofessional teams in postoperative

cardiac surgery settings. This project aims to examine the level of adherence to best-

practice guidelines of interprofessional teams with and without ACNP in a postoperative

cardiac surgery setting in Québec, Canada.

Methods

A retrospective observational study will be conducted of 300 patients hospitalized

between January 1, 2019 and January 31, 2020 in a postoperative cardiac surgery unit

62 in Québec, Canada. Data will be collected from patient health records and electronic

63 databases. An extraction tool will be developed based on systematic review of the

64 literature, and will include best-practice guidelines and confounding variables related to

65 patient and interprofessional teams' characteristics. Content and criterion validation,

66 and a pilot-test will be conducted for the development of the tool. A multivariate linear

67 regression model will be developed and adjusted for ~~several~~ confounding variables, in

68 order to examine the association between interprofessional teams with and without

69 ACNP, and ~~the~~ level of adherence to best-practice guidelines.

70 **Discussion**

71 This project represents the first study to examine the level of adherence to best-practice

72 guidelines by interprofessional teams with and without ACNP in a postoperative cardiac

73 surgery setting. The findings of this project will generate empirical data focusing on the

74 contribution of ACNP within interprofessional teams, and ultimately enhance the

75 delivery of high quality and evidence-based care for patients and families.

76 **Keywords**

77 Acute care nurse practitioner, best-practice guidelines, cardiac surgery,

78 interprofessional teams, quality of care

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Background

Cardiac surgeries are one of the leading types of surgical procedures performed
internationally. In 2017, approximately 1 million patients throughout the world underwent
a cardiac surgery (1). Most of cardiac surgeries are performed in developed countries
(1). In 2018, the Society of Thoracic Surgeons (STS) reported 287,872 cardiac
surgeries and procedures performed in the United States (2). In Canada, 42,989
coronary artery bypass grafts (CABG) and 7,186 valve repairs were performed between
2013 and 2016 (3, 4).

In the postoperative phase after the surgery, many patients are at high risk of
developing adverse events and postoperative complications such as myocardial
infarction and wound infection (5). These complications are associated with higher risk
of mortality and development of comorbidities (e.g., heart failure), as well as a decrease
in the well-being and quality of life of patients and families (6). For healthcare
organizations, adverse events and postoperative complications are associated with a
longer length of stay at the hospital, higher rates of readmission in intensive care units,
higher rates of surgical re exploration, and an increase in cost (7, 8).

To prevent the risk of adverse events and postoperative complications for
patients and families, international healthcare organizations and research teams have
developed best-practice guidelines (7, 9). Best-practice guidelines are defined as
evidence-based practice of care, and aim to ensure the performance of
interprofessional teams, enhancing the quality and safety of the care given to patients
and families. In postoperative cardiac surgery settings, best-practice guidelines related
to the pharmacotherapy, laboratory tests, clinical indicators, and lifestyle promotion

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108 (e.g., diet, cardiac rehabilitation) have been developed and implemented in healthcare

109 centres (2).

110   A consensus in the literature supports the importance of a high level of

111 adherence by interprofessional teams to best-practice guidelines, in order to ensure

112 their efficacy (7, 10). Adherence to best-practice guidelines is defined as the

113 achievement of the guideline, as well as the associated interventions performed by

114 clinicians (11). In surgical settings (e.g., neurosurgery, orthopedic surgery) international

115 research teams (12-15) have developed composite scores to examine the level of

116 adherence to best-practice guidelines by interprofessional teams. Their findings

117 suggested that a higher level of adherence is associated with a higher quality of care

118 given to patients and families.

119   In postoperative cardiac surgery settings, recent studies (5, 16) identified a

120 significant association between a high level of adherence to best-practice guidelines by

121 interprofessional teams and a lower risk of postoperative complications and adverse

122 events for patients. Other studies (5, 16, 17) have shown a significant association

123 between a lower level of adherence to best-practice guidelines by interprofessional

124 teams and a higher risk of postoperative complications and adverse events for patients.

125 Larrazzet et al. (2014) conducted a longitudinal study of 144 patients who died after

126 cardiac surgery. The authors identified a significant association between a lack of

127 adherence to best-practice guidelines by interprofessional teams, and a higher risk of

128 mortality, highlighting the importance of the high adherence to best-practice guidelines

129 by interprofessional teams (17).

130   Internationally, there is variability in the scope of practice and level of autonomy

131   of ACNPs (18,19). Recent studies have examined the practice of nurse practitioners

132   (NP) within primary and acute care settings, and suggested that their practice could

133   increase the level of adherence to best-practice guidelines by interprofessional teams

134   (18, 19). The NP's support of the practice of different care providers in the team with a

135   focus on best evidence is believed to underpin providers' adherence to best-practice

136   guidelines focused on pharmacotherapy, clinical indicators, and lifestyle promotion. NPs

137   also enhance collaboration and communication among teams' members and facilitate

138   continuity of care, contributing to the higher adherence to best-practice guidelines by

139   interprofessional teams (18, 20).

140   Based on the International Council of Nurses guidelines, the NP is an advanced

141   practice nursing role, based on a graduate or postgraduate education and an in-depth

142   nursing and medical expertise (21-23). In several acute care settings, including

143   postoperative cardiac surgery, acute care nurse practitioners (ACNP) have been

144   implemented in interprofessional teams and performed activities such as the clinical and

145   psychosocial assessment of patients, the prescription and management of

146   pharmacotherapy, laboratory tests and clinical interventions, lifestyle promotion,

147   teaching of coping strategies, preparation for hospital discharge, and the management

148   of consultations and external resources (24). International research teams (23, 25) have

149   examined the practice of ACNPs within postoperative cardiac surgery settings. They

150   identified significant associations between the ACNPs' practice and higher patient

151   satisfaction, higher participation of patients to cardiac rehabilitation, and lower length of

152   stay at the hospital after the cardiac surgery. However, other research teams (21, 26)

6

153 did not identify significant associations between ACNP practice and patient and

154 organizational outcomes within postoperative cardiac surgery settings. More

155 specifically, the authors suggested that the difficulty of to recruiting participants, the high

156 attrition rate, the small sample sizes, and the inability to adjust the data analysis for

157 confounding variables related to the patient and interprofessional teamsteams'

158 characteristics were important limits contributing to the non-significant findings (21,26).

159   Systematic reviews of randomized controlled trials (RCT) (21, 23) have been

160 conducted to understand the inconsistent findings in the current literature. These

161 systematic reviews have identified three important limits contributing to the inconsistent

162 findings of the current literature. Firstly, although several RCT of the current literature

163 focus on the efficacy of ACNP for patients and healthcare organizations, less attention

164 has been paid to the efficacy of these providers for interprofessional teams. The

165 qualitative study of Reich et al. (2018) suggested that the implementation of ACNP

166 within interprofessional teams increases the level of adherence of those teams to best-

167 practice guidelines in postoperative cardiac surgery settings, and represents an

168 underlying factor contributing to the efficacy of NP (19). However, these propositions

169 have not been subjected to statistical validation, thus it is unknown if interprofessional

170 teams with ACNP are associated with higher levels of adherence to best-practice

171 guidelines, compared to interprofessional teams without ACNP. Moreover, until today,

172 no validated extraction tool is available to measure the level of adherence to best-

173 practice guidelines of interprofessional teams with and without ACNP in postoperative

174 cardiac surgery settings.

175   Secondly, systematics reviews have highlighted the difficulty in adequality

176   controlling confounding variables in the existing RCT (21, 23). Confounding variables

177   represent important factors influencing the efficacy of ACNP on patient and

178   organizational outcomes in postoperative cardiac surgery settings. Methodological limits

179   of the existing RCT, such as the small sample size and high attrition rate, limit the

180   capacity of research teams to develop robust multivariate statistical models adjusted for

181   confounding variables related to patient, interprofessional teams, and organizational

182   characteristics (21, 23). Interestingly, retrospective observational studies have shown to

183   be a relevant alternative to examine the association between ACNP and patient and

184   organizational outcomes in postoperative cardiac surgery settings. Existing studies (27-

185   30) have used retrospective observational studies to gather a large cohort of patients,

186   limit attrition, and develop statistical models adjusted for many confounding variables.

187   These studies (6, 27-29) have identified significant associations between ACNP within

188   interprofessional teams, and lower risks of mortality and decreased costs in

189   postoperative cardiac surgery settings.

190   Thirdly, the majority of the RCT focus on ACNP practice within primary care

191   settings (e.g., in-home care, rehabilitation clinic) after the cardiac surgery. Less

192   attention has been paid to ACNP practice in acute care settings; however, within these

193   settings, ACNP works in collaboration with cardiac surgeons, nursing teams,

194   rehabilitation teams, social workers, and other members of the interprofessional teams

195   to ensure the patient optimal recovery after the surgery, and prevents the risk of

196   adverse events and postoperative complications. Moreover, for patients and families,

197   the acute care hospitalization after the surgery represents a crucial phase of their

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198 postoperative recovery and is associated with several physical, psychosocial, and

199 emotional stressors (30). Future studies are needed to substantiate the contribution of

200 ACNP in interprofessional teams within acute care settings, and identify the benefits of

201 their practice for patients, families, interprofessional teams, and healthcare

202 organizations.

203   Consequently, the aim of this project is to examine the level of adherence to

204 best-practice guidelines of interprofessional teams with and without ACNP in acute

205 postoperative cardiac surgery settings in Québec, Canada.

206 **Study hypothesis and objectives**

207 The hypothesis of this study is:

208   H1: This study will verify if interprofessional teams with ACNP are associated

209 with a higher level of adherence to best-practice guidelines compared to

210 interprofessional teams without ACNP, after controlling for the patient and

211 interprofessional team characteristics.

212 The objectives of this study are as follows:

213   1. Develop and pilot-test an extraction tool to measure the level of adherence to

214   best-practice guidelines of interprofessional teams within postoperative cardiac

215   surgery setting.

216   2. Describe the patient and interprofessional teams' characteristics, as well as the

217   level of adherence to best-practice guidelines, of patients under the care of

218   interprofessional teams with and without ACNP.

219   3. Examine the association between interprofessional teams with ACNP and the

220   level of adherence to best-practice guidelines, compared to interprofessional

221   teams without ACNP, ~~after adjusting patient and interprofessional team~~

222   ~~characteristics in postoperative cardiac surgery setting.~~

223 **Methods and design**

224 **Study design**

225 A retrospective observational study (31, 32) will be conducted. De-identified data will be

226 extracted from the UHC data ==warehouse==, and ~~the~~ patient health records ~~to assemble~~

227 ~~the retrospective cohort of patients and conduct the data collection~~. Ethics approval was

228 obtained from the McGill University Health Centre Research Ethics Board on

229 September 15, 2021 (IPSSA chirurgie cardiaque/2022-8094). ~~This project uses the~~

230 ~~guidelines from~~ *Strengthening the Reporting of Observational Studies in Epidemiology*

231 *(STROBE) Statement: Guidelines for Reporting Observational Studies* (32) were used

232 for this project (SA appendix).

233 ==Study setting==

234 ==This study will be conducted at a University healthcare centre (UHC) in Québec,==

235 ==Canada. Annually, this healthcare centre performs approximately 1,000 cardiac==

236 ==surgeries== and has a 36-bed postoperative cardiac surgery unit.

237   After cardiac surgery, patients are admitted to the intensive care unit (ICU), and

238 are under the care of ICU teams. At the time of data collection, the ICU teams in

239 Québec, Canada do not include ACNP. On average, patients are hospitalized for 24

240 hours in the ICU before being transferred to the postoperative cardiac surgery unit.

241 Patients readmitted to the ICU are under the care of ICU teams.

242   Upon admission to the postoperative cardiac surgery unit, patients are assigned

243 to the care of interprofessional teams with or without ACNP. Team assignment depends

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244   on the current workload of each team, and the availability of the beds in the unit.

245   Interprofessional teams with ACNPs are assigned 16 of the unit's beds (44%) and

246   interprofessional teams without ACNP are assigned 20 of the unit's beds (56%).

247   Patients are followed by their respective teams from their admission to the cardiac

248   surgery unit, until the hospital discharge or death. On average, the length of stay at the

249   hospital after the surgery ranges from 9 to 11 days (33).

250   Interprofessional teams with and without ACNP include the following: cardiac

251   surgeons and residents nursing teams, skin care and wound therapists,

252   physiotherapists, nutritionists, respiratory therapists, social workers, and medical and

253   other specialists. Interprofessional teams with and without ACNP ensure the daily

254   follow-up of patients, the assessment of the patient's clinical and psychosocial condition,

255   the management of pharmacotherapy, clinical intervention, laboratory tests, lifestyle

256   promotion, and the preparation of patients upon hospital discharge.

257   **The practice of acute care nurse practitioners in postoperative cardiac surgery**

258   **unit**

259   Since 2017, seven ACNPs practice in postoperative cardiac surgery, based on a

260   monthly rotation system. Two ACNP simultaneously practice within interprofessional

261   teams and collaborate with other clinicians to ensure the daily follow-up of the patients

262   after cardiac surgery. ACNP practice includes the assessment of the clinical and

263   psychosocial condition of the patient and families, the management of ~~the~~

264   pharmacotherapy, clinical interventions, and laboratory tests. The ACNP also teaches

265   coping strategies, lifestyle promotion, cardiac rehabilitation, preparation of the patients

266   and families for the in-home recovery after discharge. The ACNP supports the

267 preparation for hospital discharge (e.g., prescription of the patient medication after

268 discharge, summary for the family physician, etc.) (34).

269 **Study population and sample**

270 A dynamic cohort of patients will be assembled from hospitalized patients at the

271 postoperative cardiac surgery unit between January 1, 2019, and January 31, 2020.

272 This timeframe will avoid the recruitment of patients during the COVID-19 pandemic, a

273 window of time during which the practice of ACNP within the unit was inconsistent.

274 Patients will be selected, based on three inclusion criteria: 1) patient admitted for a

275 diagnosis of CABG and/or valve repair, 2) patient age is over 18 years old, and 3)

276 patient has been hospitalized for at least 24 hours in the postoperative cardiac surgery

277 unit. The minimum 24-hour criteria will allow our team to examine the hospitalization of

278 the patient in the postoperative cardiac surgery unit, which is the setting where ACNPs

279 practice in Québec (35). Patients will be identified from the electronic databases of the

280 UHC and the diagnostic codes of the Canadian Institute for Health Information (36) (SB

281 appendix).

282 A sample size calculation was conducted in G*power (37). This project will

283 include 15 variables, including one independent variable, one dependent variable, and

284 13 confounding variables. The variables selected for this project are described in the

285 next section. To perform one multivariate linear regression model and detect an effect

286 size of f^2=0.15 with a power of 0.80 and a standard error of 5%, a minimum sample size

287 of 183 patients was estimated.

288 A total of 300 patients will be selected, based on the sample size calculation and

289 an over-estimation of at least 20%, to consider the risk of error from the presence of

290 missing data and incomplete patient health records (38, 39). A systematic random

291 selection of 150 patients under the care of interprofessional teams with ACNP will be

292 conducted and matched with 150 patients under the care of interprofessional teams

293 without ACNP. Three criteria (40-43) will be used to match each pair (1:1): 1) age (i.e., a

294 five-year gap will be tolerated) 2) sex, and 3) type of cardiac surgery (i.e., CABG, valve

295 repair, or CABG/valve repair).

296   Patients will be followed from their admission to the ICU after the cardiac

297 surgery, until the occurrence of the following events, whichever occurs first: 1)

298 discharge from the hospital, 2) death, or 3) the cumulation of 14-days in hospital after

299 the surgery. The 14-days' timeframe will allow our team to capture the acute phase of

300 the patient hospitalization after the cardiac surgery (33). The total length of stay for

301 patients hospitalized longer than 14-days will be measured.

302 **Variables under study**

303 A systematic review of RCTs (24) and an extensive search in the literature and

304 international healthcare organizations (e.g., American Heart Association, Society of

305 Thoracic Surgeons) was conducted to retrieve best-practice guidelines for

306 interprofessional teams in postoperative cardiac surgery settings, and confounding

307 variables related to patient and interprofessional teams' characteristics. A total of 12

308 best-practice guidelines and 13 confounding variables were identified and presented in

309 Figure 1. The operationalization of each variable is presented in SC appendix.

310 *Independent variable: interprofessional teams with and without acute care nurse*

311 *practitioner*

13

312   A dichotomous variable will be created to measure the inclusion of at least one ACNP

313   within the interprofessional team. For patients under the care of an interprofessional

314   team with ACNP, an additional descriptive variable will measure the number of days

315   where the ACNP was implicated in the daily follow-up of the patient, on the entire

316   hospitalization at the postoperative cardiac surgery unit.

317   *Dependant variable: the level of adherence to best-practice ~~guidelines~~ by*

318   *interprofessional teams*

319   A composite score will be developed to measure the level of adherence to best-practice

320   ~~guidelines~~ by interprofessional teams. An individual composite score will be calculated

321   per patient per day of hospitalization at the postoperative cardiac surgery unit. A total of

322   12 best-practice guidelines will be included in the composite score (Figure 1). Each

323   best-practice guideline will be scored on two points based on the following: 1) the

324   achievement of the guideline recommendation (e.g., prescription of beta blocker) and 2)

325   the associated interventions performed by clinicians (e.g., follow-up of the blood

326   pressure). All best-practice guidelines are divided into three categories: 1)

327   pharmacotherapy (n=4), 2) laboratory tests (n=4), and 3) postoperative assessment

328   (n=4).

329   Four best-practice guidelines are included in the category of pharmacotherapy.

330   These guidelines are the prescription and monitoring of medications including: 1)

331   anticoagulants, 2) beta blockers, 3) lipid-lowering agents, and 4) anti-platelets, during

332   hospitalization and at hospital discharge of the patient. For each best-practice guideline,

333   two additional descriptive variables will be collected, including the type of medication

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334 prescribed and the presence of a contraindication, which precludes the possibility of

335 achieving the guideline recommendation (e.g., allergy).

336   Four best-practice guidelines on laboratory tests are included, recommending the

337 prescription and monitoring of the following: 1) potassium (K+), 2) magnesium (Mg+), 3)

338 serum glucose, and 4) international normalized ratio (INR) by interprofessional teams

339 during the patient's hospitalization in the postoperative cardiac surgery unit. The

340 achievement of each best-practice guideline recommendation will be confirmed if the

341 laboratory result falls under the normal range supported by the current literature. An

342 additional variable called "no INR needed" will be added specifically for the best-practice

343 guideline related to the prescription and management of INR, to take into consideration

344 patient who don't need a strict INR follow-up (e.g., administration of direct acting oral

345 anticoagulant (DAOC)). A pilot test will be performed to assess the characteristics of the

346 patients hospitalized at the post-operative cardiac surgery unit and the feasibility of the

347 data collection. The following three additional descriptive variables will be measured for

348 each guideline: 1) number of prescriptions requested by interprofessional teams, 2)

349 proportion of abnormal values below or above normal range, and 3) average of all

350 values of laboratory tests.

351   Four best-practice guidelines are included in the category of the postoperative

352 assessment performed by interprofessional teams. A daily assessment of the patient's

353 level of pain, surgical wound(s), nutrition, and mobilization will be measured. For each

354 best-practice guideline recommendation, the achievement of the guideline will be

355 confirmed if at least one postoperative assessment per day is performed by the ACNP

356 or other members of the interprofessional teams during the patient's hospitalization in

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357 the postoperative cardiac surgery unit. Two additional descriptive variables will be

358 measured for each best-practice guideline, including: 1) the total number of

359 postoperative assessments performed by interprofessional teams during the

360 hospitalization, and 2) the type of associated interventions conducted by clinicians (e.g.,

361 non-pharmacological, consultation, etc.).

362 *Confounding variables related to patient characteristics*

363 Eleven confounding variables related to patient characteristics will be measured. For

364 each patient, sociodemographic characteristics (e.g., sex, age) will be measured. The

365 total length of stay at the hospital will be measured, which includes the stay in the ICU

366 and postoperative cardiac surgery unit. The type of cardiac surgery will be collected

367 from a categorical variable with three categories: 1) CABG, 2) valve repair, and 3)

368 CABG/valve repairs. Comorbidities will be measured and operationalized from the

369 Charlson Comorbidity Index (CCI) (44, 45). A total score of 24 points will be calculated

370 for each patient based on the 17 clinical conditions included in the CCI (SD appendix).

371 The length of stay in the postoperative cardiac surgery unit will be collected for each

372 patient. The hospital 30-days readmission at the postoperative cardiac surgery unit after

373 discharge will be measured for each patient from a dichotomous variable.

374   Four confounding variables related to the patient characteristics in the ICU

375 setting will be measured. The total number of hours hospitalized in the ICU will be

376 measured from the time (in hours) of admission to the ICU after the surgery and the

377 time (in hours) of discharge of the patient. The postoperative prolonged mechanical

378 ventilation will be measured from a dichotomous variable. A prolonged mechanical

379 ventilation will be confirmed if the time under mechanical ventilation exceeds 24 hours.

380 The failed extubation of the patient and reintubation after first extubation will be

381 measured with a dichotomous variable. The number of episodes of ICU readmission

382 after initial discharge will be measured for each patient.

383 *Confounding variables related to interprofessional teams' characteristics*

384 Two confounding variables related to interprofessional teams' characteristics will be

385 measured. First, the cardiac surgeon who performed the surgery and ensured the

386 follow-up of the patient's recovery will be noted. A confidential code will be created for

387 each surgeon practising in the UHC. Second, a discrete variable will be created to

388 measure the number of consultations conducted by clinicians from different expertises

389 (e.g., nutrition, rehabilitation team) during the patient's hospitalization in the

390 postoperative cardiac surgery unit. A categorical descriptive variable will be created to

391 measure each clinician's expertise, including the following: 1) rehabilitation team (e.g.,

392 physical therapist, occupational therapist), 2) respiratory therapist, 3) social worker, 4)

393 skin and wound care therapist, 5) nutritionist, and 6) speciality consultation (e.g.,

394 internal medicine, nephrology).

395 **Data collection**

396 An extraction tool will be developed and pilot-tested, based on the best-practice

397 guidelines and the confounding variables related to the patient and interprofessional

398 team characteristics (Figure 1). One extraction will be completed per patient per day

399 during the hospitalization in the postoperative cardiac surgery unit, by the first author or

400 a research assistant. The development of the extraction tool followed the Consensus-

401 based Standards for the selection of health measurement instrument (COSMIN)

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402   guidelines (46) and will include three stages: the content validation; the criteria

403   validation; and the pilot-test.

404   *Data collection for the content validation*

405   Content validation will be performed following two steps (46). First, an expert committee

406   will be recruited from clinicians, managers, and researchers who have expertise in

407   postoperative cardiac surgery. The identification and recruitment of experts will be

408   conducted by our research team and will include experts in Canada. A total of 10

409   experts will be recruited, including at least the following five: 1) an ACNP who worked a

410   minimum of one year within a postoperative cardiac surgery unit outside of our

411   associated UHC, 2) a cardiac surgeon or fellow in cardiac surgery who worked at least

412   two years in an acute care centre outside of our associated UHC, 3) a nurse manager

413   who manages, at least one year, a postoperative cardiac surgery unit, within our

414   associated UHC, 4) a healthcare professional who worked in the data warehouse of our

415   associated UHC for at least one year, and 5) a researcher in nursing or healthcare

416   sciences with an expertise in measurement instruments and/or cardiac surgery.

417   Second, an electronic survey (47) will be created and composed of all items of

418   the extraction tool (best-practice guidelines and confounding variables). For each item,

419   experts will assess its relevance using a 5-points Likert scale (48, 49). Additional

420   spaces for qualitative comments and suggestions will be included in the survey. Two

421   rounds of revision are planned. After the first round, our team will update the extraction

422   tool and revise any unclear items based on the experts' recommendations, and an

423   updated version will be resubmitted to the expert committee.

424   *Data collection for the criterion validation*

425 The criterion validation of the extraction tool will follow three consecutive steps. Firstly,

426 the best-practice guidelines of The Society of Thoracic Surgeons (STS) have been

427 selected as the gold standard of comparison for this study. For many years, the STS

428 has been a leading healthcare organization in the development and validation of best-

429 practice guidelines and performance measures in the care of patients in cardiac surgery

430 settings (10). In 2007, the STS developed and validated 21 performance measures for

431 the delivery of high quality of care for patients who underwent CABG, valve repair, and

432 CABG/valve repairs (50, 51). For this project, five performance measures were

433 selected, including: 1) prolonged mechanical ventilation higher than 24 hours in the ICU;

434 2) a 30-day readmission rate at the postoperative cardiac surgery unit after hospital

435 discharge; and prescription of the 3) anti-platelet, 4) beta blocker, 5) and lipid-lowering

436 agent, during the hospitalization at the postoperative cardiac surgery unit and at

437 discharge. Each performance measure is operationalized as the proportion of patients

438 who achieved the outcome (e.g., proportion of patients who were under prolonged

439 mechanical ventilation) over the total sample size (46, 47).

440   Secondly, 30 patient health records will be reviewed independently by two

441 reviewers on two occasions, including the first author and a research assistant. For the

442 first round of revision, the patient's health record will be reviewed with the extraction

443 tool. For the second round of revision, the records will be reviewed with the five

444 performance measures from the STS.

445 *Data collection for the pilot-test*

446 A pilot-test will be conducted to assess the feasibility of the tool, standardize data

447 collection among reviewers, examine the quality and accessibility of the retrospective

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448   data, and update the tool if needed. Four iterative steps will be included in the pilot-test

449   (52-55). First, two reviewers will conduct the pilot-test and data collection. Training

450   sessions and documentation will be given to the reviewers.

451   Secondly, 30 patient health records from hospitalized patients in the

452   postoperative cardiac surgery unit between January 1, 2019, and January 31, 2020, will

453   be randomly selected. These patients will not be included in the retrospective cohort.

454   Data will be collected by the two reviewers with the extraction tool. Inter-rater reliability

455   will be assessed and a Cohen kappa higher than 0.60 will be targeted (55).

456   Thirdly, a triangulation of the available data will be performed to assess the

457   quality and accessibility of the data. Multiple data sources will be screened between the

458   electronic databases and patient health records. Items from the extraction tool with a

459   high quantity of missing data or low quality of available data will be modified or

460   removed.

461   Finally, frequent meetings among all research team members will be conducted

462   to discuss divergences, reinforce convergences, and establish a consensus. The

463   extraction tool will be updated after the pilot-test if needed (52).

464   During data collection from the retrospective cohort of patients, an additional 30

465   patient health records will be reviewed by two independent reviewers to ensure the

466   standardization of the data collection (49, 50). Inter-rater reliability will be assessed and

467   a Cohen Kappa value higher than 0.60 will be targeted (55).

468   **Data analysis**

469   Statistical analysis will be conducted to meet objectives one, two and three. The unit of

470   observation will be the patient-level and the unit of analysis will be the interprofessional

471   team-level.

472   *Objective 1*

473   The content validation of the extraction tool will include two rounds of revisions, with

474   additional rounds if needed (56, 57). For each round of revision, a Fleiss Kappa will be

475   calculated and a value between 0.60 and 0.80 will be targeted (48, 49). The content

476   validity index (CVI) of each individual item of the extraction tool will be calculated from

477   the proportion of experts who rated a score of 4 or 5 on the Likert scale (58). A CVI of

478   0.80 will be targeted for each item and items with a value below 0.80 will be removed or

479   modified. Then, the proportion of items with a CVI value above 0.80 will be calculated to

480   determine the overall CVI of the extraction tool. A value higher than 0.80 for the overall

481   CVI of the extraction tool will be targeted (46). Qualitative comments and

482   recommendations by experts will be analyzed by content analysis (59).

483   The criteria validation will be assessed using 30 patient health records. Five

484   performance measures developed by the STS will serve as the gold standard for the

485   comparison (10). First, the proportion of patients who achieved each performance

486   measure over the total sample size (n=30) will be calculated, from the measures

487   collected with the gold standard, as well as the measures collected with the extraction

488   tool. Second, Spearman correlation will be calculated to assess the correlation between

489   the proportions obtained from the measures of the gold standard, and the proportions

490   obtained from the measures of the extraction tool. Values of Spearman correlation

491   higher than 0.70 will be targeted (48, 49).

Objective 2

492

493 Descriptive analysis will be performed to assess the level of adherence by

494 interprofessional teams with and without ACNP, as well as the confounding variables for

495 patients under the care of both teams (60). An analysis of missing data will be

496 conducted to examine the quality and distribution of missing data within patient health

497 records and electronic databases. Team meetings and consultations with clinicians and

498 statisticians will be held to discuss and identify potential causes of missing data, as well

499 as to conduct a statistical analysis to manage them (61).

500   A composite score will be developed to measure the level of adherence to best-

501 practice guidelines by interprofessional teams with and without ACNP. A composite

502 score per patient per day of hospitalization in postoperative cardiac surgery will be

503 developed and based on four consecutive steps. Firstly, for each best-practice

504 guideline, a score on a scale of two will be created and points will be attributed for: 1)

505 the achievement of the best-practice guideline recommendation, and 2) the associated

506 intervention performed by clinicians. Points will be given based on the information

507 contained in the patient health record and electronic databases. A missed intervention

508 will be considered as a lack of adherence to best-practice guidelines, and no point will

509 be given.

510   Secondly, all best-practice guidelines are divided into three categories: 1)

511 pharmacotherapy, 2) laboratory tests, and 3) postoperative assessments. The sum of

512 the individual score of each best-practice guideline will be calculated for each category.

513 More specifically, each category includes four best-practice guidelines, and will be

514 based on a total score ranging from zero to eight.

515   Thirdly, an overall composite score will be calculated from the sum of all the

516   scores of the three categories, ranging from zero to 24. The overall composite score will

517   be transformed into a value in percentage (0 to 100%) and an increase of the score will

518   be associated with an increase of the level of adherence to best-practice guidelines by

519   interprofessional teams. An overall score will be calculated per patient per each day

520   hospitalized in the postoperative cardiac surgery unit.

521   Finally, an average composite score will be calculated from the average of all

522   overall scores during the patient's hospitalization at the postoperative cardiac surgery

523   unit. An average composite score will be calculated for all patients included in the

524   retrospective cohort. A graphic illustration will be created from all average scores to

525   visualize the tendency and distribution of the scores of the cohort.

526   *Objective 3*

527   Bivariate analysis will be conducted, and the statistical significance will be based on a *p*-

528   value of 0.05 (60). The Bonferroni correction will be applied for the examination of each

529   confounding variable related to the patient and interprofessional teams' characteristics

530   (62).

531   A multivariate linear regression model will be developed to examine the

532   association between interprofessional teams with and without ACNP and the level of

533   adherence to best-practice guidelines (63-65). An examination of the distribution of the

534   data will be performed. In the case of an abnormal distribution of the data, a

535   transformation will be conducted to adjust the statistical model based on the observed

536   data. The independent variables will include the interprofessional teams with and

537   without ACNP, as well confounding variables. A correlation matrix will be developed,

538 and tolerance value lower than 0.2 and a variance inflation factor (VIF) value higher

539 than 5 will be used to identify multicollinearity between independent variables (63-65).

540 Independent variables with multicollinearity will be removed one at the time and a new

541 regression will be calculated. The dependent variable of the regression model will be

542 the average composite score (%) of the level of adherence to best-practice guidelines.

543 Statistical significance will be based on a *p*-value of 0.05. Sensitivity analysis will be

544 conducted based on a selection of confounding variables related to the characteristics

545 of the patient (e.g., length of stay, ICU readmission). The selection of these confounding

546 variables will be based on the observed data and descriptive analysis. The residual

547 analysis and the analysis of the R^2 will be conducted to assess the goodness-of-fit of

548 the multivariate linear regression model.

549 **Interpretation of the findings**

550 Consultations with clinicians and managers practising in postoperative cardiac surgery

551 settings in Québec and Canada will be conducted to gain an in-depth understanding of

552 the findings. These consultations will allow our team to explore potential underlying

553 factors and mechanisms which could influence the level of adherence to best-practice

554 guidelines by interprofessional teams with and without ACNP. Field notes will be taken

555 during these consultations and analyzed using content analysis (45).

556 **Ethical considerations**

557 Ethics approval was obtained prior to the beginning of the study. No identifying

558 information will be collected during the content validation with the expert committee and

559 the data collection within electronic databases and patient health records. A confidential

560 pairing system will be created to match the patient identification with a random number

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561   (66). The database of the project will be kept in a secure server, protected by a

562   confidential numeric code known only by the research team. During the dissemination of

563   the findings, data will be shared in an aggregated form and the identity of the UHC, as

564   well as the identity of the patients and clinicians, will remain confidential.

565   **Discussion**

566   ACNPs hold an important place within interprofessional teams caring for patients and

567   families following cardiac surgery. For patients and families, ACNPs contribute to the

568   management of pharmacotherapy, clinical and psychosocial conditions, as well as

569   lifestyle promotion and teaching of coping strategies. For interprofessional teams,

570   ACNPs enhance the collaboration and communication among team members and

571   reinforce continuity of care. Until now studies examined the efficacy of ACNP on patient

572   and organization outcomes within postoperative cardiac surgery settings; however, less

573   attention has been paid to underlying factors contributing to the effect of ACNPs on

574   these outcomes.

575   The findings of this study will further our understanding of the contributions of

576   ACNPs in interprofessional teams, practising in postoperative cardiac surgery settings

577   in Québec, Canada and internationally. This project will generate empirical data to

578   support and document the practice of ACNPs within interprofessional teams in four

579   important ways. Firstly, as part of this project, a systematic review of randomized

580   controlled trials was published to retrieve the current literature on the efficacy of ACNP

581   and advanced practice nursing roles in postoperative cardiac surgery settings, and to

582   examine their adherence to best-practice guidelines (40). Secondly, an extraction tool

583   focusing on the level of adherence to best-practice guidelines by interprofessional

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teams in postoperative cardiac surgery will be available for the field of cardiac surgery research, and the scientific community more broadly. Thirdly, for patients under the care of interprofessional teams with and without ACNP, the findings will provide a description of the patient and interprofessional team characteristics, as well as adherence to best-practice guidelines. Finally, this study will examine the effect of ACNPs on adherence to best-practice guidelines in settings where ACNPs are incorporated within interprofessional teams, and provide empirical data for those settings looking to introduce such roles in a postoperative cardiac surgery setting.

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Competing interest

None to declare.

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