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Incorporating Value-based Healthcare Projects in Residency Training: A mixed methods study on the impact of participation on understanding & competency development

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1 **Incorporating Value-based Healthcare Projects in Residency Training:**

2 A mixed methods study on the impact of participation on understanding &

3 competency development

4

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Abstract

Objectives: Residency training programs have changed to competency-based education. Stimulating active participation of residents in actual and societal relevant themes in healthcare, such as Value-Based Healthcare (VBHC), can be a strategy to support competency development. In this study we hypothesize that when residents conduct a VBHC project, CanMEDS competencies are learned. As extra revenue, knowledge about VBHC is gained and skills to apply VBHC are learned at the same time.

Methods: An explorative mixed-methods study amongst residents in training, in academic and non-academic hospitals in the Netherland, was conducted. We assessed residents' self-perceived learning effects of conducting VBHC projects on three main components: (i) CanMEDS competency development, (ii) the recognition of VBHC dilemmas in clinical practice, and (iii) potential facilitators for and barriers to implementing a VBHC-project. We triangulated the data resulting from qualitative analyses of: (a) text-based summaries of VBHC projects by residents, and (b) semi-structured interviews with residents who conducted these projects.

Results: 56 text-based summaries and 11 semi-structured interviews were included in the final analysis. Regarding CanMEDS competencies development the competencies 'leader', 'communicator' and 'collaborator' scored highest. Opportunities to recognize VBHC dilemmas in practice were mainly stimulated by analyzing healthcare practices from different perspectives, and by learning how to relate and define costs to value. Finally, implementation of VBHC projects is, amongst others, facilitated by a thorough investigation of a VBHC dilemma combined with an in-depth stakeholder analysis.

Conclusion: In medical residency training programs, competency development, by active participation in an actual (or emerging) and societal relevant theme in healthcare - such as VBHC - was found a promising strategy. From a residents' perspective combining a thorough investigation of the VBHC dilemma with an in-depth stakeholder analysis is key to successful implementation of a VBHC project.

3

Strengths and limitations of this study

- Small sample size, especially in semi-structured interviews.

- Only projects that were thought to be viable for implementation led by residents with the intrinsic motivation to make a change were publicised and therefor selected, which could lead to overestimation of results.

- CanMEDS competency development was self-reported.

- Due to the nature of the semi-structured interviews it will be difficult to replicate this data.

Key words

- Value-Based Healthcare

- Residency training programs

- Competency-based education

- CanMEDS competencies

Background

The Canadian Medical Education Directions for Specialist (CanMEDS) project contributed to a major change in (postgraduate) medical education moving away from a time-based learning system, to a competency-based learning system (1). It described important competencies medical residents should master during their training, such as communicator, collaborator, leader and health advocate (2). However it appears that the `soft` competencies such as 'leader' and 'health advocate' are neither easy to teach, nor to assess (3). Educational efforts that specifically train these competencies are therefore appreciated.

In addition to the CanMEDS competencies, and to assure that physicians' competencies align with evolving health systems, overarching themes focusing on societal needs and future demands are

3

83 increasingly integrated into medical education (4). Examples of such themes are patient safety, shared

84 decision-making, and value-based health care (5-7). In the Netherlands, educators experienced the

85 urge to combine these developments. This resulted in the so-called CanBetter project (7), which

86 started in 2015. The project meant linking development of all CanMeds competencies with teaching

87 residents about societal relevant themes. Value-based healthcare (VBHC) was one of the current

88 relevant themes the CanBetter project focusses on, because health care expenditure is rising and

89 medical professionals need to take their responsibility (8).

90 VBHC is defined as the health outcome that matters to the patient, relative to the costs of

91 achieving this outcome (8). Health outcomes can be, for example, disease free survival for patients

92 with cancer, or the time needed to regain functionality after a knee joint replacement (8). Despite

93 achieving health outcomes, professionals also carry responsibility for stewardship of resources; which

94 requires an entirely new way of managing (9). Therefore instruction, training and fundamental

95 knowledge on VBHC is required (10-12). Past efforts to teach residents about cost-effective care

96 unfortunately have not always been as effective as intended (13, 14) for example, because medical

97 education didn't provide a positive culture, the training environment was not suitable, or difficulties

98 arose when changing practice patterns of both residents and supervising faculty (14).

99 Recent research illustrated that key elements of learning to deliver VBHC are knowledge

100 transmission, appropriate role modelling, reflection and presence of a supportive environment (10).

101 Medical students and residents must be educated and trained in settings where they have

102 opportunities to develop and use VBHC; preferably in a clinical setting (15-17). Amongst others, a

103 specific training program, incorporating formal and informal learning is necessary to learn how to

104 deliver VBHC (18). The residency training programs are believed to be one of the best places to initiate

105 VBHC education because residents are adaptable, highly educated and motivated. In addition, it is

106 shown, that what residents learn during their residency has a significant impact on how they treat their

107 patients when they are medical specialists (19).

4

108   In our regional organization of teaching hospitals strategy was set up combining formal and

109   informal training, within the residency training program, getting residents involved with VBHC.

110   Residents were stimulated to critically assess daily healthcare and recognize potential VBHC dilemmas

111   and transform this into a VBHC project. Such VBHC-projects are resident-led and practice-based.

112   This study evaluates the impact of incorporating VBHC projects within the residency training

113   program. The following research questions were formulated: (I) 'Which CanMEDS competencies do

114   residents develop, when conducting VBHC projects in residency training?' (II) 'Is recognition of VBHC

115   dilemmas in medical practice facilitated when residents conduct VBHC projects during residency

116   training program?', (III) 'Which facilitators for and barriers to VBHC project implementation can we

117   detect when conducting a VBHC project during residency training?'.

118

Methods

Study Design

121   An explorative mixed-methods design was used. The study entailed an analysis of retrospective

122   information of VBHC projects, conducted by residents between 2014 and 2018 via text-

123   based summaries of VBHC projects, and semi-structured interviews with residents. The text-based

124   summaries were retrieved via the "standard format for VBHC projects", (see appendix 1 for the

125   format), which are publicly available in Dutch via a webpage (20).

126

Ethical approval

128   Ethical approval was provided by the Dutch Association for Medical Education (NVMO) on the 19th of

129   June 2017 (ID number 915).

130

Patient and public involvement

132   Unfortunately there was no Patient and Public Involvement in this study. Patient involvement was not

133   applicable as there are no Patients involved.

6

134

135 *Setting*

136 This study focused on the postgraduate training setting (residency training) in the Southeast region of

137 Netherlands. *Table 1* presents a general overview of the Dutch medical undergraduate and

138 postgraduate training programs. The region of study has chosen to apply a multifaceted approach of

139 incorporating VBHC in residency training, by having residents conduct small, pragmatic initiatives

140 called "VBHC projects". At the time of study, VBHC training and projects were not mandatory, though

141 much stimulated as a method for residents to learn about VBHC in different ways.

142

143 *Table 1. Overview of general characteristics of the Dutch undergraduate and postgraduate training*

144 *programs*

Name and structure	Duration	Qualification after graduation
Preclinical training (bachelor)	3 years	Bachelor of medicine
Clinical training (master)	3 years	Physician, M.D.
Resident not in training	Optional	-
Residency training or training for general practitioner	3 to 6 years	Medical specialist, general practitioner

145

146 *The VBHC projects*

147 Residents were stimulated to critically assess daily healthcare and recognize potential VBHC dilemmas

148 in practice. These dilemmas entail a wide range of problems or possibilities of improvement residents

149 would come across. For example inefficiency in logistics, unnecessary costs spent on diagnostics, or a

150 new treatment with less complications. Residents were then guided step-by-step. Firstly, they were

151 offered knowledge and skills to identify, measure and value both costs and outcome. Secondly,

152 residents were encouraged to discuss VBHC dilemmas with relevant stakeholders, consequently

153 assessing the dilemma from multiple perspectives. These perspectives, for example, could be the

154 patient`s, the doctor`s, that from other health care professionals and/or that from the health care

155 organisation as a whole. Thirdly, residents had to determine goals for improvements or search an

156 effective alternative for current clinical practice. Finally, residents reported to each other how they

6

157 implemented their change or planned how they were going to implement there change, what

158 (potential) facilitators and barriers they foresaw or encountered and what they learned during the

159 process. Altogether, this resulted in a VBHC-project. In order to enhance the chance of successfully

160 conducting such a project the residents were stimulated to keep the projects relatively small-scale, i.e.

161 with the goal to finish this within approximately 3 to 6 months.

162

163 ***Data collection and analyses***

164 *Data collection & Analyses of Text-Based Summaries*

165 VBHC projects were included in this study when a standard format was completed and published online

166 at the publicly available webpage (20) including a clear problem statement, and potential costs and

167 effects identified as measured and valued from multiple perspectives (at least 2). In case of incomplete

168 data, an email and one reminder email were sent to request missing information. In case of persisting

169 incomplete data, the VBHC project was excluded.

170　　　The final set of included VBHC projects was assessed by two independent researchers (CN, SV).

171 Data extraction of the included VBHC projects concerned a summary of setting, medical specialty,

172 focus of the project, aimed and achieved results and learning effects in terms of residents' self-

173 perceived CanMEDS competency development. Furthermore, data extraction yielded a scoring for

174 learning effects in terms of residents' self-perceived CanMEDS competency development. Any

175 disagreements were resolved through discussion. Focus of the projects were categorised as medical

176 education, medical care and/or organisational efficiency. The category medical education included

177 projects that aimed to improve education for residents, either in terms of practical skills or theoretical

178 knowledge. The category medical care included projects that focused on improvement in current

179 quality of care and/or direct reduction of healthcare costs. The category organisational efficiency

180 included projects that aimed to optimise processes in healthcare.

181

182 *Data Collection & Analyses of Semi-structured Interviews*

183   Semi structured interviews were held with residents who conducted a VBHC project and published this

184   in the online publicly available database (20). After initial resident contact, a reminder request was

185   sent in case of non-response. All interviews were performed, by telephone or face-to-face by one

186   investigator (MK) under supervision of a trained interviewer (CN). There was no prior relationship

187   between the interviewer and the interviewees before the start of the study. Before the included

188   interviews were performed, a series of pilot interviews were held to train the interviewer and asses

189   the quality and feasibility of the topic list. The final topic list for the semi-structured interviews can be

190   found in appendix 2. In short, residents were asked to provide a general reflection of the process, and

191   to reflect on both successful and unsuccessful processes of implementation. If it appeared, based on

192   the interview data, no attempt for implementation was performed, the interview data was not

193   included in the analyses. Interview data was analysed by summarizing information on residents' self-

194   perceived learning of CanMEDS competencies, assessing the learning effects of VBHC and gathering

195   detailed information on implementation facilitators and barriers. Individual interview data were

196   transformed into a transcript (MK) and clustered by two independent researchers (CN, SV) applying

197   the generally accepted principles of primary, secondary and tertiary coding to the data, in a constant

198   comparison, iterative approach. In case of disagreements discussion followed until consensus was

199   reached.

200

201   **Results**

202   *Text-based summaries*

203   From the 63 VBHC projects identified in the publicly available online database (20), 56 VBHC projects

204   were included and analysed (see figure 1). Fifty VBHC projects (89%) included in this study were

205   implemented in practice.

206   - Insert figure 1 -

207

9

208   In Table 2 a general description of the 56 included VBHC projects is presented. For 14 residents, the

209   focus of their VBHC project was on more than one goal (e.g. medical education and medical care, or

210   organisational efficiency and medical care).

211

212   *Individual semi-structured interviews*

213   Out of the 19 residents approached for the interview, 11 interviews were included and analysed in this

214   study (see figure 2). To some extent (n= 5) residents and their projects were both included in the text

215   based summaries and the interviews.

216   *- Insert figure 2 -*

217   Descriptive details of the VBHC projects conducted by the 11 residents interviewed are summarized in

218   Table 2. Amongst others more detailed information can be found in Appendix 3.

219

220   *Table 2: Specifics of the included VBHC projects*

Method		Text-based summaries	Interviews
Setting	University medical centre	38 (68 %)	6 (55%
	Non-academic	18 (32 %)	5 (45%)
Medical specialty	Anaesthesiology	4 (7 %)	2 (18%)
	Cardiology	1 (2%)	-
	Cardiothoracic surgery	2 (4 %)	-
	Clinical pharmacology	3 (5 %)	-
	Clinical genetics	3 (5 %)	-
	Internal medicine	1 (2 %)	-
	Neurology	1 (2 %)	2 (18%)
	Neurosurgery	4 (7 %)	1 (9%)
	Obstetrics and gynaecology	7 (13 %)	1 (9%)
	Orthopaedics	6 (11 %)	-
	Ophthalmology	2 (4 %)	-
	Paediatrics	1 (2%)	2 (18%)
	Plastic surgery	1 (2%)	-
	Psychiatry	3 (5 %)	1 (9%)
	Pulmonary medicine	3 (5 %)	-
	Radiology	4 (7 %)	-
	Rehabilitation medicine	1 (2 %)	2 (18%)
	Surgery	7 (13 %)	-
	Urology	1 (2 %)	-
	Vascular medicine	1 (2 %)	-
Focus of the projects	Organisational efficiency	14 (25 %)	-

9

10

Medical education	2 (4 %)	1 (9%)
Medical care	25 (45 %)	1 (9%)
More than one goal	14 (25 %)	9 (82%)

221

CanMEDS competency development

223 Data from the text-based summaries showed that self-perceived learning effects regarding CanMeds

224 roles were 100% for at least two competencies. In addition 93% of the residents trained three or more

225 CanMeds competencies when conducting a VBHC project. In frequency order, the highest trained

226 competencies were 'leader' (n=50), 'communicator' (n=48), and 'collaborator' (n=48). See figure 3 for

227 more details.

228   The interview data showed a similar distribution of self-perceived learning regarding CanMeds

229 roles (see Figure 3), except for the competency health advocate (n=11) and to some extent scholar

230 (n=5). Supporting quotes were found for most frequent trained competencies: R3: *''I learned a lot*

231 *about organisation of healthcare and how many possibilities there still are for improvement.''* R1: *''[...]*

232 *communication: by the high frequency of presentations I had to do; organisation as well, because I*

233 *gained great insight in the structure of our organisation, financial background, whom different*

234 *stakeholders are and how choices are made.''* R4*: ''I learned about health advocacy because I tried to*

235 *reduce health care costs for the community without loss of quality of care.''* R7: *''Collaborator: I learned*

236 *that supportive departments, for example the financial administration, are easily reached which gave*

237 *me great insight in how the organisational structure is, but also showed me that communications*

238 *sometimes is lacking.''* R10: *scholar, because I did a complete literature investigation to support the*

239 *new protocol I implemented.''*

240   - Insert figure 3 –

241

Recognition of VBHC dilemmas in clinical practice

243 Conducting VBHC projects included a step-by-step guidance and completion of the format. Doing this,

244 the VBHC dilemma could be linked to clinical practice, facilitating the recognition of VBHC – or the

10

11

245 lacking of - VBHC in practice. All text-based summaries of VBHC projects included in this study (N=56),

246 described the VBHC dilemma by defining the costs and outcomes from multiple perspectives and the

247 goal for improvement or alternatives for practice (see appendix 1, item 2 and 3). The interviewed

248 residents (N=11) supported this finding since they could all explain how this format helped them to

249 recognize the VBHC dilemma. R12: *"the format obliges you to walk through the process step by step.*

250 *We often say we do, but this helps us actually do so, because you have an anchor.''* Furthermore, the

251 interview data yielded that residents were able to explain their learning regarding VBHC in clinical

252 practice as well. R10: *"[...] every randomised controlled trial we use or refer to in clinical practice that*

253 *refers to cost in relation to quality reflects a moment were we reflect on VBHC […] we don't always*

254 *recognise it, but it is the basis of VBHC.''* In addition, all interviewed residents (n=11) could explain the

255 multiple perspectives they took into account when analysing their VBHC problem. R5: ''*I learned to*

256 *reduce waste and made the process of patient letters more efficient and improved the quality of care*

257 *in the same process. So, patient, doctor and organisation have a benefit.*''

258 In addition, all interviewed residents (n=11) explained how they became more aware of the

259 relationship between both costs and effects (value), when conducting their VBHC project. For example,

260 R8: ''*we measured the number of no-shows in the intervention group versus the group that received*

261 *standard care, and measured the revenues we missed out on because of the no-shows.''* R7: *''I reduced*

262 *costs without loss of quality of care for the patient by reducing standardised laboratory tests upon*

263 *admission.''* Self-perceived learning effect could also be described as an improvement on awareness

264 and identification of costs in a broader perspective. R4: *"We had a reduction in leading time, for patient*

265 *letters to the general practitioner, from an average of a few weeks to at least 80% finished and send*

266 *within 5 days after discharge. But the cost reduction and quality improvement I envisioned were not*

267 *just the reduction in leading time of the patient letter, but also in better care when the GP has adequate*

268 *information as soon as possible.''*

269

270 **Implementation facilitators and barriers**

11

271 Resident's (n=6) stated that detecting and defining the problem is a very important facilitator and

272 relates to the first step in the VBHC process: R4: *''A thorough investigation of the problem and making*

273 *sure we knew why and for whom the problem was relevant made implementation a lot easier''*. A much-

274 needed item to facilitate implementation (n=11) was the involvement and support from all

275 stakeholders defined during the second step in the guidance by experts: stakeholder analyses. R4:

276 "*Involve all relevant stakeholders and create a sense of urgency and relevance*". R2: *"Everybody*

277 *(doctors, nurses, secretarial staff) recognised the problem of a language barrier and wanted a change*

278 *to be able to take better care of patients who speak a different language […].''* Intrinsic motivation to

279 solve the problem was a huge facilitator as well for many residents (n=5). R8: ''*[…] my interest and*

280 *motivation turned a small project into a hospital wide project.''* A final facilitator many residents (n=7)

281 mentioned, was a mentor or supervisor who helped them with potential barriers, and that they

282 probably would not have been able to change anything without their support. R6: *''The educational*

283 *committee supported my project and supported the different residents to investigate and implement*

284 *possibilities. That was really helpful.''*

285   Self-perceived barriers were often the opposites of the facilitators related to the VBHC

286 dilemma. For example no clear VBHC dilemma or no clear problem definition. A major barrier for

287 implementation is felt to be in the preconditions and technical aspects, for instance ICT or secretarial

288 support to implement the VBHC project. R11: ''*In the end, the ICT application was not realized and*

289 *therefore I could not implement my project.''* Another barrier mentioned was the lack of a supportive

290 environment by a sufficient number of stakeholders involved (n=6). On the one hand, too few could

291 be experienced as a barrier. R10: ''*in the end I did not have enough support from the other residents to*

292 *implement my change although the educational committee was on board.''* On the other hand,

293 involvement of too many stakeholders was also described as a barrier. R11: ''*I needed not only other*

294 *residents, but also different supervisors to be on-board with the plan, which I understood along the*

295 *way.''* Finally, the extent of the project made it more difficult to implement, for instance when the

296   whole organisation was involved instead of just your own department (n=3). R11: *''because it became*

297   *a hospital wide project, it is currently not yet implemented.''*

298

Discussion

300   In this explorative mixed-methods study different aspects of learning when conducting small,

301   pragmatic VBHC projects, from the residents' perspective, were identified. Firstly, conducting VBHC

302   projects was shown to contribute to developing different CanMEDS competencies, especially

303   communicator, collaborator, leader and health advocate. Secondly, residents learned to recognise

304   VBHC dilemmas in clinical practice. Finally, facilitators for and barriers to implement VBHC projects

305   were explored. In the subsequent sections, these findings will be discussed more extensively.

306   Firstly, our study has shown that by conducting VBHC projects, residents were provided

307   opportunities to further develop at least two different CanMEDS competencies. Our data showed that

308   competencies 'leader', 'collaborator' and 'communicator' were most often learned. These are

309   examples of the `soft` competencies. Helping master these competencies was part of the motivation

310   of stimulating our residents to perform VBHC projects. Also, the competencies 'scholar' and 'health

311   advocate' were mentioned, but especially by the participants of the interviews, more than in the text-

312   based summaries. This was an unexpected and remarkable finding: young medical specialists feel

313   inadequately prepared for these specific competencies (3).

314   Secondly, we showed that residents are facilitated to learn to recognize a VBHC dilemma in

315   clinical practice, when conducting a VBHC project. Additionally, they perceive an improvement on

316   awareness regarding VBHC. Our data supports that when residents conduct VBHC projects, recognition

317   of VBHC dilemmas in medical practice is facilitated if they: (i) perform a thorough investigation of the

318   problem, (ii) explore potential barriers and, (iii) set up a project viable for implementation. This data

319   might overestimate the learning effects because we only included those residents who believed their

320   projects were viable for implementation and those with the intrinsic motivation to make a change

321   since participation in VBHC projects was voluntary. For future research it could be interesting to

322 investigate if VBHC projects are fruitful learning opportunities when mandatory in any post-graduate

323 curriculum.

324 Finally, the self-perceived facilitators for and barriers to implement a VBHC project during

325 residency training were extracted from the interviews. The information found, showed many

326 similarities to the current literature on facilitators and barriers in change management (21-23). Based

327 on the modified model of Senge 1999 (21) and the model of Kotter 2002 (22) with key roles by O'Neill

328 2007 (23), the following potential facilitators were extracted. These are compared and interwoven

329 here as they are believed to be crucial when implementing a VBHC project successfully. First, a

330 thorough investigation of the VBHC dilemma, in terms of balancing costs and outcomes, from multiple

331 perspectives (such as patient, organisation, doctor, nurses, and supportive staff) is crucial to establish

332 a sense of urgency and/or relevance. This is much needed to get support from the people involved in

333 the (potential) change. Next, it is crucial to identify stakeholders and get them involved. This is only

334 possible via 'a clear VBHC dilemma', of relevance for those to whom it's related. Then, find a supervisor

335 or mentor with influence to make the change happening and someone who has control of resources,

336 in a hospital this could also be several different people. Finally establish a plan of action, keep it small

337 and simple, within your own influence, and describe how effects are going to be measured (i.e. in

338 terms of costs and effects) from the start to prove improvement. In the end you need to consolidate

339 and secure your new way of working. Appendix 4 summarizes the tips for residents who want to

340 implement a VBHC project. In the end, we would advise any educator who is about to support residents

341 when implementing VBHC projects to: use a similar format and combine structured teaching with

342 support by an expert in the field. This strategy adheres to the necessary requirements of knowledge,

343 support, role models and reflection when it comes to teaching the concepts of VBHC (18)

344

Conclusion

346 This study revealed the positive impact of incorporating VBHC projects within the residency training

347 program. VBHC-projects are resident-led and practice-based, and proved to be an effective

348 educational method to learn and develop CanMEDS competencies and learn and practice the concepts

349 of VBHC via learning-by-doing. Residents learn to recognise VBHC dilemmas, learn how to implement

350 an effective change and have the potential to influence medical care, medical education or efficiency

351 in health care. According to residents, important facilitators for successfully implementing a change

352 are a thorough investigation of the VBHC dilemma combined with a thorough stakeholder analysis.

353

Practice points:

- Introducing a societal relevant theme such as VBHC in residency training programs is a promising strategy to enhance competency-based education.

- Residents develop different CanMEDS competencies, especially those of 'leader', 'communicator' and 'collaborator' when conducting a VBHC project.

- Residents learn to recognize VBHC dilemmas in practice when combining formal teaching with conducting VBHC projects.

- A thorough investigation of a VBHC dilemma combined with an in-depth stakeholder analysis are key to successfully implementing a VBHC project.

354

List of abbreviations

356 CanMEDS   Canadian Medical Education Directives for Specialists

357 VBHC   Value-Based Healthcare

358

Figure legends

360 Figure 1: *Flowchart on selection and exclusion of text-based summaries*

361 *Figure 2. Flowchart on selection and exclusion of individual semi-structured interviews*

362 *Figure 3: Self-perceived learning regarding the different CanMEDS competencies*

363

364   ## *Declarations*

365   *Author contributions :*

366   SV analyzed and interpreted all data and was a major contributor in writing the manuscript. CN

367   analyzed and interpreted data and was a major contributor in writing the manuscript. MK performed

368   the interviews and analyzed data. BE, IH, LS and WM contributed in writing the manuscript. All authors

369   read and approved the final manuscript.

370   *Competing interests:*

371   *The authors declare no competing interests*

372   *Funding:*

373   There was no funding for this research project.

374   *Data sharing statement:*

375   Project information is available via https://www.oorzon.nl/doelmatigheidsinitiatieven-oor-zon.

376   Besides this no additional data is available.

377   *Acknowledgments:*

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380

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Figure 1: *Flowchart on selection and exclusion of text-based summaries*

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┌─────────────────────┐
│  63 VBHC projects   │
│     identified      │
└─────────────────────┘
          │                              ┌──────────────────────────────┐
          │           ──────────────────▶│  4 VBHC projects excluded:   │
          │                              │  - incomplete data           │
          │                              └──────────────────────────────┘
          │
          │                              ┌──────────────────────────────┐
          │           ──────────────────▶│  3 VBHC projects excluded:   │
          │                              │  - no self-perceived learning│
          ▼                              │    effects described         │
┌─────────────────────┐                  └──────────────────────────────┘
│  56 VBHC projects   │
│     analysed        │
└─────────────────────┘
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Figure 2. Flowchart on selection and exclusion of individual semi-structured interviews

Figure 3: Self-perceived learning regarding the different CanMEDS competencies

	medical expert	scholar	leader	collaborator	communicator	professional	health advocate
■ Text-based summaries	18%	23%	89%	86%	86%	34%	43%
■ Interviews	9%	45%	91%	100%	82%	36%	100%

Appendix 1: Format VBHC projects (multiple 2019)

Format VBHC project	
[title of project]	
ABSTRACT (*Max. 150 words)*	
A) What does this project contribute to the improvement of the quality of care at your department or organisation*?*	
B) How are the general competencies (for example communicator, collaborator, leader, health advocate and professional) trained and evaluated by conducting and implementing this VBHC project?	
C) How will you secure this VBHC project within your organisation or at your department?	
1) Medical specialty:	
2) Issue:	*[describe with a max. of 150 words what the problem or issue is you would like to change with this project]*
3) Goal of the project:	*[describe what your main goal is]*
4) Plan of action:	*[describe your plan of action stepwise, max. 200 words. Describe the procedure and your plan of implementation. Explain both analysis and plan of action]*
5) Aimed results:	*[describe, max. 150 words, your aimed results of this VBHC project, in terms of costs and effects]*
6) Achieved results:	*[describe, max. 150 words, your results so far, in terms of costs and effects]*
7) Evaluation:	*[describe, max. 150 words, how you will evaluate the costs and effects of your VBHC project, in the long-term]*
8) Consolidate:	*[describe, max. 150 words, how you will institutionalize this project within the current structure of the organisation or department]*
9) Generalizability:	*[describe if your results might be applicable at other departments, organisations or regions]*
10) Role resident:	*[describe your role in this VBHC project]*
11) Learning effects:	*[describe what you learned by executing this project, how you learned this and how evaluated what you have learned]*
12) Mentor:	*[describe the role of the mentor / supervisor regarding the execution of the VBHC project]*

☐   I agree this information will be published at the OORZON (Southeast region of Netherlands) website.

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Appendix 2: Topic list for semi-structured interview

The topic list was constructed by two experienced researchers in this field, minor changes were made after a pilot interview.

VBHC-Projects	**1) General information** - Definition of VBHC & position in PGME - Goal of own VBHC project - Orientation (education, process, care delivery, …)
	2) Implementation - Enhancing factors - Hindering factors
	3) Learning goals and learning curves - initial goal - achieved goal
	4) Self-perceived competency training - components trained & developed
	5) Self-perceived effect on influencing medical care - patient outcomes and experiences - costs (for example in monetary terms, efficiency, others)
	6) Embedding within organisation - reasons - enhancing or hindering factors

Appendix 3: Basic characteristics and focus of projects of the residents interviewed

	Specialty	Impl.*	Primary focus	Res.**	Explanation of exact focus
R1	Neurosurgery	Yes	Education	No	Development of a training session for other residents on registration and finances in their department
R2	Anesthesiology	Partly	Care and efficiency	No	ICT application to register any language barriers and provide helpful tools to overcome this language barrier
R3	Anesthesiology	Partly	Care and efficiency	No	ICT application to register any language barriers and provide helpful tools to overcome this language barrier
R4	Rehabilitation	Yes	Care and efficiency	No	Improving the leading time of patient letters
R5	Neurology	Yes	Care and efficiency	No	Implementation of digital patient letters to improve lead time
R6	Pediatrics	Yes	Care and efficiency	No	Give residents a day at another speciality to learn from each other and see possibilities to make work more efficient
R7	Rehabilitation	Yes	Care	Yes	Stop standard laboratory testing on admittance, only perform test when necessary
R8	Psychiatry	Yes	Care and efficiency	Yes	Send a standard SMS reminder before outpatient consults to reduce the number of no-shows
R9	Gynaecology	Yes	Care and efficiency	Yes	Direct removal of a catheter after a laparoscopic hysterectomy
R10	Pediatrics	No	Care and efficiency	No	Implementing a new structure for duty schedules to bring more continuity on the ward
R11	Neurology	No	Care and efficiency	No	ICT application to show when a patient had completed in hospital treatment and is waiting for a bed elsewhere

* Implemented at time of the interview.
** VBHC project was part of a research project or PhD trajectory

Appendix 4: Tips for residents' performing a VBHC project within a modified model of change

Examine the VBHC problem thoroughly - *Complete assessment of the current situation from multiple perspectives (patient, doctor, organisation, etc)* - *Take the culture of the organisation into account*
Establish a sense of urgency and/or relevance
Identify potential problems that could stand in the way of your change - *Identify and involve all stakeholders*
Form a powerful coalition with enough power to lead the change Different key roles: - *Sponsor and/or advocate (can be a supervisor or mentor for instance)* - *Implementer (often resident)* - *Change agent (often resident)*
Create a vision and develop strategies for achieving that vision - *keep it small and keep it simple, within your scope of power*
Communicate your vision
Plan for short-term wins - *make sure you can show what is improved*
Consolidating improvement and still produces more change - *implementation is more than changing a protocol. All employees involved need to work in the new way.*
Institutionalizing your change so it is incorporated in the new culture - *make sure you can show what is improved to support the sense of urgency to stick to the new way of working* - *secure the new way of working in ways that are not solely depending on your presence*

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	6-8
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6-8*
Bias	9	Describe any efforts to address potential sources of bias	n.a.
Study size	10	Explain how the study size was arrived at	8,9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	n.a.
		(*b*) Describe any methods used to examine subgroups and interactions	n.a.
		(*c*) Explain how missing data were addressed	n.a.
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	-
		(*e*) Describe any sensitivity analyses	

Continued on next page

Results

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8,9
		(b) Give reasons for non-participation at each stage	8,9
		(c) Consider use of a flow diagram	8,9
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	n.a.
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	n.a.
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	*n.a.*
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	-
		Cross-sectional study—Report numbers of outcome events or summary measures	-
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	-
		(*b*) Report category boundaries when continuous variables were categorized	-
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-

Discussion

Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13,14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13,14
Generalisability	21	Discuss the generalisability (external validity) of the study results	14

Other information

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Incorporating Value-based Healthcare Projects in Residency Training: A mixed methods study on the impact of participation on understanding & competency development

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1

1   **Incorporating Value-based Healthcare Projects in Residency Training:**

2   A mixed-methods study on the impact of participation on understanding &

3   competency development

4

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1

Abstract

Objectives: Stimulating the active participation of residents in projects with societally relevant healthcare themes, such as Value-Based Healthcare (VBHC), can be a strategy to enhance competency development. Canadian Medical Education Directions for Specialists (CanMEDS) competencies such as leader and scholar are important skills for all doctors ([1]). In this study, we hypothesise that when residents conduct a VBHC project, CanMEDS competencies are developed. There is the added value of gaining knowledge about VBHC.

Design: An explorative mixed-methods study assessing residents' self-perceived learning effects of conducting VBHC projects according to three main components: (i) CanMEDS competency development, (ii) recognition of VBHC dilemmas in clinical practice, and (iii) potential facilitators for and barriers to implementing a VBHC project. We triangulated data resulting from qualitative analyses of: (a) text-based summaries of VBHC projects by residents and (b) semi-structured interviews with residents who conducted these projects.

Setting: Academic and non-academic hospitals in the Netherlands.

Participants: Out of 63 text-based summaries from residents, 56 were selected, and out of 19 eligible residents, 11 were selected for semi-structured interviews and were included in the final analysis.

Results: Regarding CanMEDS competency development, the competencies 'leader', 'communicator' and 'collaborator' scored the highest. Opportunities to recognise VBHC dilemmas in practice were mainly stimulated by analysing healthcare practices from different perspectives, and by learning how to define costs and relate them to outcomes. Finally, implementation of VBHC projects is facilitated by a thorough investigation of a VBHC dilemma combined with an in-depth stakeholder analysis.

Conclusion: In medical residency training programmes, competency development through active participation in projects with societally relevant healthcare themes—such as VBHC—was found to be a promising strategy. From a resident's perspective, combining a thorough investigation of the VBHC dilemma with an in-depth stakeholder analysis is key to the successful implementation of a VBHC project.

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58

Strengths and limitations of this study

60 • The residents included were from diverse specialities, both academic and non-academic,

61 making this research relevant for a broad spectrum of doctors and educators.

62 • This is a practice-oriented study, easily applicable in current medical practice.

63 • Data from the semi-structured interviews supported data from the text-based summaries,

64 although the sample size is small.

65 • CanMEDS competency development was self-reported.

66 • Only projects that were thought to be viable for implementation and led by residents with the

67 intrinsic motivation to make a change were publicised and therefore eligible for selection,

68 which could lead to overestimation of the results.

69

Key words

71 • Value-Based Healthcare

72 • Residency training programmes

73 • Competency-based education

74 • CanMEDS competencies

75

Background

77 The Canadian Medical Education Directions for Specialists (CanMEDS) project contributed to a major

78 change in medical education (undergraduate and postgraduate), moving away from a time-based

79 learning system to a competency-based learning system ([1]). It describes important competencies

80 residents should master during their training, such as communicator, collaborator, leader and health

81 advocate ([2], [3]). However, it appears that the `soft` competencies such as 'leader' and 'health advocate'

3

82 are neither easy to teach nor to assess (4). Educational efforts that specifically train these

83 competencies are therefore appreciated.

84   In addition to the CanMEDS competencies, and to ensure that physicians' competencies align

85 with evolving health systems, overarching themes focusing on societal needs and future demands are

86 increasingly integrated into medical education (5). Examples of such themes are patient safety, shared

87 decision-making, and value-based health care (6-8). In the Netherlands, educators undertook action to

88 combine these developments, resulting in the CanBetter project, which started in 2015 (8). That

89 project involved linking the development of all CanMEDS competencies with teaching residents about

90 societally relevant themes. Value-based healthcare (VBHC) is one of the current relevant themes the

91 CanBetter project focusses on, because health care expenditure is rising and medical professionals

92 need to take their responsibility for keeping costs down (9).

93   VBHC is defined as the health outcome that matters to the patient, relative to the costs of

94 achieving this outcome (9). Health outcomes can be, for example, disease-free survival for patients

95 with cancer, or the time needed to regain functionality after a knee joint replacement (9). As well as

96 achieving the health outcomes, the professionals are also responsible for the stewardship of resources,

97 which requires an entirely new way of managing (10). Therefore, instruction, training and fundamental

98 knowledge of VBHC are required (11-13). Past efforts to teach residents about cost-effective care have

99 unfortunately not always been as effective as intended (14, 15), for example, because medical

100 education didn't provide a positive culture, the training environment was not suitable, or difficulties

101 arose when changing practice patterns of both residents and the supervising faculty (15).

102   Recent research has illustrated that key elements of learning to deliver VBHC are knowledge

103 transmission, appropriate role modelling, reflection, and the presence of a supportive environment

104 (13). Medical students and residents must be educated and trained in settings where they have

105 opportunities to develop and use VBHC, preferably a clinical setting (16-18). Amongst others, a specific

106 training programme, incorporating formal and informal learning, is necessary to learn how to deliver

107 VBHC (19). The residency training programmes are believed to be one of the best places to initiate

5

108 VBHC education because residents are adaptable, highly educated and motivated. In addition, it has

109 been shown that what residents learn during their residency has a significant impact on how they treat

110 their patients when they become medical specialists (20).

111   In our regional organisation of teaching hospitals, a strategy was set up that combined formal

112 and informal training within the residency training programme, getting residents involved with VBHC.

113 Residents were stimulated to critically assess daily healthcare and recognise potential VBHC dilemmas

114 and transform all this into a VBHC project. Such VBHC projects are resident-led and practice-based.

115   This study evaluates the impact of incorporating VBHC projects within the residency training

116 programme. The following research questions were formulated: (I) Which CanMEDS competencies do

117 residents develop when conducting VBHC projects in residency training? (II) Is recognition of VBHC

118 dilemmas in medical practice facilitated when residents conduct VBHC projects during their residency

119 training programme? (III) Which facilitators for and barriers to VBHC project implementation can we

120 detect when conducting a VBHC project during residency training?

121

122 **Methods**

123 *Study Design*

124 An explorative mixed-methods design was used. The study entailed an analysis of retrospective

125 information from text-based summaries of VBHC projects conducted by residents between 2014 and

126 2018, and semi-structured interviews with residents. The text-based summaries were retrieved via the

127 "standard format for VBHC projects" (see appendix 1 for the format), which are publicly available in

128 Dutch via a webpage (21).

129

130 *Ethical approval*

131 Ethical approval was provided by the Dutch Association for Medical Education (NVMO) on June 19,

132 2017 (ID number 915).

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134   *Patient and public involvement*

135   Unfortunately, there was no Patient and Public Involvement in this study. Patient involvement was not

136   applicable as there were no patients involved.

137

138   *Setting*

139   This study focused on the postgraduate training setting (residency training) in the southeast region of

140   the Netherlands. *Table 1* presents a general overview of the Dutch medical undergraduate and

141   postgraduate training programmes. The region of study has chosen to apply a multifaceted approach

142   of incorporating VBHC in residency training by having residents conduct small, pragmatic initiatives

143   called "VBHC projects". At the time of the study, VBHC training and projects were not mandatory,

144   though greatly encouraged as a method for residents to learn about VBHC in different ways.

145

146   *Table 1. Overview of general characteristics of the Dutch undergraduate and postgraduate training*

147   *programmes*

Name and structure	Duration	Qualification after graduation
Preclinical training (bachelor)	3 years	Bachelor of medicine
Clinical training (master)	3 years	Physician, M.D.
Resident not in training	Optional	-
Residency training or training for general practitioner	3 to 6 years	Medical specialist, general practitioner

148

149   **The VBHC projects**

150   Residents were stimulated to critically assess daily healthcare and recognise potential VBHC dilemmas

151   in practice. These dilemmas entail a wide range of problems or possibilities for improvement that

152   residents would come across; for example, inefficiency in logistics, unnecessary costs spent on

153   diagnostics, or a new treatment with fewer complications. Residents were then guided step-by-step.

154   Firstly, they were offered the knowledge and skills to identify, measure and evaluate both costs and

155   outcome. Secondly, they were encouraged to discuss VBHC dilemmas with the relevant stakeholders,

156   consequently assessing the dilemma from multiple perspectives. These perspectives could be the

157 patient's, the doctor's, other health care professionals' and/or that from the health care organisation

158 as a whole. Thirdly, residents had to determine goals for improvement or search for an effective

159 alternative for current clinical practice. Finally, they reported to each other how they implemented

160 their change or planned to implement their change, what facilitators and barriers they foresaw or

161 encountered (potential or actual), and what they learned during the process. Altogether, this resulted

162 in a VBHC project. In order to enhance the chance of successfully conducting such a project, the

163 residents were encouraged to keep the projects relatively small-scale, i.e. with the goal to finish it

164 within 3 to 6 months.

165

166 ***Data collection and analyses***

167 *Data collection & Analyses of Text-Based Summaries*

168 VBHC projects were included in this study when a standard format was completed and published online

169 on the publicly available webpage (21), with a clear problem statement and potential costs and effects

170 identified as measured and valued from multiple perspectives (at least 2). If the data were incomplete,

171 an email and one reminder email were sent to request the missing information. If the data remained

172 incomplete, the VBHC project was excluded.

173   The final set of included VBHC projects was assessed by two independent researchers (CN, SV).

174 Data extraction of these projects involved a summary of the setting, medical specialty, focus of the

175 project, anticipated and achieved results, and learning effects in terms of the residents' self-perceived

176 CanMEDS competency development. Data extraction yielded a score for the learning effects. Any

177 disagreements were resolved through discussion. The focus of the projects was categorised after an

178 inductive process as medical education, medical care and/or organisational efficiency. The medical

179 education category included projects that aimed to improve education for residents, either in terms

180 of practical skills or theoretical knowledge. The medical care category included projects that focused

181 on improvement in the current quality of care and/or direct reduction of healthcare costs. The

182 organisational efficiency category included projects that aimed to optimise processes in healthcare.

183

Data Collection & Analyses of Semi-structured Interviews

184

185 Semi-structured interviews were held with residents who conducted a VBHC project and published it

186 in the publicly available online database ([21](#)). After the initial contact with a resident, a reminder

187 request was sent if there was no response. All interviews were performed by telephone or face-to-face

188 by one investigator (MK) under the supervision of a trained interviewer (CN). There was no prior

189 relationship between the interviewer and the interviewees before the start of the study. Prior to

190 performing the interviews, a series of pilot interviews was held to train the interviewer and assess the

191 quality and feasibility of the topic list. The final topic list for the semi-structured interviews can be

192 found in appendix 2. The residents were asked to provide a general reflection of the process, and to

193 reflect on both successful and unsuccessful processes of implementation. If it appeared that no

194 implementation attempt was made, based on the interview data, the interview data was not included

195 in the analyses. Individual interview data were recorded and transcribed verbatim (MK).

196 The data were analysed by summarising information on the residents' self-perceived learning

197 of CanMEDS competencies, assessing the learning effects of VBHC, and gathering detailed information

198 on implementation facilitators and barriers. Data was clustered by two independent researchers (CN,

199 SV) applying the generally accepted principles of primary, secondary, and tertiary coding, in a constant

200 comparison ([22](#)), iterative approach. Regarding potential facilitators for and barriers to

201 implementation, this means reading through the transcripts inductively to find patterns ([23](#), [24](#)).

202 Finally, all interview data were searched for these patterns. These steps were executed by two

203 researchers (SV, CN), and in case of disagreement, dialogue followed until consensus was reached.

204

Results

205

Text-based summaries

206

207 From the 63 VBHC projects identified in the publicly available online database ([21]), 56 VBHC projects

208 were included and analysed (see figure 1). Fifty VBHC projects (89%) included in this study were

209 implemented in practice.

210   - Insert figure 1 -

211

212 In Table 2, a general description of the 56 included VBHC projects is presented. For 14 residents, the

213 focus of their VBHC project was on more than one goal (e.g. medical education and medical care, or

214 organisational efficiency and medical care).

215

216 *Individual semi-structured interviews*

217 Out of the 19 residents approached for the interview, 11 were included and analysed in this study (see

218 figure 2). To some extent (n= 5), both the residents and their projects were included in the text-based

219 summaries and the interviews.

220   *- Insert figure 2 –*

221

222 Descriptive details of the VBHC projects conducted by the 11 residents interviewed are summarised in

223 Table 2. More detailed information can be found in Appendix 3.

224

225 *Table 2: Specifics of the VBHC projects included*

Method		Text-based summaries	Interviews
Setting	University medical centre	38 (68%)	6 (55%)
	Non-academic	18 (32%)	5 (45%)
Medical specialty	Anaesthesiology	4 (7%)	2 (18%)
	Cardiology	1 (2%)	-
	Cardiothoracic surgery	2 (4%)	-
	Clinical pharmacology	3 (5%)	-
	Clinical genetics	3 (5%)	-
	Internal medicine	1 (2%)	-
	Neurology	1 (2%)	2 (18%)
	Neurosurgery	4 (7%)	1 (9%)
	Obstetrics and gynaecology	7 (13%)	1 (9%)
	Orthopaedics	6 (11%)	-

	Ophthalmology	2 (4%)	-
	Paediatrics	1 (2%)	2 (18%)
	Plastic surgery	1 (2%)	-
	Psychiatry	3 (5%)	1 (9%)
	Pulmonary medicine	3 (5%)	-
	Radiology	4 (7%)	-
	Rehabilitation medicine	1 (2%)	2 (18%)
	Surgery	7 (13%)	-
	Urology	1 (2%)	-
	Vascular medicine	1 (2%)	-
Focus of the projects	Organisational efficiency	14 (25%)	-
	Medical education	2 (4%)	1 (9%)
	Medical care	25 (45%)	1 (9%)
	More than one goal	14 (25%)	9 (82%)

226

227 ***CanMEDS competency development***

228 Data analysis of the text-based summaries and interviews revealed that self-perceived learning

229 effects regarding CanMEDS roles were present for at least two competencies. See figure 3 for details

230 and distribution and the text below for elaboration and illustrative quotes.

231

232   - Insert figure 3 –

233

234 Data from the text-based summaries showed that self-perceived learning effects regarding CanMEDS

235 roles were evident in all respondents for at least two competencies. In addition, 93% of the residents

236 trained three or more CanMEDS competencies when conducting a VBHC project. In order of frequency,

237 the best trained competencies were 'leader' (n=50), 'communicator' (n=48) and 'collaborator' (n=48).

238   The interview data showed a similar distribution of self-perceived learning regarding CanMEDS

239 roles to the data from the text-based summaries (see Figure 3), except for the health advocate

240 competency (n=11) and, to some extent, scholar (n=5), which were more often developed according

241 to the interviewed residents. Supporting quotes were found for the most frequently trained

242 competencies. R10 comment on scholar: *"because I did a complete literature investigation to support*

243 *the new protocol I implemented."* R3 comment on leader: *"I learned a lot about the organisation of*

244 *healthcare and how many possibilities there still are for improvement."* R7 comment on collaborator:

11

"I learned that supportive departments, for example the financial administration, are easily accessed,

which gave me great insight into the organisational structure, but also showed me that communication

is sometimes lacking." R1 comment on communicator: *"[…] communication as well, by the high*

frequency of presentations I had to do." R1 comment on organisation: *"[…] because I gained great*

insight into the structure of our organisation, financial background, who different stakeholders are,

and how choices are made." R4 comment on health advocate*: "I learned about health advocacy*

because I tried to reduce health care costs for the community without loss of quality of care."

Learning concepts of VBHC

Concerning the concepts of VBHC, our data revealed a few important aspects of the residents' learning

process. Firstly, the resident needs to recognise the VBHC dilemma in clinical practice. Next, they need

to examine this dilemma from multiple perspectives. Finally, they need to balance costs versus

outcome regarding this dilemma from these multiple perspectives.

Recognition of VBHC dilemmas in clinical practice

Conducting VBHC projects included a step-by-step guidance and completion of the format. This

allowed the VBHC dilemma to be linked to clinical practice, facilitating the recognition of VBHC - or its

lack - in practice. All text-based summaries of VBHC projects included in this study (N=56) described

the VBHC dilemma by defining the costs and outcomes from multiple perspectives and the goal for

improvement or alternatives for practice (see appendix 1, items 2 and 3). The interviewed residents

(N=11) helped us to gain insight since they could explain how this format helped them to recognise the

VBHC dilemma. R12: *"the format obliges you to walk through the process step by step. We often say*

we do, but this helps us actually to do so, because you have an anchor."

Learning multiple perspectives concerning VBHC

11

270 All interviewed residents (n=11) could explain the multiple perspectives they took into account when

271 analysing their VBHC problem. R5: "*I learned to reduce waste and made the process of patient letters*

272 *more efficient and improved the quality of care in the same process. So, patient, doctor and*

273 *organisation benefit.*"

274

275 *Learning process of costs versus effects*

276 All interviewed residents (n=11) explained how they became more aware of the relationship between

277 both costs and effects (value) when conducting their VBHC project. For example, R8: "*we measured*

278 *the number of no-shows in the intervention group versus the group that received standard care, and*

279 *measured the revenues we missed out on because of the no-shows."* R7: *"I reduced costs without loss*

280 *of quality of care for the patient by reducing standardised laboratory tests upon admission."* A self-

281 perceived learning effect could also be described as an improvement in awareness and identification

282 of costs in a broader perspective. R4: *"We had a reduction in leading time for patient letters to the*

283 *general practitioner, from an average of a few weeks to at least 80% finished and sent within 5 days*

284 *after discharge. But the cost reduction and quality improvement I envisioned were not just the*

285 *reduction in leading time of the patient letter, but also in better care when the GP has adequate*

286 *information as soon as possible."* The interview data also revealed that the residents were able to

287 explain their learning regarding VBHC in clinical practice as well. R10: *"[...] every randomised controlled*

288 *trial we use or refer to in clinical practice that refers to cost in relation to quality reflects a moment*

289 *where we reflect on VBHC [...] we don't always recognise it, but it is the basis of VBHC."*

290

291 **Facilitators for implementation**

292 Residents mentioned a number of facilitators for implementation, in part related to the step-by-step

293 process we use (see methods section for details). Firstly, a thorough problem analysis from multiple

294 perspectives is important. Secondly, the involvement of all important stakeholders seems essential.

295 Thirdly, an intrinsic motivation to resolve the problem at hand is a strong facilitator. Finally, support

296 from a supervisor or mentor seems important.

297

Problem analysis

299 Residents (n=6) stated that detecting and defining the problem is a very important facilitator and

300 relates to the first step in the process of conducting a VBHC project (see appendix 1, points 2, 3), in

301 which residents are stimulated to critically assess daily healthcare and recognise potential VBHC

302 dilemmas and assess all this from multiple perspectives. R4: "*A thorough investigation of the problem*

303 *and making sure we knew why and for whom the problem was relevant made implementation a lot*

304 *easier.*"

305

Stakeholder involvement

307 An important item to facilitate implementation (n=11) turned out to be the involvement and support

308 of all stakeholders as defined during the second step in the guidance by experts: stakeholder analyses.

309 R4: "*Involve all relevant stakeholders and create a sense of urgency and relevance*". R2: *"Everybody*

310 *(doctors, nurses, secretarial staff) recognised the problem of a language barrier and wanted a change*

311 *to be able to take better care of patients who speak a different language […].*"

312

Intrinsic motivation

314 Intrinsic motivation to solve the problem was a huge facilitator as well for many residents (n=5). R8:

315 "*[…] my interest and motivation turned a small project into a hospital-wide project.*"

316

Support

318 A final facilitator many residents (n=7) mentioned was a mentor or supervisor who helped them with

319 potential barriers, and that they probably would not have been able to change anything without their

320   support. R6: "*The educational committee supported my project and supported the different residents*

321   *to investigate and implement possibilities. That was really helpful.*"

322

323   ***Barriers to implementation***

324   Self-perceived barriers were often the opposite of the facilitators related to the VBHC dilemma. For

325   example, there was no clear VBHC dilemma or no clear problem definition. A few distinct barriers were

326   mentioned, namely a lack of support, involvement of too many stakeholders, and problems with the

327   magnitude of the project.

328

329   *Support*

330   A major barrier for implementation was felt to involve the preconditions and technical aspects, for

331   instance, ICT or secretarial support to implement the VBHC project. R11: "*In the end, the ICT application*

332   *was not realised and therefore I could not implement my project.*" Another barrier mentioned was the

333   lack of a supportive environment by a sufficient number of the stakeholders involved (n=6). Too few

334   could also be experienced as a barrier. R10: "*in the end I did not have enough support from the other*

335   *residents to implement my change although the educational committee was on board.*"

336

337   *Stakeholders*

338   Involvement of too many stakeholders was described as a barrier. R11: "*I needed not only other*

339   *residents, but also different supervisors to be on-board with the plan, which I understood along the*

340   *way.*"

341

342   *Magnitude*

343   Finally, the extent of the project made it more difficult to implement, for instance when the whole

344   organisation was involved instead of just their own department (n=3). R11: *"because it became a*

345   *hospital-wide project, it is currently still not implemented."*

15

346

Discussion

348 In this explorative mixed-methods study, different aspects of learning were identified from the

349 residents' perspective when conducting small, pragmatic VBHC projects. Firstly, conducting VBHC

350 projects was shown to contribute to developing different CanMEDS competencies, especially

351 communicator, collaborator, leader and health advocate. Secondly, residents learned to recognise

352 VBHC dilemmas in clinical practice. Finally, facilitators for and barriers to implementing VBHC

353 projects were explored. In the subsequent sections, these findings will be discussed more

354 extensively.

355   Our study has shown that by conducting VBHC projects, residents were provided with

356 opportunities to further develop at least two different CanMEDS competencies. Our data showed that

357 the 'leader', 'collaborator' and 'communicator' competencies were most often developed. These are

358 examples of the `soft` competencies (25). Mastering these competencies is helpful when implementing

359 any change project, and this motivates residents to acquire them (26). In this study, the 'scholar' and

360 'health advocate' competencies were often mentioned, especially by the participants of the

361 interviews, more than in the text-based summaries. This was an unexpected and remarkable finding:

362 young medical specialists feel inadequately prepared for these specific competencies (4).

363   We showed that residents are facilitated to learn to recognise a VBHC dilemma in clinical

364 practice when conducting a VBHC project. Additionally, they perceived an improvement in awareness

365 regarding VBHC, which is an important step in teaching residents to deliver VBHC (27). Our data

366 supports that when residents conduct VBHC projects, recognition of VBHC dilemmas in medical

367 practice is facilitated if they: (i) perform a thorough investigation of the problem, (ii) explore potential

368 barriers and (iii) set up a viable project for implementation. The data might overestimate the learning

369 effects because we only included those residents who believed their projects were viable for

370 implementation and those with the intrinsic motivation to make a change since participation in the

371 VBHC projects was voluntary. Intrinsic motivation has a known positive effect on change projects in

15

372   health care (28). For future research, it could be interesting to investigate if VBHC projects are fruitful

373   learning opportunities when mandatory in any postgraduate curriculum.

374   Finally, the self-perceived facilitators for and barriers to implementing a VBHC project during

375   residency training were extracted from the interviews. We believe them to be crucial for the successful

376   implementation of a VBHC project. The information revealed many similarities to the contemporary

377   literature on facilitators and barriers in change management (29-31). First, a thorough investigation of

378   the problem is crucial (31), specifically concerning the VBHC dilemma. This means investigating the

379   costs and outcomes from multiple perspectives (such as patient, organisation, doctor, nurses, and

380   supportive staff) and balancing these costs versus outcomes (32). This is crucial in our opinion to

381   establish a sense of urgency and/or relevance, which in turn is essential for a successful

382   implementation (33, 34). Next, it is important to identify stakeholders and get them involved (35, 36).

383   This is only possible via 'a clear VBHC dilemma', of relevance for those who are affected by it (34).

384   Subsequently, find a supervisor or mentor with enough influence to make the change happen and

385   someone who has control of resources; in a hospital, this could be several different people (29). Then

386   establish a plan of action, keep it small and simple, within your own scope of influence (37). Finally,

387   describe how the effects are going to be measured (i.e. in terms of costs and effects) and demonstrate

388   intermediate results (36). Ultimately, you need to consolidate and secure your new way of working

389   (29). Inspired by the work of other researchers in the field of change management (29-31), we

390   summarised the tips from this study in an overview checklist (see appendix 4). We hope to inspire and

391   guide residents who want to implement a VBHC project. We would advise any educator who is about

392   to support residents when implementing VBHC projects to use a similar format and combine structured

393   teaching with support by an expert in the field (19). This strategy adheres to the necessary

394   requirements of knowledge, support, role models and reflection when it comes to teaching the

395   concepts of VBHC (19).

396

397   **Conclusion**

17

398 This study revealed the positive impact of incorporating VBHC projects within the residency training

399 programme. VBHC projects are resident-led and practice-based, and proved to be an effective

400 educational method to learn and develop CanMEDS competencies and practise the concepts of VBHC

401 via learning-by-doing. Residents learn to recognise VBHC dilemmas, how to implement an effective

402 change and that they have the potential to influence medical care, medical education or efficiency in

403 health care. According to the residents, important facilitators for successfully implementing a change

404 are a thorough investigation of the VBHC dilemma combined with a thorough stakeholder analysis.

405

Practice points:

- Introducing a societally relevant theme such as VBHC in residency training programmes is a promising strategy to enhance competency-based education.
- Residents develop different CanMEDS competencies when conducting a VBHC project, especially those of 'leader', 'communicator' and 'collaborator'.
- Residents learn to recognise VBHC dilemmas in practice when combining formal teaching with conducting VBHC projects.
- A thorough investigation of a VBHC dilemma combined with an in-depth stakeholder analysis are key to successfully implementing a VBHC project.

406

407 *List of abbreviations*

408 CanMEDS   Canadian Medical Education Directives for Specialists

409 VBHC   Value-Based Healthcare

410

411 *Figure legends*

412 *Figure 1: Flowchart on selection and exclusion of text-based summaries*

413 *Figure 2. Flowchart on selection and exclusion of individual semi-structured interviews*

17

18

414   *Figure 3: Self-perceived learning regarding the different CanMEDS competencies*

415

Declarations

417   *Author contributions :*

418   SV analysed and interpreted all data and was a major contributor in writing the manuscript. CN

419   analysed and interpreted data and was a major contributor in writing the manuscript. MK performed

420   the interviews and analysed data. BE, IH, LS and WM contributed to writing the manuscript. All authors

421   read and approved the final manuscript.

422   *Competing interests:*

423   *The authors declare no competing interests*

424   *Funding:*

425   There was no funding for this research project.

426   *Data sharing statement:*

427   Project information is available via https://www.oorzon.nl/doelmatigheidsinitiatieven-oor-zon. No

428   additional data is available.

429   *Acknowledgments:*

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432   `

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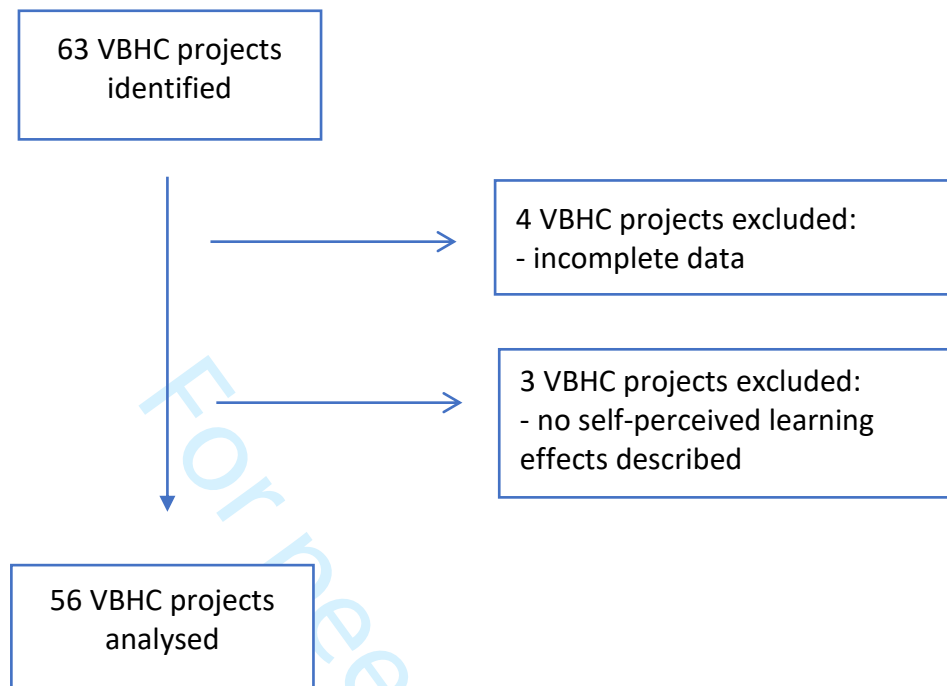
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Figure 1: *Flowchart on selection and exclusion of text-based summaries*

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Figure 2. Flowchart on selection and exclusion of individual semi-structured interviews

Figure 3: Self-perceived learning regarding the different CanMEDS competencies

	medical expert	scholar	leader	collaborator	communicator	professional	health advocate
Text-based summaries	18%	23%	89%	86%	86%	34%	43%
Interviews	9%	45%	91%	100%	82%	36%	100%

Appendix 1: Format VBHC projects (multiple 2019)

Format VBHC project *[title of project]*	
ABSTRACT (*Max. 150 words)*	
A) What does this project contribute to the improvement of the quality of care at your department or organisation*?*	
B) How are the general competencies (for example communicator, collaborator, leader, health advocate and professional) trained and evaluated by conducting and implementing this VBHC project?	
C) How will you secure this VBHC project within your organisation or at your department?	
1) Medical specialty:	
2) Issue:	*[describe with a max. of 150 words what the problem or issue is you would like to change with this project]*
3) Goal of the project:	*[describe what your main goal is]*
4) Plan of action:	*[describe your plan of action stepwise, max. 200 words. Describe the procedure and your plan of implementation. Explain both analysis and plan of action]*
5) Aimed results:	*[describe, max. 150 words, your aimed results of this VBHC project, in terms of costs and effects]*
6) Achieved results:	*[describe, max. 150 words, your results so far, in terms of costs and effects]*
7) Evaluation:	*[describe, max. 150 words, how you will evaluate the costs and effects of your VBHC project, in the long-term]*
8) Consolidate:	*[describe, max. 150 words, how you will institutionalize this project within the current structure of the organisation or department]*
9) Generalizability:	*[describe if your results might be applicable at other departments, organisations or regions]*
10) Role resident:	*[describe your role in this VBHC project]*
11) Learning effects:	*[describe what you learned by executing this project, how you learned this and how evaluated what you have learned]*
12) Mentor:	*[describe the role of the mentor / supervisor regarding the execution of the VBHC project]*

☐ I agree this information will be published at the OORZON (Southeast region of Netherlands) website.

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Appendix 2: Topic list for semi-structured interview

The topic list was constructed by two experienced researchers in this field, minor changes were made after a pilot interview.

VBHC-Projects	**1) General information** - Definition of VBHC & position in PGME - Goal of own VBHC project - Orientation (education, process, care delivery, …)
	2) Implementation - Enhancing factors - Hindering factors
	3) Learning goals and learning curves - initial goal - achieved goal
	4) Self-perceived competency training - components trained & developed
	5) Self-perceived effect on influencing medical care - patient outcomes and experiences - costs (for example in monetary terms, efficiency, others)
	6) Embedding within organisation - reasons - enhancing or hindering factors

Appendix 3: Basic characteristics and focus of projects of the residents interviewed

	Specialty	Impl.*	Primary focus	Res.**	Explanation of exact focus
R1	Neurosurgery	Yes	Education	No	Development of a training session for other residents on registration and finances in their department
R2	Anesthesiology	Partly	Care and efficiency	No	ICT application to register any language barriers and provide helpful tools to overcome this language barrier
R3	Anesthesiology	Partly	Care and efficiency	No	ICT application to register any language barriers and provide helpful tools to overcome this language barrier
R4	Rehabilitation	Yes	Care and efficiency	No	Improving the leading time of patient letters
R5	Neurology	Yes	Care and efficiency	No	Implementation of digital patient letters to improve lead time
R6	Pediatrics	Yes	Care and efficiency	No	Give residents a day at another speciality to learn from each other and see possibilities to make work more efficient
R7	Rehabilitation	Yes	Care	Yes	Stop standard laboratory testing on admittance, only perform test when necessary
R8	Psychiatry	Yes	Care and efficiency	Yes	Send a standard SMS reminder before outpatient consults to reduce the number of no-shows
R9	Gynaecology	Yes	Care and efficiency	Yes	Direct removal of a catheter after a laparoscopic hysterectomy
R10	Pediatrics	No	Care and efficiency	No	Implementing a new structure for duty schedules to bring more continuity on the ward
R11	Neurology	No	Care and efficiency	No	ICT application to show when a patient had completed in hospital treatment and is waiting for a bed elsewhere

* Implemented at time of the interview.
** VBHC project was part of a research project or PhD trajectory

Appendix 4: Tips for residents' performing a VBHC project within a modified model of change

Examine the VBHC problem thoroughly
- *Complete assessment of the current situation from multiple perspectives (patient, doctor, organisation, etc)* - *Take the culture of the organisation into account*
Establish a sense of urgency and/or relevance
Identify potential problems that could stand in the way of your change
- *Identify and involve all stakeholders*
Form a powerful coalition with enough power to lead the change Different key roles:
- *Sponsor and/or advocate (can be a supervisor or mentor for instance)* - *Implementer (often resident)* - *Change agent (often resident)*
Create a vision and develop strategies for achieving that vision
- *keep it small and keep it simple, within your scope of power*
Communicate your vision
Plan for short-term wins
- *make sure you can show what is improved*
Consolidating improvement and still produces more change
- *implementation is more than changing a protocol. All employees involved need to work in the new way.*
Institutionalizing your change so it is incorporated in the new culture
- *make sure you can show what is improved to support the sense of urgency to stick to the new way of working* - *secure the new way of working in ways that are not solely depending on your presence*

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	6-8
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6-8*
Bias	9	Describe any efforts to address potential sources of bias	n.a.
Study size	10	Explain how the study size was arrived at	8,9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	n.a.
		(*b*) Describe any methods used to examine subgroups and interactions	n.a.
		(*c*) Explain how missing data were addressed	n.a.
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	-
		(*e*) Describe any sensitivity analyses	

Results

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8,9
		(b) Give reasons for non-participation at each stage	8,9
		(c) Consider use of a flow diagram	8,9
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	n.a.
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	n.a.
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	*n.a.*
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	-
		Cross-sectional study—Report numbers of outcome events or summary measures	-
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	-
		(*b*) Report category boundaries when continuous variables were categorized	-
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-

Discussion

Key results	18	Summarise key results with reference to study objectives	15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15, 16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15,6
Generalisability	21	Discuss the generalisability (external validity) of the study results	15-17

Other information

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	n.a.

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Incorporating value-based healthcare projects in residency training: a mixed-methods study on the impact of participation on understanding and competency development

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Incorporating value-based healthcare projects in residency training: a mixed-methods study on the impact of participation on understanding and competency development

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Abstract

Objectives: Stimulating the active participation of residents in projects with societally relevant healthcare themes, such as Value-Based Healthcare (VBHC), can be a strategy to enhance competency development. Canadian Medical Education Directions for Specialists (CanMEDS) competencies such as leader and scholar are important skills for all doctors. In this study, we hypothesise that when residents conduct a VBHC project, CanMEDS competencies are developed. There is the added value of gaining knowledge about VBHC.

Design: An explorative mixed-methods study assessing residents' self-perceived learning effects of conducting VBHC projects according to three main components: (i) CanMEDS competency development, (ii) recognition of VBHC dilemmas in clinical practice, and (iii) potential facilitators for and barriers to implementing a VBHC project. We triangulated data resulting from qualitative analyses of: (a) text-based summaries of VBHC projects by residents and (b) semi-structured interviews with residents who conducted these projects.

Setting: Academic and non-academic hospitals in the Netherlands.

Participants: Out of 63 text-based summaries from residents, 56 were selected, and out of 19 eligible residents, 11 were selected for semi-structured interviews and were included in the final analysis.

Results: Regarding CanMEDS competency development, the competencies 'leader', 'communicator' and 'collaborator' scored the highest. Opportunities to recognise VBHC dilemmas in practice were mainly stimulated by analysing healthcare practices from different perspectives, and by learning how to define costs and relate them to outcomes. Finally, implementation of VBHC projects is facilitated by a thorough investigation of a VBHC dilemma combined with an in-depth stakeholder analysis.

Conclusion: In medical residency training programmes, competency development through active participation in projects with societally relevant healthcare themes—such as VBHC—was found to be a promising strategy. From a resident's perspective, combining a thorough investigation of the VBHC dilemma with an in-depth stakeholder analysis is key to the successful implementation of a VBHC project.

58

Strengths and limitations of this study

60   • The residents included were from diverse specialities, both academic and non-academic,

61   making this research relevant for a broad spectrum of doctors and educators.

62   • This is a practice-oriented study, easily applicable in current medical practice.

63   • Data from the semi-structured interviews supported data from the text-based summaries,

64   although the sample size is small.

65   • CanMEDS competency development was self-reported.

66   • Only projects that were thought to be viable for implementation and led by residents with the

67   intrinsic motivation to make a change were publicised and therefore eligible for selection,

68   which could lead to overestimation in the results.

69

Keywords

71   Value-Based Healthcare, Residency training programmes, Competency-based education, CanMEDS

72   competencies

73

Introduction

75   The Canadian Medical Education Directions for Specialists (CanMEDS) project contributed to a major

76   change in medical education (undergraduate and postgraduate), moving away from a time-based

77   learning system to a competency-based learning system ([1]). It describes important competencies

78   residents should master during their training, such as communicator, collaborator, leader and health

79   advocate ([2], [3]). However, it appears that the `soft` competencies such as 'leader' and 'health advocate'

80   are neither easy to teach nor to assess ([4]). Educational efforts that specifically train these

81   competencies are therefore appreciated.

3

82   In addition to the CanMEDS competencies, and to ensure that physicians' competencies align

83   with evolving health systems, overarching themes focusing on societal needs and future demands are

84   increasingly integrated into medical education (5). Examples of such themes are patient safety, shared

85   decision-making, and value-based health care (6-8). In the Netherlands, educators undertook action to

86   combine these developments, resulting in the CanBetter project, which started in 2015 (8). That

87   project involved linking the development of all CanMEDS competencies with teaching residents about

88   societally relevant themes. Value-based healthcare (VBHC) is one of the current relevant themes the

89   CanBetter project focusses on, because health care expenditure is rising and medical professionals

90   need to take their responsibility for keeping costs down (9).

91   VBHC is defined as the health outcome that matters to the patient, relative to the costs of

92   achieving this outcome (9). Health outcomes can be, for example, disease-free survival for patients

93   with cancer, or the time needed to regain functionality after a knee joint replacement (9). As well as

94   achieving the health outcomes, the professionals are also responsible for the stewardship of resources,

95   which requires an entirely new way of managing (10). Therefore, instruction, training and fundamental

96   knowledge of VBHC are required (11-13). As recent research had illustrated, past efforts to teach

97   residents about cost-effective care have unfortunately not always been as effective as intended (13-

98   15), and that key elements of learning to deliver VBHC are knowledge transmission, appropriate role

99   modelling, reflection, and the presence of a supportive environment (13). Medical students and

100   residents must be educated and trained in settings where they have opportunities to develop and use

101   VBHC, preferably a clinical setting (16-18). Amongst others, a specific training programme,

102   incorporating formal and informal learning, is necessary to learn how to deliver VBHC (19). The

103   residency training programmes are believed to be one of the best places to initiate VBHC education

104   because residents are adaptable, highly educated and motivated. In addition, it has been shown that

105   what residents learn during their residency has a significant impact on how they treat their patients

106   when they become medical specialists (20).

4

107   In our regional organisation of teaching hospitals, a strategy was set up that combined formal

108   and informal training within the residency training programme, getting residents involved with VBHC.

109   Residents were stimulated to critically assess daily healthcare and recognise potential VBHC dilemmas

110   and transform all this into a VBHC project. Such VBHC projects are resident-led and practice-based.

111   This study evaluates the impact of incorporating VBHC projects within the residency training

112   programme. The following research questions were formulated: (I) Which CanMEDS competencies do

113   residents develop when conducting VBHC projects in residency training? (II) Is recognition of VBHC

114   dilemmas in medical practice facilitated when residents conduct VBHC projects during their residency

115   training programme? (III) Which facilitators for and barriers to VBHC project implementation can we

116   detect when conducting a VBHC project during residency training?

117

118   **Methods**

119   *Study design*

120   An explorative mixed-methods design was used. The study entailed an analysis of retrospective

121   information from text-based summaries of VBHC projects conducted by residents between 2014 and

122   2018, an analysis of semi-structured interviews with residents and a comparison of data of both

123   analyses. The text-based summaries were retrieved via the "standard format for VBHC projects" (see

124   appendix 1 for the format), which are publicly available in Dutch via a webpage (21).

125

126   *Ethical approval*

127   Ethical approval was provided by the Dutch Association for Medical Education (NVMO) on June 19,

128   2017 (ID number 915).

129

130   *Setting*

131   This study focused on the postgraduate training setting (residency training) in the southeast region of

132   the Netherlands. Table 1 presents a general overview of the Dutch medical undergraduate and

133 postgraduate training programmes. The region of study has chosen to apply a multifaceted approach

134 of incorporating VBHC in residency training by having residents conduct small, pragmatic initiatives

135 called "VBHC projects". At the time of the study, VBHC training and projects were not mandatory,

136 though greatly encouraged as a method for residents to learn about VBHC in different ways.

137

138 **Table 1. Overview of general characteristics of the Dutch undergraduate and postgraduate training**

139 **programmes**

Name and structure	Duration	Qualification after graduation
Preclinical training (bachelor)	3 years	Bachelor of medicine
Clinical training (master)	3 years	Physician, M.D.
Resident not in training	Optional	-
Residency training or training for general practitioner	3 to 6 years	Medical specialist, general practitioner

140

141 ***The VBHC projects***

142 Residents were stimulated to critically assess daily healthcare and recognise potential VBHC dilemmas

143 in practice. These dilemmas entail a wide range of problems or possibilities for improvement that

144 residents would come across; for example, inefficiency in logistics, unnecessary costs spent on

145 diagnostics, or a new treatment with fewer complications. Residents were then guided step-by-step.

146 Firstly, they were offered the knowledge and skills to identify, measure and evaluate both costs and

147 outcome. Secondly, they were encouraged to discuss VBHC dilemmas with the relevant stakeholders,

148 consequently assessing the dilemma from multiple perspectives. These perspectives could be the

149 patient's, the doctor's, other health care professionals' and/or that from the health care organisation

150 as a whole. Thirdly, residents had to determine goals for improvement or search for an effective

151 alternative for current clinical practice. Finally, they reported to each other how they implemented

152 their change or planned to implement their change, what facilitators and barriers they foresaw or

153 encountered (potential or actual), and what they learned during the process. Altogether, this resulted

154 in a VBHC project. In order to enhance the chance of successfully conducting such a project, the

155 residents were encouraged to keep the projects relatively small-scale, i.e. with the goal to finish it

156 within 3 to 6 months.

157

158 ***Data collection and analyses***

159 *Data collection and analyses of text-based summaries*

160 VBHC projects were included in this study when a standard format was completed and published online

161 on the publicly available webpage (21), with a clear problem statement and potential costs and effects

162 identified as measured and valued from multiple perspectives (at least 2). If the data were incomplete,

163 an email and one reminder email were sent to request the missing information. If the data remained

164 incomplete, the VBHC project was excluded.

165 The final set of included VBHC projects was assessed by two independent researchers (CN, SV).

166 Data extraction of these projects involved a summary of the setting, medical specialty, focus of the

167 project, anticipated and achieved results, and learning effects in terms of the residents' self-perceived

168 CanMEDS competency development. Data extraction yielded a score for the learning effects and were

169 compared with data from the semi-structured interviews. Any disagreements were resolved through

170 discussion. The focus of the projects was categorised after an inductive process as medical education,

171 medical care and/or organisational efficiency. The medical education category included projects that

172 aimed to improve education for residents, either in terms of practical skills or theoretical knowledge.

173 The medical care category included projects that focused on improvement in the current quality of

174 care and/or direct reduction of healthcare costs. The organisational efficiency category included

175 projects that aimed to optimise processes in healthcare.

176 *Data collection and analyses of semi-structured interviews*

177 Semi-structured interviews were held with residents who conducted a VBHC project and published it

178 in the publicly available online database (21). After the initial contact with a resident, a reminder

179 request was sent if there was no response. All interviews were performed by telephone or face-to-face

180 by one investigator (MK) under the supervision of a trained interviewer (CN). There was no prior

181 relationship between the interviewer and the interviewees before the start of the study. Prior to

182 performing the interviews, a series of pilot interviews was held to train the interviewer and assess the

183 quality and feasibility of the topic list. The final topic list for the semi-structured interviews can be

184 found in appendix 2. The residents were asked to provide a general reflection of the process, and to

185 reflect on both successful and unsuccessful processes of implementation. If it appeared that no

186 implementation attempt was made, based on the interview data, the interview data was not included

187 in the analyses. Individual interview data were recorded and transcribed verbatim (MK).

188 The data were analysed by summarising information on the residents' self-perceived learning

189 of CanMEDS competencies and compared with data form the text-based summaries. Furthermore data

190 were analysed assessing the learning effects of VBHC, and gathering detailed information on

191 implementation facilitators and barriers. Data was clustered by two independent researchers (CN, SV)

192 applying the generally accepted principles of primary, secondary, and tertiary coding, in a constant

193 comparison ([22]), iterative approach. Regarding potential facilitators for and barriers to

194 implementation, this means reading through the transcripts inductively to find patterns ([23], [24]).

195 Finally, all interview data were searched for these patterns. These steps were executed by two

196 researchers (SV, CN), and in case of disagreement, dialogue followed until consensus was reached.

197

198 ***Patient and public involvement***

199 None.

200

Results

202 ***Text-based summaries***

203 From the 63 VBHC projects identified in the publicly available online database ([21]), 56 VBHC projects

204 were included and analysed (see figure 1). Fifty VBHC projects (89%) included in this study were

205 implemented in practice.

9

206   In Table 2, a general description of the 56 included VBHC projects is presented. For 14

207   residents, the focus of their VBHC project was on more than one goal (e.g. medical education and

208   medical care, or organisational efficiency and medical care).

209

210   *Individual semi-structured interviews*

211   Out of the 19 residents approached for the interview, 11 were included and analysed in this study (see

212   figure 2). To some extent (n= 5), both the residents and their projects were included in the text-based

213   summaries and the interviews.

214   Descriptive details of the VBHC projects conducted by the 11 residents interviewed are

215   summarised in Table 2. More detailed information can be found in Appendix 3.

216

217   **Table 2. Specifics of the VBHC projects included**

Method		Text-based summaries	Interviews
Setting	University medical centre	38 (68%)	6 (55%)
	Non-academic	18 (32%)	5 (45%)
Medical specialty	Anaesthesiology	4 (7%)	2 (18%)
	Cardiology	1 (2%)	-
	Cardiothoracic surgery	2 (4%)	-
	Clinical pharmacology	3 (5%)	-
	Clinical genetics	3 (5%)	-
	Internal medicine	1 (2%)	-
	Neurology	1 (2%)	2 (18%)
	Neurosurgery	4 (7%)	1 (9%)
	Obstetrics and gynaecology	7 (13%)	1 (9%)
	Orthopaedics	6 (11%)	-
	Ophthalmology	2 (4%)	-
	Paediatrics	1 (2%)	2 (18%)
	Plastic surgery	1 (2%)	-
	Psychiatry	3 (5%)	1 (9%)
	Pulmonary medicine	3 (5%)	-
	Radiology	4 (7%)	-
	Rehabilitation medicine	1 (2%)	2 (18%)
	Surgery	7 (13%)	-
	Urology	1 (2%)	-
	Vascular medicine	1 (2%)	-
Focus of the projects	Organisational efficiency	14 (25%)	-
	Medical education	2 (4%)	1 (9%)
	Medical care	25 (45%)	1 (9%)

9

10

		More than one goal	14 (25%)	9 (82%)

CanMEDS competency development

Data analysis of the text-based summaries and interviews revealed that self-perceived learning effects regarding CanMEDS roles were present for at least two competencies. See Table 3 and figure 3 for details, distribution and comparison.

Data from the text-based summaries showed that self-perceived learning effects regarding CanMEDS roles were evident in all respondents for at least two competencies. In addition, 93% of the residents trained three or more CanMEDS competencies when conducting a VBHC project. In order of frequency, the best trained competencies were 'leader' (n=50), 'communicator' (n=48) and 'collaborator' (n=48).

The interview data showed a somewhat similar distribution of self-perceived learning regarding CanMEDS roles as the data from the text-based summaries (see table 3 and figure 3). In order of frequency, the best trained competencies found in the data from the interviews were 'collaborator' (n=11), 'leader' (n=10) and 'communicator' (n=9). A difference in the distribution of self-perceived learning was noted when comparing the data from the text-based summaries to the data from the interviews for the health advocate competency (n=11) and, to some extent, scholar (n=5), which were more often developed according to the interviewed residents. See text below for illustrative quotes on self-perceived learning regarding CanMEDS roles.

Table 3. Self-perceived learning regarding the different CanMEDS competencies

	Medical expert	Scholar	Leader	Collaborator	Communicator	Professional	Health advocate
Text-based summaries	18%	23%	89%	86%	86%	34%	43%
Interviews	9%	45%	91%	100%	82%	36%	100%

10

11

240   Supporting quotes were found for the most frequently trained competencies. R10 comment

241   on scholar: *"because I did a complete literature investigation to support the new protocol I*

242   *implemented."* R3 comment on leader: *"I learned a lot about the organisation of healthcare and how*

243   *many possibilities there still are for improvement."* R7 comment on collaborator: *"I learned that*

244   *supportive departments, for example the financial administration, are easily accessed, which gave me*

245   *great insight into the organisational structure, but also showed me that communication is sometimes*

246   *lacking."* R1 comment on communicator: *"[…] communication as well, by the high frequency of*

247   *presentations I had to do."* R1 comment on organisation: *"[…] because I gained great insight into the*

248   *structure of our organisation, financial background, who different stakeholders are, and how choices*

249   *are made."* R4 comment on health advocate*: "I learned about health advocacy because I tried to reduce*

250   *health care costs for the community without loss of quality of care."*

251

252   ***Learning concepts of VBHC***

253   Concerning the concepts of VBHC, our data revealed a few important aspects of the residents' learning

254   process. Firstly, the resident needs to recognise the VBHC dilemma in clinical practice. Next, they need

255   to examine this dilemma from multiple perspectives. Finally, they need to balance costs versus

256   outcome regarding this dilemma from these multiple perspectives.

257

258   *Recognition of VBHC dilemmas in clinical practice*

259   Conducting VBHC projects included a step-by-step guidance and completion of the format. This

260   allowed the VBHC dilemma to be linked to clinical practice, facilitating the recognition of VBHC - or its

261   lack - in practice. All text-based summaries of VBHC projects included in this study (N=56) described

262   the VBHC dilemma by defining the costs and outcomes from multiple perspectives and the goal for

263   improvement or alternatives for practice (see appendix 1, items 2 and 3). The interviewed residents

264   (N=11) helped us to gain insight since they could explain how this format helped them to recognise the

11

265 VBHC dilemma. R12: *"the format obliges you to walk through the process step by step. We often say*

266 *we do, but this helps us actually to do so, because you have an anchor."*

267

268 *Learning multiple perspectives concerning VBHC*

269 All interviewed residents (n=11) could explain the multiple perspectives they took into account when

270 analysing their VBHC problem. R5: "*I learned to reduce waste and made the process of patient letters*

271 *more efficient and improved the quality of care in the same process. So, patient, doctor and*

272 *organisation benefit.*"

273

274 *Learning process of costs versus effects*

275 All interviewed residents (n=11) explained how they became more aware of the relationship between

276 both costs and effects (value) when conducting their VBHC project. For example, R8: "*we measured*

277 *the number of no-shows in the intervention group versus the group that received standard care, and*

278 *measured the revenues we missed out on because of the no-shows."* R7: *"I reduced costs without loss*

279 *of quality of care for the patient by reducing standardised laboratory tests upon admission."* A self-

280 perceived learning effect could also be described as an improvement in awareness and identification

281 of costs in a broader perspective. R4: *"We had a reduction in leading time for patient letters to the*

282 *general practitioner, from an average of a few weeks to at least 80% finished and sent within 5 days*

283 *after discharge. But the cost reduction and quality improvement I envisioned were not just the*

284 *reduction in leading time of the patient letter, but also in better care when the GP has adequate*

285 *information as soon as possible."* The interview data also revealed that the residents were able to

286 explain their learning regarding VBHC in clinical practice as well. R10: *"[...] every randomised controlled*

287 *trial we use or refer to in clinical practice that refers to cost in relation to quality reflects a moment*

288 *where we reflect on VBHC [...] we don't always recognise it, but it is the basis of VBHC."*

289

290 **Facilitators for implementation**

291 Residents mentioned a number of facilitators for implementation, in part related to the step-by-step

292 process we use (see methods section for details). Firstly, a thorough problem analysis from multiple

293 perspectives is important. Secondly, the involvement of all important stakeholders seems essential.

294 Thirdly, an intrinsic motivation to resolve the problem at hand is a strong facilitator. Finally, support

295 from a supervisor or mentor seems important.

296

297 *Problem analysis*

298 Residents (n=6) stated that detecting and defining the problem is a very important facilitator and

299 relates to the first step in the process of conducting a VBHC project (see appendix 1, points 2, 3), in

300 which residents are stimulated to critically assess daily healthcare and recognise potential VBHC

301 dilemmas and assess all this from multiple perspectives. R4: "*A thorough investigation of the problem*

302 *and making sure we knew why and for whom the problem was relevant made implementation a lot*

303 *easier.*"

304

305 *Stakeholder involvement*

306 An important item to facilitate implementation (n=11) turned out to be the involvement and support

307 of all stakeholders as defined during the second step in the guidance by experts: stakeholder analyses.

308 R4: "*Involve all relevant stakeholders and create a sense of urgency and relevance*". R2: "*Everybody*

309 *(doctors, nurses, secretarial staff) recognised the problem of a language barrier and wanted a change*

310 *to be able to take better care of patients who speak a different language […].*"

311

312 *Intrinsic motivation*

313 Intrinsic motivation to solve the problem was a huge facilitator as well for many residents (n=5). R8:

314 "*[…] my interest and motivation turned a small project into a hospital-wide project.*"

315

316 *Support*

317 A final facilitator many residents (n=7) mentioned was a mentor or supervisor who helped them with

318 potential barriers, and that they probably would not have been able to change anything without their

319 support. R6: "*The educational committee supported my project and supported the different residents*

320 *to investigate and implement possibilities. That was really helpful.*"

321

322 ***Barriers to implementation***

323 Self-perceived barriers were often the opposite of the facilitators related to the VBHC dilemma. For

324 example, there was no clear VBHC dilemma or no clear problem definition. A few distinct barriers were

325 mentioned, namely a lack of support, involvement of too many stakeholders, and problems with the

326 magnitude of the project.

327

328 *Support*

329 A major barrier for implementation was felt to involve the preconditions and technical aspects, for

330 instance, ICT or secretarial support to implement the VBHC project. R11: "*In the end, the ICT application*

331 *was not realised and therefore I could not implement my project.*" Another barrier mentioned was the

332 lack of a supportive environment by a sufficient number of the stakeholders involved (n=6). Too few

333 could also be experienced as a barrier. R10: "*in the end I did not have enough support from the other*

334 *residents to implement my change although the educational committee was on board.*"

335

336 *Stakeholders*

337 Involvement of too many stakeholders was described as a barrier. R11: "*I needed not only other*

338 *residents, but also different supervisors to be on-board with the plan, which I understood along the*

339 *way.*"

340

341 *Magnitude*

342 Finally, the extent of the project made it more difficult to implement, for instance when the whole

343 organisation was involved instead of just their own department (n=3). R11: *"because it became a*

344 *hospital-wide project, it is currently still not implemented."*

345

346 **Discussion**

347 In this explorative mixed-methods study, different aspects of learning were identified from the

348 residents' perspective when conducting small, pragmatic VBHC projects. Firstly, conducting VBHC

349 projects was shown to contribute to developing different CanMEDS competencies, especially

350 communicator, collaborator, leader and health advocate. Secondly, residents learned to recognise

351 VBHC dilemmas in clinical practice. Finally, facilitators for and barriers to implementing VBHC

352 projects were explored. In the subsequent sections, these findings will be discussed more

353 extensively.

354 Our study has shown that by conducting VBHC projects, residents were provided with

355 opportunities to further develop at least two different CanMEDS competencies. Our data showed that

356 the 'leader', 'collaborator' and 'communicator' competencies were most often developed. These are

357 examples of the `soft` competencies (25). Mastering these competencies is helpful when implementing

358 any change project, and this motivates residents to acquire them (26). In this study, the 'scholar' and

359 'health advocate' competencies were often mentioned, especially by the participants of the

360 interviews, more than in the text-based summaries. This was an unexpected and remarkable finding:

361 young medical specialists feel inadequately prepared for these specific competencies (4).

362 We showed that residents are facilitated to learn to recognise a VBHC dilemma in clinical

363 practice when conducting a VBHC project. Additionally, they perceived an improvement in awareness

364 regarding VBHC, which is an important step in teaching residents to deliver VBHC (27). Our data

365 supports that when residents conduct VBHC projects, recognition of VBHC dilemmas in medical

366 practice is facilitated if they: (i) perform a thorough investigation of the problem, (ii) explore potential

367 barriers and (iii) set up a viable project for implementation. The data might overestimate the learning

368 effects because we only included those residents who believed their projects were viable for

369 implementation and those with the intrinsic motivation to make a change since participation in the

370 VBHC projects was voluntary. Intrinsic motivation has a known positive effect on change projects in

371 health care (28). For future research, it could be interesting to investigate if VBHC projects are fruitful

372 learning opportunities when mandatory in any postgraduate curriculum.

373   Finally, the self-perceived facilitators for and barriers to implementing a VBHC project during

374 residency training were extracted from the interviews. We believe them to be crucial for the successful

375 implementation of a VBHC project. The information revealed many similarities to the contemporary

376 literature on facilitators and barriers in change management (29-31). First, a thorough investigation of

377 the problem is crucial (31), specifically concerning the VBHC dilemma. This means investigating the

378 costs and outcomes from multiple perspectives (such as patient, organisation, doctor, nurses, and

379 supportive staff) and balancing these costs versus outcomes (32). This is crucial in our opinion to

380 establish a sense of urgency and/or relevance, which in turn is essential for a successful

381 implementation (33, 34). Next, it is important to identify stakeholders and get them involved (35, 36).

382 This is only possible via 'a clear VBHC dilemma', of relevance for those who are affected by it (34).

383 Subsequently, find a supervisor or mentor with enough influence to make the change happen and

384 someone who has control of resources; in a hospital, this could be several different people (29). Then

385 establish a plan of action, keep it small and simple, within your own scope of influence (37). Finally,

386 describe how the effects are going to be measured (i.e. in terms of costs and effects) and demonstrate

387 intermediate results (36). Ultimately, you need to consolidate and secure your new way of working

388 (29). Inspired by the work of other researchers in the field of change management (29-31), we

389 summarised the tips from this study in an overview checklist (see appendix 4). We hope to inspire and

390 guide residents who want to implement a VBHC project. We would advise any educator who is about

391 to support residents when implementing VBHC projects to use a similar format and combine structured

392 teaching with support by an expert in the field (19). This strategy adheres to the necessary

17

393 requirements of knowledge, support, role models and reflection when it comes to teaching the

394 concepts of VBHC (19).

395

Conclusion

397 This study revealed the positive impact of incorporating VBHC projects within the residency training

398 programme. VBHC projects are resident-led and practice-based and proved to be an effective

399 educational method to learn and develop CanMEDS competencies and practise the concepts of VBHC

400 via learning-by-doing. Residents learn to recognise VBHC dilemmas, how to implement an effective

401 change and that they have the potential to influence medical care, medical education or efficiency in

402 health care. According to the residents, important facilitators for successfully implementing a change

403 are a thorough investigation of the VBHC dilemma combined with a thorough stakeholder analysis.

404 Practice points are presented in box 1.

405

Box 1: Practice points

- Introducing a societally relevant theme such as VBHC in residency training

  programmes is a promising strategy to enhance competency-based education.

- Residents develop different CanMEDS competencies when conducting a VBHC project,

  especially those of 'leader', 'communicator' and 'collaborator'.

- Residents learn to recognise VBHC dilemmas in practice when combining formal

  teaching with conducting VBHC projects.

- A thorough investigation of a VBHC dilemma combined with an in-depth stakeholder

  analysis are key to successfully implementing a VBHC project.

406

List of abbreviations

408 CanMEDS   Canadian Medical Education Directives for Specialists

17

409   VBHC   Value-Based Healthcare

410

Contributors

412   SV analysed and interpreted all data and was a major contributor in writing the manuscript. CN

413   analysed and interpreted data and was a major contributor in writing the manuscript. BE and SE were

414   involved in the design of the project. MK performed the interviews and analysed data. LS contributed

415   in the analysis and interpretation of data. IH, LPS, KW and WM contributed to writing the manuscript

416   and the revisions. All authors read and approved the design of the study and final manuscript.

Competing interests

418   The authors declare no competing interests.

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Data availability statement

422   Project information is available via https://www.oorzon.nl/doelmatigheidsinitiatieven-oor-zon.

423   Interview data are available upon reasonable request.

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427

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513

514   ***Figure titles***

515   ***Figure 1. Flowchart on selection and exclusion of text-based summaries***

516   ***Figure 2. Flowchart on selection and exclusion of individual semi-structured interviews***

517   ***Figure 3. Self-perceived learning regarding the different CanMEDS competencies***

Figure 1: *Flowchart on selection and exclusion of text-based summaries*

```
┌─────────────────────┐
│  63 VBHC projects    │
│  identified          │
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           │              ┌──────────────────────────────┐
           │──────────────▶│  4 VBHC projects excluded:   │
           │              │  - incomplete data           │
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           │──────────────▶│  3 VBHC projects excluded:   │
           │              │  - no self-perceived learning │
           │              │  effects described           │
           ▼              └──────────────────────────────┘
┌─────────────────────┐
│  56 VBHC projects    │
│  analysed            │
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Figure 2. Flowchart on selection and exclusion of individual semi-structured interviews

19 residents approached

6 residents did not respond

2 interviews excluded
- incomplete data due to no attempt of implementation

11 interviews analysed

Figure 3: *Self-perceived learning regarding the different CanMEDS competencies*

Appendix 1: Format VBHC projects (multiple 2019)

Format VBHC project *[title of project]*	
ABSTRACT (*Max. 150 words)*	
A) What does this project contribute to the improvement of the quality of care at your department or organisation*?*	
B) How are the general competencies (for example communicator, collaborator, leader, health advocate and professional) trained and evaluated by conducting and implementing this VBHC project?	
C) How will you secure this VBHC project within your organisation or at your department?	
1) Medical specialty:	
2) Issue:	*[describe with a max. of 150 words what the problem or issue is you would like to change with this project]*
3) Goal of the project:	*[describe what your main goal is]*
4) Plan of action:	*[describe your plan of action stepwise, max. 200 words. Describe the procedure and your plan of implementation. Explain both analysis and plan of action]*
5) Aimed results:	*[describe, max. 150 words, your aimed results of this VBHC project, in terms of costs and effects]*
6) Achieved results:	*[describe, max. 150 words, your results so far, in terms of costs and effects]*
7) Evaluation:	*[describe, max. 150 words, how you will evaluate the costs and effects of your VBHC project, in the long-term]*
8) Consolidate:	*[describe, max. 150 words, how you will institutionalize this project within the current structure of the organisation or department]*
9) Generalizability:	*[describe if your results might be applicable at other departments, organisations or regions]*
10) Role resident:	*[describe your role in this VBHC project]*
11) Learning effects:	*[describe what you learned by executing this project, how you learned this and how evaluated what you have learned]*
12) Mentor:	*[describe the role of the mentor / supervisor regarding the execution of the VBHC project]*

☐   I agree this information will be published at the OORZON (Southeast region of Netherlands) website.

Appendix 2: Topic list for semi-structured interview

The topic list was constructed by two experienced researchers in this field, minor changes were made after a pilot interview.

VBHC-Projects	**1) General information** - Definition of VBHC & position in PGME - Goal of own VBHC project - Orientation (education, process, care delivery, …)
	2) Implementation - Enhancing factors - Hindering factors
	3) Learning goals and learning curves - initial goal - achieved goal
	4) Self-perceived competency training - components trained & developed
	5) Self-perceived effect on influencing medical care - patient outcomes and experiences - costs (for example in monetary terms, efficiency, others)
	6) Embedding within organisation - reasons - enhancing or hindering factors

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Appendix 3: Basic characteristics and focus of projects of the residents interviewed

	Specialty	Impl.*	Primary focus	Res.**	Explanation of exact focus
R1	Neurosurgery	Yes	Education	No	Development of a training session for other residents on registration and finances in their department
R2	Anesthesiology	Partly	Care and efficiency	No	ICT application to register any language barriers and provide helpful tools to overcome this language barrier
R3	Anesthesiology	Partly	Care and efficiency	No	ICT application to register any language barriers and provide helpful tools to overcome this language barrier
R4	Rehabilitation	Yes	Care and efficiency	No	Improving the leading time of patient letters
R5	Neurology	Yes	Care and efficiency	No	Implementation of digital patient letters to improve lead time
R6	Pediatrics	Yes	Care and efficiency	No	Give residents a day at another speciality to learn from each other and see possibilities to make work more efficient
R7	Rehabilitation	Yes	Care	Yes	Stop standard laboratory testing on admittance, only perform test when necessary
R8	Psychiatry	Yes	Care and efficiency	Yes	Send a standard SMS reminder before outpatient consults to reduce the number of no-shows
R9	Gynaecology	Yes	Care and efficiency	Yes	Direct removal of a catheter after a laparoscopic hysterectomy
R10	Pediatrics	No	Care and efficiency	No	Implementing a new structure for duty schedules to bring more continuity on the ward
R11	Neurology	No	Care and efficiency	No	ICT application to show when a patient had completed in hospital treatment and is waiting for a bed elsewhere

* Implemented at time of the interview.
** VBHC project was part of a research project or PhD trajectory

Appendix 4: Tips for residents' performing a VBHC project within a modified model of change

Examine the VBHC problem thoroughly - *Complete assessment of the current situation from multiple perspectives (patient, doctor, organisation, etc)* - *Take the culture of the organisation into account*
Establish a sense of urgency and/or relevance
Identify potential problems that could stand in the way of your change - *Identify and involve all stakeholders*
Form a powerful coalition with enough power to lead the change Different key roles: - *Sponsor and/or advocate (can be a supervisor or mentor for instance)* - *Implementer (often resident)* - *Change agent (often resident)*
Create a vision and develop strategies for achieving that vision - *keep it small and keep it simple, within your scope of power*
Communicate your vision
Plan for short-term wins - *make sure you can show what is improved*
Consolidating improvement and still produces more change - *implementation is more than changing a protocol. All employees involved need to work in the new way.*
Institutionalizing your change so it is incorporated in the new culture - *make sure you can show what is improved to support the sense of urgency to stick to the new way of working* - *secure the new way of working in ways that are not solely depending on your presence*

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	6-8
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6-8*
Bias	9	Describe any efforts to address potential sources of bias	n.a.
Study size	10	Explain how the study size was arrived at	8,9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	n.a.
		(*b*) Describe any methods used to examine subgroups and interactions	n.a.
		(*c*) Explain how missing data were addressed	n.a.
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	-
		(*e*) Describe any sensitivity analyses	

Results

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8,9
		(b) Give reasons for non-participation at each stage	8,9
		(c) Consider use of a flow diagram	8,9
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	n.a.
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	n.a.
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	*n.a.*
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	-
		Cross-sectional study—Report numbers of outcome events or summary measures	-
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	-
		(*b*) Report category boundaries when continuous variables were categorized	-
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-

Discussion

Key results	18	Summarise key results with reference to study objectives	15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15, 16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15, 16
Generalisability	21	Discuss the generalisability (external validity) of the study results	15-17

Other information

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	n.a.

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.