

1 **Barriers and Enablers in the Implementation of a Standardized Process for Nutrition Care:**
2 **Findings from a Multi-National Survey of Dietetic Professionals in 10 Countries**

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7

8 **Abstract**

9 Objective: To explore the barriers and enablers experienced by nutrition and dietetic
10 professionals in implementation of the standardized Nutrition Care Process (NCP) across 10
11 different countries. NCP related beliefs, motivations and values were also investigated and
12 compared.

13 Study setting: A validated online survey was disseminated to nutrition and dietetics professionals
14 in 10 countries in the local language during 2017.

15 Study design: Cross-sectional associations and differences between countries were explored for
16 level of implementation, barriers/enablers and attitudes/motivation among the respondents.

17 Principal findings: Higher NCP implementation was associated with greater occurrence of
18 enabling aspects, as well as fewer occurrences of barriers. The most common enabler was
19 “*recommendation by the national dietetic association*” (69%), and the most common barrier was
20 “*lack of time*” (39%). A longer experience of NCP use was associated with a more positive
21 attitude towards all NCP aspects. Differences between countries were identified, regarding both
22 occurrence of barriers/enablers and attitudes/motivations.

23 Conclusions: Implementation efforts need to be tailored to country specific contexts when
24 implementing a new standard of care framework among nutrition and dietetic professionals.
25 Future research is needed to further assess the management and workplace strategies to support
26 the development of nutrition and dietetics professionals in multi-disciplinary health care
27 organizations.

28

29 ***Introduction and background***

30 Among health care organizations and authorities, standardized care processes and terminologies,
31 evidence-based guidelines and person-centered approaches are increasingly seen as essential
32 parts of a modern and effective health care system ⁽¹⁻³⁾. However, new approaches and
33 innovations often fail when it comes to implementation into practice ⁽⁴⁻⁸⁾.

34

35 During the last decade, the structured framework Nutrition Care Process (NCP) has been
36 implemented among nutrition and dietetics professionals (referred to as ‘professionals’ thereafter)
37 internationally. The NCP was developed by the Academy of Nutrition and Dietetics to provide
38 professionals with a structured framework for critical thinking and decision-making, aiming to
39 improve the quality and safety of nutrition care. The four steps of the NCP include Nutrition
40 Assessment, Nutrition Diagnosis, Nutrition Intervention and Nutrition Monitoring and Evaluation
41 ^(9,10). This framework is supported by the Nutrition Care Process Terminology (NCPT), with
42 terms for each of the four NCP steps, to facilitate communication among health care practitioners
43 in nutrition related issues ^(11,12). Several studies from hospitals and other settings have
44 demonstrated the positive impact of NCP on nutrition care ^(10,13).

45

46 The implementation of NCP has been encouraged and supported by several national and
47 international dietetic associations. However, a recent international survey showed that
48 implementation varies substantially between countries ⁽¹⁴⁾. Reasons for differences in NCP
49 implementation remain to be explained. A lack of knowledge, support, training and resources
50 have been previously noted as important barriers to uptake in Australia, as well as busy work
51 loads. Identified enablers included protected time to learn and apply the NCP, as well as support
52 from leadership and management ⁽¹⁵⁾. However, it is not known if the same factors would also be
53 associated with NCP use on an international level.

54
55 Management, workplace culture, past experiences among employees, and feasibility of structured
56 feedback mechanisms on the implementation process, are all contextual components that may
57 affect the implementation of a new workflow ^(16,17). Support from management and peers has
58 been identified as an important NCP implementation enabler in Australia and Sweden ^(15,18).
59 Clinical nutrition managers in the USA reported confidence as an important aspect connected to
60 use of the NCP. Among motivated individuals, organizational and group dynamics were key
61 elements for NCP implementation ⁽¹⁹⁾.

62
63 Motivation, values and beliefs as well as knowledge and skills among professionals are
64 considered to be essential factors for the success of the implementation of guidelines or
65 innovations ⁽²⁰⁾. Lack of motivation can be connected to several aspects, such as clinical
66 uncertainty, lack of self confidence in skills, or information overload,⁽⁵⁾ along with a lack of
67 awareness or disagreement with the implementation ⁽²¹⁾. Younger and less experienced
68 individuals are more likely to embrace new guidelines compared to older and more experienced
69 professionals ^(22,23).

70 Reported advantages of using the NCP include concise documentation, more efficient patient
71 handover and the ability to aggregate nutrition outcomes data ⁽²⁴⁾. Several concerns related to the
72 implementation of NCP have also been expressed, such as the risk for decreased productivity and
73 possible alienation from other health care professionals ^(15,25,26). Difficulties to combine a
74 standardized process with a flexible and person-centered approach to nutrition care has also been
75 expressed ⁽²⁷⁾. Time may be a factor: an Australian survey conducted in 2011 (n=218 dietitians)
76 and 2014 (n=205 dietitians), showed that professionals gradually acknowledged the value of
77 incorporating the NCP into their practice over a three year period ⁽²⁸⁾.

78

79 To date, there is no international study on the barriers and enablers of NCP implementation.

80 While the international perspective is important, we also should take into account major
81 differences between countries regarding health care systems, use of Electronic Health Records
82 (EHR), and regulation of the nutrition and dietetics profession. Thus, there is a need to increase
83 our understanding of NCP implementation at a global level while at the same time individually
84 assess implementation enablers and barriers for different countries.

85 Therefore, the aim of this international multicenter study was to explore the barriers and enablers
86 experienced by nutrition and dietetic professionals of NCP implementation across 10 different
87 countries. Additionally, professionals' NCP related attitudes, motivations and values were
88 compared.

89

90 ***Methods***

91 A validated online survey, the INIS tool ⁽¹⁴⁾, was disseminated to professionals in Australia,
92 Canada, Denmark, Greece, Ireland, New Zealand, Norway, Sweden, Switzerland and the USA in

93 2017. These countries were included in the study as they had earlier been involved in various
94 NCP-related collaborations. Full details of the methods are described elsewhere ⁽¹⁴⁾.

95

96 *Context*

97 The context of NCP implementation varies between the countries included in this study. For
98 example, the NCP was introduced in the USA in 2003, in Australia 2009, and in Greece it had not
99 been officially introduced (at time of this publication) (Supplement 1). Earlier analyses of the
100 INIS survey results have shown implementation differences between countries, with Australia,
101 New Zealand and USA showing higher and Greece, Ireland and Norway showing lower
102 implementation levels compared to the other countries ⁽²⁹⁾.

103

104 *Survey tool*

105 The INIS tool was developed and carefully tested in seven languages. It consists of four modules
106 that collect information on 1) demographics, 2) NCP implementation levels, 3) NCP attitudes and
107 4) NCP knowledge. A full description of the tool has been published earlier ⁽¹⁴⁾. In this analysis,
108 questions about length and level of NCP implementation, barriers and enablers in
109 implementation, and NCP attitudes were included. In the development of the INIS survey,
110 response options regarding implementation barriers and enablers as well as the measurement of
111 NCP attitudes were informed by previous research ^(25,30).

112

113 *Recruitment*

114 The total number of nutrition and dietetic professionals varied among the included countries.
115 Most had 500-1500 professionals in total, except for Australia (5 500), Canada (12 000) and the
116 USA (almost 100 000). We aimed to survey as many professionals as possible from each

117 participating country. They were invited to take part in the survey through national dietetic
118 association e-newsletters, e-mail lists and local dietetic networks, invitations posted in
119 professional social media groups, and directed e-mails to nutrition and dietetic workplaces.

120
121 Inclusion criteria were registered or accredited dietitians, or equivalent in the countries where
122 registration is not mandated. To ensure that all respondents met the inclusion criteria, control
123 questions were included in the survey. Details regarding national context of the included
124 countries, as well as further details regarding survey development and recruitment of participants
125 have been published elsewhere ⁽¹⁴⁾.

126
127 After closing the survey, a comparison of survey respondent demographics and the characteristics
128 of the professionals in the included countries was performed which confirmed that the responses
129 were likely to be representative for the target populations. This comparison has been described in
130 further detail previously ⁽¹⁴⁾.

131

132 *Variables of interest*

133 1) Barriers and enablers in implementation

134 Respondents were presented with a list of enablers (nine factors) and barriers (nine factors); these
135 lists were partially informed by previous research (Table 1) ^(25,30). In the Greek version, due to a
136 technical failure, only eight enablers and eight barriers, respectively, were presented to
137 respondents (the enabler “*NCP use is recommended by the professional dietetic association*” and
138 the barrier “*Lack of training and education*” were excluded). Respondents were asked to indicate
139 which enablers and barriers to NCP implementation they had experienced in their practice. For
140 each of the chosen factors, respondents were also asked to indicate on a scale from 1 to 4 (1=very

141 little, 2=somewhat, 3=quite a lot, 4=to a great extent) their impact on NCP implementation or the
142 absence of NCP implementation.

143 2) NCP attitudes

144 Respondents were asked to indicate the extent to which they agreed with 15 statements about the
145 NCP, using a scale from 1 to 5 (1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5 =
146 strongly agree). Statements covered aspects such as NCP usability and benefits for practice and
147 patient care.

148 3) Level and length of NCP use

149 Respondents were asked to indicate, on a scale from 1 to 5 (1=never; 2=rarely; 3=occasionally;
150 4=often; 5=always), to what extent they had implemented each of the four steps of the NCP. The
151 responses for all four NCP steps were then summarized, resulting in a total score that ranged
152 from 0 to 20 points, where 20 indicated full implementation of the NCP. The results were split
153 into groups as follows: very low implementation 0-4 points, low implementation 5-8 points,
154 medium implementation 9-12 points, high implementation 13-16 points, very high
155 implementation 17-20 points.

156
157 The respondents were also asked about the length of their experience using the NCP, using a
158 scale between 1 to 5 for each NCP step (1=not using and do not plan to implement; 2=not using
159 but plan to implement; 3=<1 year; 4=1-5 years; 5=>5 years). Also for this question, responses for
160 all NCP steps were summarized to indicate an overall implementation length, with a maximum of
161 20 points. Results were grouped depending on the overall implementation length: not started
162 implementation 0-4 points, planning to implement 5-8 points, short term implementation 9-12
163 points, medium term implementation 13-16 points and long-term implementation 17-20 points.

164

165

166 *Statistical analyses*

167 Descriptive statistics were used to identify the demographic characteristics of respondents.

168

169 Due to a somewhat skewed distribution of residuals, multinomial regression analysis was
170 performed to investigate associations between occurrence of enablers/barriers and country of
171 residence, with the USA set as the reference country. Due to high prevalence of missing data in
172 the Greek data set, Greece was excluded from the multinomial regression analysis. For the other
173 data sets, missing data was managed with pairwise deletion. Multiple imputation was also
174 performed, showing similar results when compared with pairwise deletion. Multinomial
175 regression analysis was also used to explore associations between the occurrence of
176 enablers/barriers and level of implementation. In the analysis, respondents with very low NCP
177 implementation were set as reference point, to be compared to higher levels of NCP
178 implementation (some implementation/medium implementation/high implementation/full
179 implementation). No adjustments for demographic variables or other aspects were performed in
180 the models (Table 1).

181

182 NCP attitudes were grouped according to the respondents' length of NCP use, after which
183 correlation between length of use and NCP attitudes was assessed using Spearman's rho test, due
184 to the ordinal level of data. Cohen's criteria for strength of correlation was applied in
185 interpretation of the results (0.5=large correlation, 0.3=medium correlation, 0.1=small
186 correlation)⁽³¹⁾.

187

188 Statistical significance level was set at 0.05 and statistical analyses were performed using SPSS
189 version 22 (IBM SPSS Statistics Release 22.0, 2013; IBM Corp, Armonk, NY, USA).

190

191 **Results**

192 *Demographics*

193 In total, 5727 nutrition and dietetic professionals completed the survey modules that were
194 included in this part of the study. In Australia, Canada, Denmark and USA, <10% of all eligible
195 professionals responded to the survey, while in Greece, Ireland, New Zealand, Norway and
196 Switzerland, 10-20% responded. Sweden had the greatest response rate with approximately 30%
197 of professionals responding to the survey.

198 Regarding areas of practice, clinical related work was the most common (75%), followed by
199 community work (17%) and consultation and business practice (11%). A Bachelor's (53%) or
200 Master's (42%) level degree were the most common educational levels.

201

202 *Enablers for NCP implementation*

203 There was a large variance regarding occurrence of NCP implementation enablers across
204 countries, such as "*NCP use is required by my workplace*" (e.g. Norway 19%, USA 52% and
205 New Zealand 80%) and "*Electronic Health Records*" (e.g. Ireland 14%, Canada 33% and USA
206 61%) (Table 1; Supplement 2). Compared to the USA, respondents from most countries had
207 higher probability of experiencing the enabler "*peer support*", while Canadian respondents
208 reported a higher probability of experiencing most enablers. Respondents from most countries
209 had lower probability of experiencing the enabler "*Electronic Health Record*" compared to the
210 USA (Table 1).

211
212 For the international sample as a whole, the most commonly experienced enabler was
213 “*recommendation by the national dietetic association*” (69%), followed by “*peer support*” (63%)
214 and “*electronic health records*”, (55%) while the least commonly reported enablers were
215 “*designated leader/facilitator/champion at my workplace*” (39%) and “*allocated time to*
216 *practice*” (44%).

217
218 Respondents were also asked to indicate the importance of all enablers they had experienced,
219 which resulted in differences between countries. For example, “*recommendation by the national*
220 *dietetic association*” was indicated as having high impact among 73% of the USA respondents,
221 but only 44% of the Norwegian respondents. Likewise, “*peer support*” was indicated as having
222 high impact among 92% of the Irish respondents, but only 50% of the Norwegian and 32% of the
223 Greek respondents (Supplement 2).

224
225 Higher level of NCP implementation was associated with higher rates of enabling aspects such as
226 “*NCP use is required at my workplace*”, “*recommendation by the national dietetic association*”
227 and “*electronic health records*” (Supplement 3). Respondents reporting higher level of NCP
228 implementation reported higher occurrence of all enablers compared to those reporting lower
229 levels of NCP implementation (Figure 1). For example, of respondents reporting full NCP
230 implementation, 76% had experienced “*peer support*”, while only 19% of the respondents with
231 very low NCP implementation had experienced this enabler.

232
233 *Barriers for NCP implementation*

234 Implementation barriers also differed by country. For example, “*lack of management support*”
235 was reported by 60% of the Greek and 46% of the Swedish respondents, but only 17% of the
236 Australian. Likewise, “*not having access to online tools or books*” was reported by 38% of the
237 Greek respondents, 28% of the Irish but only 9% of the Swedish respondents (Table 1,
238 Supplement 2). Compared to the USA, respondents from most countries had higher probability of
239 experiencing the barriers “*lack of time*” and “*Electronic health record unavailable*” but lower
240 probability of experiencing “*lack of motivation*” (Table 1).

241
242 The most commonly perceived barrier for the international sample as a whole was “*lack of time*”
243 (39%), followed by “*lack of training and education*” (32%) and “*lack of knowledge*” (28%).

244 Respondents who reported a specific barrier were also asked to indicate how important they
245 perceived the barrier to be/have been for their NCP implementation, which also showed country
246 differences. For example, “*lack of time*” was indicated as having high impact among 85% of the
247 Norwegian, but only 49% of the Australian respondents. “*Lack of training and education*” was a
248 barrier indicated as having high impact among 77% of the Norwegian and 74% of the Swedish,
249 but only 16% of the New Zealand respondents (Supplement 2).

250
251 Respondents who reported full implementation of the NCP had a lower probability of
252 experiencing the barriers “*lack of motivation*” or “*lack of knowledge*” compared to those with
253 very low implementation (Supplement 3). Respondents reporting full NCP implementation also
254 reported lower barriers overall compared to those reporting lower levels of NCP implementation
255 (Figure 1). For example among “very low implementers” and “low implementers”, “*lack of*
256 *motivation*” was the most commonly reported implementation barrier (36% and 42% reported

257 this, respectively), while only 14% of those with full NCP implementation use reported “*lack of*
258 *motivation*”.

259

260 *Attitudes*

261 Overall, respondents agreed largely with the statements regarding the value of the NCP,
262 indicating a positive attitude towards the framework (Supplement 4). There was a statistically
263 significant difference in attitudes across the 10 included countries. Respondents from Sweden and
264 Greece were found to have the most positive overall attitude towards the NCP, with Swedish
265 respondents ranking highest on eight statements and Greek respondents on seven statements out
266 of 15. Respondents from Canada were found to have the least positive attitude to the NCP,
267 ranking lowest on 11 statements (Supplement 5).

268

269 There was also a medium to strong significant correlation between length of NCP use and NCP
270 attitudes, whereby those using NCP for longer reported a more positive attitude to all aspects of
271 NCP (Supplement 4). Of those who were not NCP users (not started implementation or planning
272 to implement), 51% agreed that “*there are benefits with NCP*”. Among long-term implementers
273 (>5 years) 87% agreed on this.

274

275 Furthermore, there were differences in agreement among the respondents that “*NCPT provides*
276 *nutrition and dietetic professionals with a common vocabulary*” (58% of non-users and 90% of
277 long-term implementers agreed) and that “*the NCP provides nutrition and dietetic professionals*
278 *with a consistent structure and framework for nutrition care*” (52% of non-users and 85% of
279 long-term implementers agreed). Fewer respondents agreed that “*the NCP improves*
280 *communication with other health care professionals*” (30% of non-users and 60% of long-term

281 implementers agreed). Among non-user respondents, 19% agreed that “*the NCP facilitates more*
282 *patient involvement in health care*” and 21% agreed that “*the NCP allows for a holistic*
283 *perspective of the patients’ situation*”. For long-term implementers, 36% and 39% agreed on this,
284 respectively. For all respondents, these two statements had the lowest median response
285 (Supplement 4).

286

287

288 ***Discussion***

289 To our knowledge, this is the first international study that incorporates languages other than
290 English, to explore factors affecting implementation of a standardized professional process in
291 nutrition care. Consistent with earlier implementation research, successful implementation was
292 associated with both a high prevalence of enabling factors and highly motivated nutrition and
293 dietetic professionals. However, we also found some differences between countries that does not
294 seem to be directly associated with the national implementation level.

295

296 Limited access to technical solutions seems to be a common implementation barrier for several of
297 the nutrition and dietetics professionals in this study, with about half of the Greek and Irish, and
298 about a third of the Australian, Canadian and New Zealand respondents reporting electronic
299 health records were unavailable in their workplace. Also, between 9-38% of the respondents
300 across the different countries reported lack of access to online tools. In his theory of the diffusion
301 of innovations, Rogers ⁽³²⁾ recognizes the importance of communication channels and access to
302 the innovation to be implemented. Respondents from the Nordic countries seem to experience
303 fewer barriers related to online access and support such as electronic health records or online
304 tools, compared to other countries. This is not surprising, as the Nordic countries are often

305 highlighted as early adopters of health information technology ⁽³³⁾. EHR has earlier been
306 suggested to be an important enabler in NCP implementation, but as the Nordic countries still all
307 have a rather low implementation level, other aspects might be more important ⁽³⁴⁾.

308
309 *Lack of management support* was indicated among respondents in Greece and Sweden as a
310 common and rather important barrier towards NCP implementation. At the same time, this barrier
311 was reported to have a much lower occurrence in Canada, Denmark, Ireland, New Zealand and
312 Switzerland. A reason for the higher occurrence in Greece might be that the NCP implementation
313 process has not yet officially commenced, and managers therefore might not be aware or
314 prioritize the NCP. In Sweden, however, the implementation process started quite early, and
315 knowledge about the NCP is widespread, thus this result remains to be explained ⁽²⁹⁾. Earlier
316 research regarding NCP as well as other innovations, has identified support from workplace and
317 management as being important requirements for successful implementation ^{(17,22,35-37)(18,26,34,38)}.
318 Swedish and US studies have described professional isolation, with lack of support and
319 understanding from management and workplace, especially in those who worked as the only
320 dietitian in a multi-professional environment and in rural areas ⁽¹⁸⁾⁽³⁹⁾.

321
322 Besides external enablers or barriers, internal aspects such as attitudes and motivation have been
323 highlighted as important factors for the implementation of new guidelines or working methods
324 ^(5,22,40). The relation between an innovation to be implemented and its intended recipients is an
325 interdependent relationship where the recipients' values, goals, knowledge and skills are essential
326 ⁽⁴¹⁾. Among non-users, lack of motivation was the most commonly reported barrier for NCP
327 implementation. The difference in motivation between users and non-users was clearly visible in

328 the attitudes questions, where users tended to be more positive towards the NCP, especially with
329 increased exposure. Professionals with a more positive attitude towards the NCP may have been
330 more active in implementation. Alternatively, non-users who have been exposed to NCP to a
331 lesser extent, might have a more negative attitude because of unfamiliarity. Exposure to a
332 phenomenon has been shown to increase peoples' appreciation of it. This is known in psychology
333 as the mere exposure effect ^(42,43). Thus, the more positive attitudes of NCP users might be an
334 effect of increased exposure and acquaintance with the NCP ⁽³⁸⁾. Interestingly, though, this
335 connection between implementation length and attitudes is not visible at a country level, where
336 some countries with more recent exposure (Greece, Sweden) seem to have a more positive
337 attitude towards the NCP, while some countries that implemented the NCP earlier (USA, Canada)
338 seem to have a less positive attitude.

339
340 The attitudes questions concerning holistic perspectives and the involvement of individuals
341 receiving care/advice were ranked quite low, indicating that several respondents did not associate
342 the NCP with these aspects. As these perspectives today are often emphasized as essential aspects
343 of a person centered approach to care, this might be an important finding and also a possible
344 reason why some professionals do not incorporate the NCP into their practice ^(44,45). In a Swedish
345 focus group study, several professionals expressed that it was difficult to apply the NCP in a
346 person-centered and flexible way ⁽²⁷⁾. Also among nurses, standardized caring processes and
347 diagnostic systems have been questioned with regards to the person-centered perspective ⁽⁴⁶⁻⁴⁸⁾.
348 The NCP and associated terminology keeps evolving, with new translations and initiatives
349 tailoring e.g. specific patient populations ^(49,50). A challenge in this evolvement is to develop
350 systems and terminologies that allow for patient safe and high quality nutrition care processes but

351 at the same time also embrace person-centered aspects such as patient involvement and holistic
352 perspectives.

353
354 Some limitations with this study should be mentioned. For example, the response rate varied
355 between different countries, with between <10-30% of all eligible professionals participating in
356 the survey. In countries with low response rates, it is possible that the professionals who chose to
357 participate had more positive attitudes towards the NCP compared to the overall population of
358 professionals and were willing to help with research. Also, a large majority of the overall
359 respondents (>70%) were from the USA, due to the much larger size of the nutrition and dietetic
360 profession in this country compared to all other participating countries. Thus, conclusions drawn
361 from the overall international responses may be more representative for US nutrition and dietetic
362 professionals than nutrition and dietetic professionals from other countries. Therefore,
363 comparison between countries was included as part of this analysis to provide an understanding
364 of cultural differences.

365
366 In this study, the occurrence of barriers and enablers for implementation of a standardized NCP
367 by nutrition and dietetic professionals differed substantially between countries. Despite these
368 differences, commonly reported enablers in several countries were: a requirement for use in the
369 workplace, recommendation from the national professional association and requirement from
370 universities in relation to dietetic student education. Based on the reported findings, several
371 challenges for health care organizations have been identified. Our research highlights a need for
372 further understanding of person-centered aspects of standardized nutrition care processes and
373 terminologies, along with the importance of tailoring NCP implementation efforts to country
374 specific contexts.

- 376 1. Stearns M, Price C, Spackman K, et al. SNOMED clinical terms: overview of the development
377 process and project status. Paper presented at: Proceedings of the AMIA Symposium 2001.
- 378 2. Yura H, Walsh MB, Garzón N. *The nursing process: assessing, planning, implementing, evaluating*.
379 5th ed. Norwalk, USA: Appleton & Lange; 1988.
- 380 3. Institute of Medicine . Committee on Quality of Health Care in America. *Crossing the quality
381 chasm: A new health system for the 21st century*. National Academy Press Washington, DC; 2001.
- 382 4. Rycroft-Malone J. The PARIHS Framework—A Framework for Guiding the Implementation of
383 Evidence-based Practice. *Journal of nursing care quality*. 2004(4):297-304.
- 384 5. Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in
385 patients' care. *The lancet*. 2003(9391):1225-1230.
- 386 6. Squires JE, Hutchinson AM, Boström A-M, et al. To what extent do nurses use research in clinical
387 practice? A systematic review. *Implementation science*. 2011(1):21.
- 388 7. Scurlock-Evans L, Upton P, Upton D. Evidence-based practice in physiotherapy: a systematic
389 review of barriers, enablers and interventions. *Physiotherapy*. 2014(3):208-219.
- 390 8. Thomas A, Law M. Research utilization and evidence-based practice in occupational therapy: A
391 scoping study. *American Journal of Occupational Therapy*. 2013(4):e55-e65.
- 392 9. Bueche J, Charney P, Pavlinac J, et al. Nutrition care process and model part I: the 2008 update. *J
393 Am Diet Assoc*. 2008(7):1113-1117.
- 394 10. Swan WI, Vivanti A, Hakel-Smith NA, et al. Nutrition Care Process and Model Update: Toward
395 Realizing People-Centered Care and Outcomes Management. *J Acad Nutr Diet*. 2017(12):2003-
396 2014.
- 397 11. Bueche J, Charney P, Pavlinac J, et al. Nutrition care process part II: using the International
398 Dietetics and Nutrition Terminology to document the nutrition care process. *J Am Diet Assoc*.
399 2008(8):1287-1293.
- 400 12. The Academy of Nutrition and Dietetics. Academy of Nutrition and Dietetics. Nutrition
401 Terminology Reference Manual (eNCPT): Dietetics Language for Nutrition Care. International
402 Collaboration and Translations. 2018; <https://ncpt.webauthor.com/international-collaboration>.
403 Accessed August 7, 2018.
- 404 13. Ichimasa A. Review of the effectiveness of the nutrition care process. *Journal of nutritional
405 science and vitaminology*. 2015(Supplement):S41-S43.
- 406 14. Authors removed for peer review. Title removed for peer review. *Journal of the Academy of
407 Nutrition and Dietetics*. 2018.
- 408 15. Porter J, Devine A, Vivanti A, et al. Development of a Nutrition Care Process implementation
409 package for hospital dietetic departments. *Nutr Diet*. 2015(3):205-212.
- 410 16. McCormack B, Kitson A, Harvey G, et al. Getting evidence into practice: the meaning of 'context'.
411 *Journal of advanced nursing*. 2002(1):94-104.
- 412 17. Senge PM. *The fifth discipline: The art and practice of the learning organization*. New York City:
413 Broadway Business; 2006.
- 414 18. Lövestam E, Boström A-M, Orrevall Y. Nutrition Care Process implementation: Experiences in
415 various Swedish dietetic environments. *J Acad Nutr Diet*. 2017(11):1738-1748.
- 416 19. Parrott JS, Galeos A, Rigassio-Radler D. Colleague Influence Predicts the Use of the International
417 Dietetics and Nutrition Terminology in Dietetics Practice. *Topics in Clinical Nutrition*. 2012(1):2.
- 418 20. Harvey G, Kitson A. PARIHS revisited: from heuristic to integrated framework for the successful
419 implementation of knowledge into practice. *Implement Sci*. 2016(1):33.

- 420 21. Cabana MD, Rand CS, Powe NR, et al. Why don't physicians follow clinical practice guidelines?: A
421 framework for improvement. *Jama*. 1999(15):1458-1465.
- 422 22. Francke AL, Smit MC, de Veer AJ, et al. Factors influencing the implementation of clinical
423 guidelines for health care professionals: a systematic meta-review. *BMC medical informatics and*
424 *decision making*. 2008(1):38.
- 425 23. Davis DA, Taylor-Vaisey A. Translating guidelines into practice: a systematic review of theoretic
426 concepts, practical experience and research evidence in the adoption of clinical practice
427 guidelines. *Cmaj*. 1997(4):408-416.
- 428 24. Thompson KL, Davidson P, Swan WI, et al. Nutrition Care Process Chains: The "Missing Link"
429 between Research and Evidence-Based Practice. *J Acad Nutr Diet*. 2015(9):1491-1498.
- 430 25. Dietitians of Canada. Final results 2011 IDNT Benchmarking survey. 2011;
431 <https://ncpt.webauthor.com/survey-results>. Accessed January 7, 2019.
- 432 26. Gardner-Cardani J, Yonkoski D, Kerestes J. Nutrition care process implementation: a change
433 management perspective. *J Am Diet Assoc*. 2007(8):1429-1433.
- 434 27. Lövestam E, Orrevall Y, Koochek A, et al. The struggle to balance system and lifeworld: Swedish
435 dietitians' experiences of a standardised nutrition care process and terminology. *Health Social*
436 *Rev*. 2016(3):240-255.
- 437 28. Vivanti A, Lewis J, O'Sullivan TA. The Nutrition Care Process Terminology: Changes in
438 perceptions, attitudes, knowledge and implementation amongst Australian dietitians after three
439 years. *Nutr Diet*. 2017(1):87-97.
- 440 29. Lövestam E, Steiber A, Vivanti A, et al. Use of the Nutrition Care Process and Nutrition Care
441 Process Terminology in an International Cohort Reported by an Online Survey Tool. *Journal of*
442 *the Academy of Nutrition and Dietetics*. 2019(2):225-241.
- 443 30. Porter J, Devine A, O'Sullivan T. Evaluation of a Nutrition Care Process implementation package
444 in hospital dietetic departments. *Nutr Diet*. 2015(3):213-221.
- 445 31. Cohen J. Statistical power analysis for the behavioral sciences 2nd edn. Erlbaum Associates,
446 Hillsdale; 1988.
- 447 32. Rogers EM. *Diffusion of innovations*. New York: The Free Press; 1962.
- 448 33. Gray BH, Bowden T, Johansen I, et al. Electronic health records: an international perspective on"
449 meaningful use". *Issue Brief (commonwealth fund)*. 2011:1-18.
- 450 34. Vivanti A, O'Sullivan TA, Porter J, et al. Successful long-term maintenance following Nutrition
451 Care Process Terminology implementation across a state-wide health-care system. *Nutr Diet*.
452 2017(4):372-380.
- 453 35. Kitson A, Harvey G, McCormack B. Enabling the implementation of evidence based practice: a
454 conceptual framework. *Quality in Health care*. 1998(3):149-158.
- 455 36. Mintzberg H. Covert leadership: Notes on managing professionals. *Harvard business review*.
456 1998:140-148.
- 457 37. Altman Y, Iles P. Learning, leadership, teams: corporate learning and organisational change.
458 *Journal of Management Development*. 1998(1):44-55.
- 459 38. O'Sullivan TA, Lo J, Vivanti A. Predictors of nutrition care process and terminology use,
460 applicability and importance within Asia-Pacific dietitians. *Nutrition & Dietetics*. 2018.
- 461 39. Devine CM, Jastran M, Bisogni CA. On the front line: practice satisfactions and challenges
462 experienced by dietetics and nutrition professionals working in community settings in New York
463 State. *Journal of the American Dietetic Association*. 2004(5):787-792.
- 464 40. Grol R, Wensing M. What drives change? Barriers to and incentives for achieving evidence-based
465 practice. *Medical Journal of Australia*. 2004(6 Suppl):S57.
- 466 41. Harvey G, Kitson A. PARIHS revisited: from heuristic to integrated framework for the successful
467 implementation of knowledge into practice. *Implement Sci*. 2016(1):33-46.

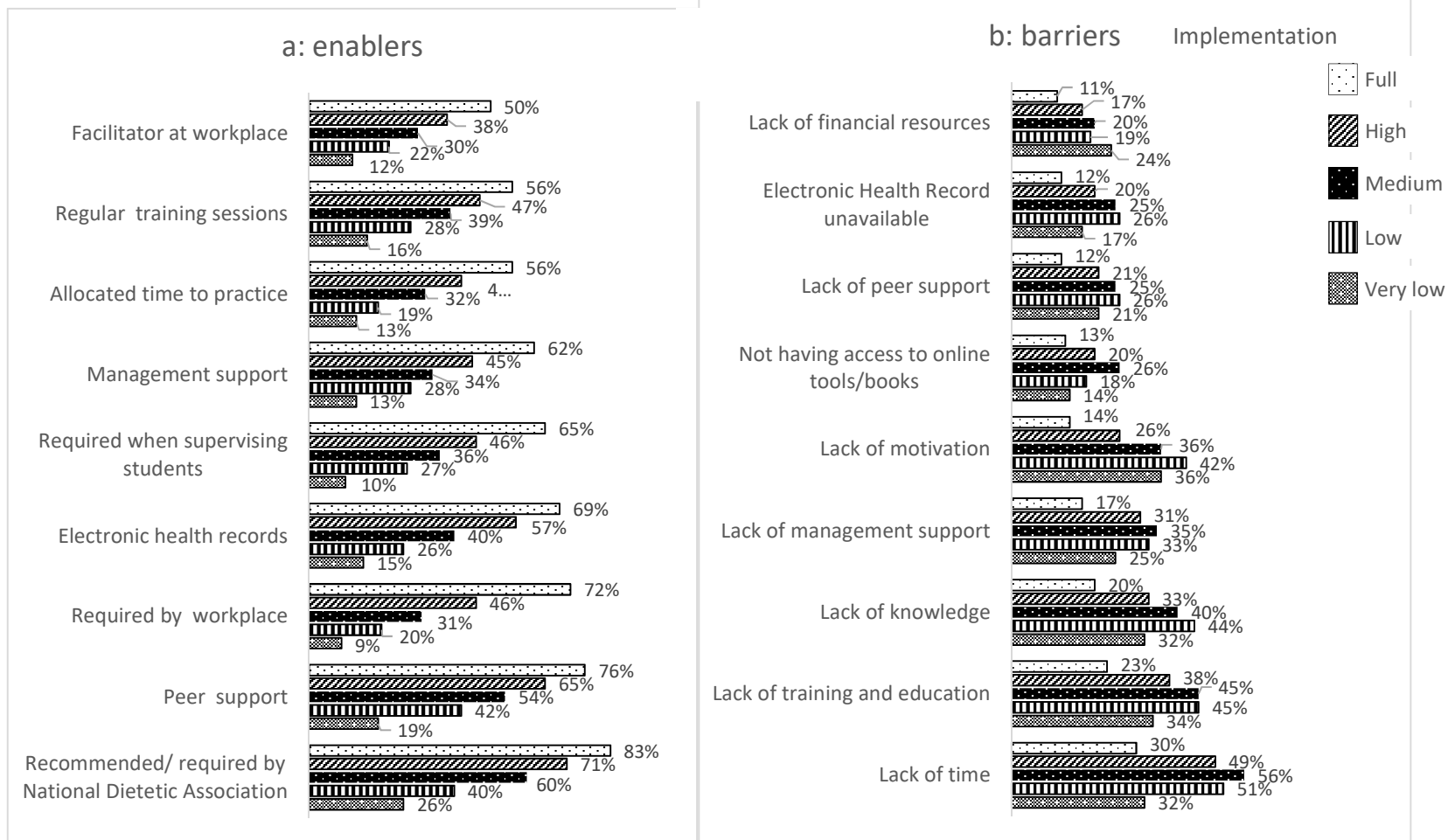
- 468 42. Harrison AA. Mere Exposure¹. *Advances in experimental social psychology*. Vol 10: Elsevier;
469 1977:39-83.
- 470 43. Zajonc RB. Attitudinal effects of mere exposure. *Journal of personality and social psychology*.
471 1968(2p2):1.
- 472 44. Ekman I, Swedberg K, Taft C, et al. Person-centered care—Ready for prime time. *European*
473 *Journal of Cardiovascular Nursing*. 2011(4):248-251.
- 474 45. Kitson A, Marshall A, Bassett K, et al. What are the core elements of patient-centred care? A
475 narrative review and synthesis of the literature from health policy, medicine and nursing. *Journal*
476 *of advanced nursing*. 2013(1):4-15.
- 477 46. Lützné K, Tishelman C. Nursing diagnosis: a critical analysis of underlying assumptions.
478 *International journal of nursing studies*. 1996(2):190-200.
- 479 47. Mitchell GJ. Diagnosis: Clarifying or obscuring the nature of nursing. *Nursing science quarterly*.
480 1991(2):52-53.
- 481 48. Powers P. A discourse analysis of nursing diagnosis. *Qualitative health research*. 2002(7):945-
482 965.
- 483 49. Rachman-Elbaum S, Stark AH, Kachal J, et al. Online training introduces a novel approach to the
484 Dietetic Care Process documentation. *Nutrition & dietetics*. 2017(4):365-371.
- 485 50. Rachman-Elbaum S, Stark AH, Kachal J, et al. A New System of Documentation to Improve
486 Dietitian-Physician Crosstalk. *The Israel Medical Association journal: IMAJ*. 2017(6):360-364.

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492 Figure 1. Enablers (a) and barriers (b) experienced by nutrition and dietetic professionals (n=5727) representing different levels (full/very
 493 high/medium/low/very low) of Nutrition Care Process implementation

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496 **Table 1. Experienced enablers/barriers for Nutrition Care Process (NCP) implementation among dietetic professionals by country, compared**
 497 **to the USA.**

Enablers								
	Australia n=140	Canada n=457	Denmark n=56	Ireland n=88	New Zealand n=100	Norway n=73	Sweden n=296	Switzer- land n=208
Peer support	2.059 (1.255- 3.376) ^a	2.016 (1.505- 2.701) ^a	1.279 (0.611- 2.676)	1.612 (0.855- 3.038)	2.370 (1.252- 4.483)	2.618 (1.397- 4.907) ^a	3.202 (2.310- 4.438) ^a	4.499 (2.899- 6.982) ^a
Designated leader at my workplace	1.437 (0.887- 2.326)	0.630 (0.477- 0.833) ^a	0.057 (0.007- 0.440) ^a	2.606 (1.424- 4.769) ^a	0.863 (0.514- 1.448)	1.963 (1.023- 3.767) ^b	0.316 (0.221- 0.453) ^a	1.261 (0.883- 1.802)
Management support	0.668 (0.406- 1.100)	1.435 (1.069- 1.925) ^b	0.569 (0.222- 1.459)	1.119 (0.613- 2.044)	1.007 (0.582- 1.741)	0.885 (0.447- 1.754)	1.093 (0.791- 1.509)	0.422 (0.291- 0.613) ^a
Allocated time to practice	0.819 (0.503- 1.334)	0.813 (0.613- 1.078)	1.382 (0.599- 3.186)	1.028 (0.583- 1.813)	0.764 (0.452- 1.291)	0.807 (0.403- 1.617)	0.699 (0.508- 0.961) ^b	0.590 (0.410- 0.848) ^a
Regular education and training sessions	1.318 (0.830- 2.094)	1.536 (1.172- 2.013) ^a	0.944 (0.422- 2.110)	1.503 (0.860- 2.630)	1.681 (0.997- 2.835)	0.579 (0.293- 1.145)	2.100 (1.554- 2.838) ^a	1.801 (1.266- 2.563) ^a
Electronic health care records	0.166 (0.104- 0.0.266) ^a	0.252 (0.195- 0.326) ^a	0.828 (0.406- 1.687)	0.048 (0.023- 0.100) ^a	0.113 (0.067- 0.190) ^a	0.430 (0.237- 0.779) ^a	0.817 (0.613- 1.090)	0.658 (0.471- 0.920) ^b
NCP use is required by my workplace	1.183 (0.718- 1.947)	1.264 (0.941- 1.699)	0.493 (0.202- 1.204)	1.537 (0.848- 2.786)	3.354 (1.718- 6.546) ^a	0.300 (0.135- 0.667) ^a	0.344 (0.242- 0.488) ^a	1.212 (0.833- 1.765)
NCP use is required when supervising dietetic students	1.333 (0.822- 2.159)	1.582 (1.191- 2.102) ^a	1.568 (0.725- 3.388)	0.664 (0.375- 1.177)	2.699 (1.425- 5.112) ^a	0.384 (0.176- 0.837) ^b	0.611 (0.442- 0.844) ^a	0.581 (0.405- 0.833) ^a
NCP use is recommended by the professional dietetic association	0.630 (0.477- 0.833) ^b	0.375 (0.291- 0.483) ^a	0.382 (0.193- 0.760) ^a	1.222 (0.702- 2.126)	0.825 (0.469- 1.451)	0.758 (0.442- 1.300)	1.167 (0.867- 1.570)	1.476 (0.999- 2.182)
Barriers								

Lack of motivation /do not see a reason to change my work approach	0.526 (0.317-0.874)	0.863 (0.666-1.119)	0.148 (0.045-0.488) ^a	0.269 (0.132-0.548) ^a	0.393 (0.214-0.721) ^a	0.473 (0.252-0.888) ^b	0.484 (0.351-0.668) ^a	0.313 (0.203-0.484) ^a
Lack of knowledge	0.710 (0.415-1.215)	0.906 (0.670-1.225)	1.188 (0.563-2.509)	1.385 (0.745-2.571)	1.723 (0.969-3.067)	2.277 (1.170-4.430) ^b	0.786 (0.567-1.088)	1.643 (1.116-2.420) ^b
Lack of time	1.675 (1.081-2.597)	2.102 (1.653-2.673) ^a	1.485 (0.771-2.859)	3.238 (1.942-5.400) ^a	3.179 (2.000-5.052) ^a	1.849 (1.050-3.256) ^b	7.564 (5.433-10.531) ^a	8.259 (5.787-11.788) ^a
Lack of financial resources	1.371 (0.807-2.329)	0.664 (0.472-0.935) ^b	1.130 (0.462-2.767)	0.791 (0.410-1.525)	0.355 (0.155-0.811) ^b	1.074 (0.525-2.196)	0.757 (0.531-1.078)	1.318 (0.883-1.968)
Lack of training and education	1.786 (1.062-3.003)	1.424 (1.057-1.918) ^b	5.144 (2.368-11.174) ^a	0.976 (0.515-1.847)	0.548 (0.294-1.022)	2.640 (1.336-5.218) ^a	2.651 (1.892-3.714) ^a	0.643 (0.425-0.973) ^b
Lack of management support	0.710 (0.422-1.196)	0.494 (0.361-0.676) ^a	0.319 (0.121-0.840) ^b	0.329 (0.162-0.669) ^a	0.554 (0.292-1.052)	0.430 (0.214-0.866) ^b	1.669 (1.211-2.300) ^a	0.452 (0.283-0.722) ^a
Lack of peer support	1.307 (0.759-2.253)	1.417 (1.036-1.939) ^b	0.561 (0.183-1.716)	1.033 (0.499-2.138)	1.534 (0.814-2.888)	2.088 (1.098-3.971) ^b	1.189 (0.846-1.672)	0.567 (0.325-0.988) ^b
Electronic health records unavailable	3.156 (2.038-4.886) ^a	2.626 (2.029-3.399) ^a	0.692 (0.263-1.820)	10.241 (6.221-16.858) ^a	2.533 (1.527-4.203) ^a	0.661 (0.292-1.497)	0.114 (0.050-0.261) ^a	1.592 (1.075-2.357) ^b
Not having access to online tools or books	0.588 (0.340-1.017)	1.000 (0.751-1.332)	1.077 (0.508-2.287)	0.949 (0.537-1.675) ⁼	1.212 (0.693-2.121)	0.321 (0.134-0.772) ^b	0.407 (0.265-0.624) ^a	0.458 (0.278-0.755) ^a

498 OR= Odds ratio compared to nutrition and dietetic professionals from USA, estimated from multinomial logistic regression analysis. Pseudo R
499 Square 0.21-0.41.

500 ^a p<0.01

501 ^b p<0.05

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