

1 **Assessment of research ethics education offerings of pharmacy master**
2 **programs: a qualitative content analysis**

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26

27 **Abstract**

28 The importance of research ethics (RE) training has led academic and funding institutions to require that
29 students, trainees, and faculty obtain such training at various stages of their careers. Despite the
30 increasing awareness of the value RE education offers, this training requirement is absent in Jordan. We
31 aimed to assess RE education offerings of pharmacy master programs in Jordan and compare with the
32 top-ranked pharmacy graduate programs globally. Therefore, a list of universities that offer research-
33 based pharmacy master programs was created. Each program was evaluated for the inclusion of RE
34 education. A qualitative content analysis approach based on inductive reasoning and latent analysis was
35 followed to analyze the data. Results of the study showed a lack of appropriate RE education for
36 graduate-level pharmacy programs in Jordan with only 40% of the programs partially discuss selected
37 topics related to RE. Regarding pharmacy graduate programs globally, 10% offer a standalone RE course,
38 40% offer some discussions related to RE, another 10% do not offer RE education in any form, and the
39 remaining 40% of the programs were difficult to assess due to lack of sufficient information available
40 online. Based on the findings of this study, training in RE is tends to be lacking in pharmacy graduate
41 programs in Jordan and globally, with a greater lack in Jordan than globally. There is a need to
42 incorporate formal RE education into programs that do not offer this type of instruction. Programs that
43 formally touch on some aspects of RE need to expand the scope of topics to include more RE-related
44 themes. Integrating a standalone RE course into pharmacy graduate programs is highly encouraged.

45

46 **Keywords:** Curriculum, Education, Jordan, Middle East and North Africa, MENA, Pharmacy Graduate
47 School, Research ethics, Responsible conduct of research, RCR.

48 **Introduction**

49 The United States National Institute of Health (NIH) requirement for education in the responsible
50 conduct of research (RCR) [1] states that the practice of science with integrity involves “*the awareness*
51 *and application of established professional norms and ethical principles in the performance of all*
52 *activities related to scientific research*”. Clearly, ethical behavior in science is valued, and it would
53 follow that research ethics education is the modality for acculturating scientists to the accepted norms
54 and conventions. In 1989, the NIH announced its first RCR educational requirement for selected NIH
55 trainees [2]. Although increased cases of research misconduct may have triggered the federal
56 requirements for RCR training [3, 4], the desire to preserve the integrity of science and to foster a good
57 research practices and a socially responsible community could arguably be another reason [5-9]. The
58 educational requirements were expanded in 1992 and 2000 for the NIH [10, 11] and by the Public Health
59 Service (PHS) in 2000 (<http://grants.nih.gov/grants/guide/notice-files/NOT-OD-01-007.html>). The NIH
60 updated its mandate for RCR training in 2009 [1] and, that same year, the National Science Foundation
61 (NSF) introduced an RCR requirement that called for “appropriate training and oversight in the
62 responsible and ethical conduct of research” [12]. In 2010, the NSF RCR requirement went into effect,
63 which required that institutions receiving NSF support have a plan for offering RCR education for all
64 students/trainees (undergraduate, graduate, and postdoctoral) supported on NSF grants. Recently, the
65 National Institute of Food and Agriculture (NIFA) of the United States Department of Agriculture
66 (USDA) incorporated RCR education as an essential requirement for institution conducting USDA-
67 funded extramural research (<https://nifa.usda.gov/responsible-andethical-conduct-research>).

68

69 Unlike the NSF requirement, which only calls for “appropriate training” to be provided to researchers
70 supported by the NSF, the NIH requirement includes detail on what topics to be discussed, as well as
71 expectations on format and frequency of training [4]. The scope of RCR training requirements has varied
72 over different versions of NIH mandates (1989, 1992, 2000, and 2009). In fact, the U.S. office of research
73 integrity (ORI) identified nine core areas which need to be addressed in an RCR course. This was
74 followed by a Delphi consensus panel report which identified 53 topics in seven core areas to be included
75 in RE teaching [13]. Some RCR topics have evolved over time, while others were newly introduced in
76 later versions of the federal requirements. Generally, accepted topics include conflict of interest and bias,

77 research subject protections, data management, authorship and publication ethics, and social
78 responsibilities [4].

79

80 As noted, increased cases of research misconduct in the 1980's led to a special congressional task force
81 to define the scope of research misconduct [3, 4] and, eventually, federal requirements for RCR training.
82 How the training requirements were implemented by institutions bound by these new training
83 requirements varied considerably across the US [13-15]. In addition to the variability in RCR instruction
84 by institution, inconsistencies in what instructors thought they were to accomplish specific to goals were
85 also common [16] making evaluation of the efficacy of RCR training challenging [5]. A range of
86 suggested goals are available in the RCR literature [13, 16].

87

88 While the federal agencies mandate institutions to provide RCR training to comply with training
89 requirements; increasingly, institutions offer RCR training regardless of funding requirements [4]. In
90 addition to U.S. institutions promoting research ethics training to foster an ethically responsible research
91 environment, the NIH Fogarty International Center (FIC) also supports proactive research ethics
92 education internationally. For example, FIC has funded research ethics education in Latin America,
93 Africa and in the Middle East. Current research practices in most Arab countries are not governed by
94 nation-level federal requirements nor do they involve the same level of mandates for research ethics as
95 the U.S. [17]. Seeing as many collaboration research projects in these countries are funded by U.S.
96 agencies [18], this could be a reasonable motive behind FIC funds outside of the U.S.

97

98 The situation in Jordan is different from the U.S., yet similar to most Arab countries in that there are no
99 research ethics education requirements for students and researchers regardless of research funding
100 source. Nonetheless, Jordan is considered one of the most academically established countries in the
101 MENA region with progressive research agendas. Jordan also has a well-established pharmaceutical
102 industry that exports several products globally. This pharmaceutical sector relies heavily on contract
103 research organizations for drug development and post-marketing studies [17]. As a result, Jordan has
104 been part of two major initiatives of research ethics training, both of which are supported by grants from
105 the NIH FIC:

106 - Middle East Research Ethics Training Initiative (MERETI), initiated in 2005, and offers
107 training in research ethics to individuals (mid-level and senior professionals) from the Middle
108 East. (<https://www.mereti-network.net/>;
109 <https://www.fic.nih.gov/Grants/Search/Pages/Bioethics-1R25TW007090-01.aspx>)
110 - The Research ethics education program in Jordan (REPJ), which started in 2015, and targets
111 junior researchers from the MENA region. (<https://jordanrcrprogram.com/about/>;
112 <https://www.fic.nih.gov/Grants/Search/Pages/bioethics-TW010026.aspx>)
113
114 Graduate masters-level pharmacy programs in Jordan generally require that students complete an
115 independent research project. Given this expectation and the potential value of RCR education in
116 preparing researchers to design and implement their research ethically and responsibly, we sought to
117 assess the extent to which research ethics education was included in graduate pharmacy programs in
118 Jordan. To see how Jordan pharmacy programs compared globally with respect to RCR offerings, we
119 then sought investigate the offerings at the top ranked graduate pharmacy programs.

120

121 **Materials and methods**

122 **Data collection in Jordan**

123 Data collection for this part involved several steps. In the beginning, websites of all Jordanian universities
124 with a pharmacy school or department were reviewed to identify schools/departments offering one or
125 more masters-level programs in pharmacy. Then, we searched through each program's description to
126 document programs requiring students to carry out an independent research project to satisfy completion
127 requirements along with the course-work requirement. In case the program's description was not
128 available online, it was retrieved from the corresponding pharmacy school/department by a direct in-
129 person visit. Next, we searched through the description of individual courses in a program to identify
130 courses that offer research ethics education. The purpose was to identify whether programs that included
131 an expectation to conduct research also provided RE instruction. Based on this search, a spreadsheet was
132 compiled (S1 Table) documenting courses with dedicated or imbedded material related to research ethics
133 by examining the list of course titles and their descriptions. Research ethics instruction was determined
134 by searching for keywords related to research ethics in the course description. For courses that contained

135 one or more keywords related to research ethics in their description, in order to determine the scope of
 136 research ethics topics covered, the entire course content was then retrieved by a direct in-person visit to
 137 the corresponding pharmacy school/department. Fig 1 summarizes the data collection process in Jordan.
 138

139 **Table 2. Keywords related to research ethics that were highlighted from course descriptions**

| Keywords | | | |
|-------------------------|-----------------------------------|--------------------|-------------------------|
| Approvals | Authorship | Benefit-risk ratio | Ethics |
| Consent | Ethical aspects | Ethical challenges | Ethical committees |
| Ethical considerations | Ethical frameworks | Ethical issues | Ethical requirements |
| Ethics approval | Ethics board | Ethics committee | Ethics submissions |
| Important issues | Issues | Medical ethics | Multi-disciplinary team |
| Problems | Problems in pharmacology research | Regulatory | Regulatory committees |
| Regulatory requirements | Research approaches | Research ethics | Research misconduct |
| Risk assessment | Risk management | Risk minimization | Safety board |
| Team approach | Special problems | Research problems | Regulatory frameworks |
| Obligations | Expertise | Ethical concerns | Conflict of interest |

140

141 **Fig 1. Stepwise data collection approach from universities in Jordan.**

142

143 Data collected during the review process were entered into a spreadsheet included: 1- name of the
 144 university and the master pharmacy program offered, 2- name of all courses; core (obligatory) and
 145 elective (optional) offering research ethics instruction, 3- course description, 4- keywords related to
 146 research ethics used in the course description, 5- whether research ethics are the main and the only focus
 147 of the course or an imbedded material (i.e. research ethics are mentioned or discussed in the course but
 148 are not the only focus of the course), and 6- research ethics related topics covered in the course(S1 Table).

149

150

151 **Data collection beyond Jordan**

152 The next step was to compare graduate research ethics educational offerings in Jordan with that of
153 pharmacy graduate programs offered globally. For this part, the data collection was based entirely on
154 information available online. Since our data collection took place during July – August 2017, we
155 therefore used the Quacquarelli Symonds (QS) World University Ranking (2017) to search for the top
156 10 universities worldwide by subject of pharmacy and pharmacology
157 ([https://www.topuniversities.com/university-rankings/university-subject-rankings/2017/pharmacy-](https://www.topuniversities.com/university-rankings/university-subject-rankings/2017/pharmacy-pharmacology)
158 [pharmacology](https://www.topuniversities.com/university-rankings/university-subject-rankings/2017/pharmacy-pharmacology)). The QS World University Ranking, published by Quacquarelli Symonds (QS) Limited,
159 is one of the most popular and reputable rankings in the educational market [19].

160 After the list of the top 10 universities was created, websites of these universities were then reviewed for
161 pharmacy master programs that have mixed coursework and research-project completion requirements.
162 Individual programs were then screened by reviewing the course description of individual courses in the
163 programs for core or elective courses that fully or partly discuss research ethics related issues. The data
164 collection process of global programs is summarized in Fig 2.

165

166 **Fig 2. Stepwise data collection approach from top 10 universities globally.**

167

168 Based on this search, data that were collected and recorded in a spreadsheet and included: 1- name and
169 rank of the university, 2- name of the master program offered, 3- the school or department offering the
170 program, 4- course title, 5- whether the course is core or elective, 6- the course description, 7- keywords
171 related to research ethics used in the course description, 8-whether the course offers research ethics
172 instruction as the only focus or as one component of the course, and 9- the course website address (the
173 website address of the program was used whenever no specific website address is available for the
174 course) [S2 Table]. All information was retrieved from official online sources with no direct or indirect
175 contact with the universities or their schools.

176

177 **Data analysis**

178 The study aim was to qualify and quantify research ethics instruction offered by pharmacy master
179 programs in Jordan and compare the results with the top 10 universities by subject of pharmacy and
180 pharmacology. Our first sample included pharmacy master programs with mixed coursework and
181 research completion requirements that are offered by universities in Jordan. Our second sample included
182 master programs offered by the top 10 universities by subject of pharmacy and pharmacology. Individual
183 courses in the programs served as units of analysis, courses descriptions served as meaning units, and
184 keywords observations from written course description texts served as condensed meaning units. A
185 qualitative content analysis, based on inductive reasoning was applied [20]. Several other studies utilized
186 content analysis to assess major text books and other educational resources for RCR content [21, 22].
187 We followed a latent analysis approach, as some of the keywords we extracted from the description texts
188 to reflect research ethics instruction may not explicitly refer to research ethics in an obvious manner,
189 rather it was our interpretation of these keywords through which we tried to seek their underlying content
190 reference.

191

192 In order to conceptualize on the collected data, the data analysis process consisted of the following four
193 steps: the decontextualization, the recontextualization, the categorization and theming, and the
194 compilation (Fig 3). The decontextualization step entails reading through texts to identify meaning units,
195 which are broken down into condensed meaning units, and creating a coding list. Recontextualization
196 includes comparing all meaning units from the previous step with the original text to check and make
197 sure that all aspects of the relevant content have been captured and coded properly. Categorization
198 involves grouping the created codes into subcategories and categories that are homogenous on the interior
199 but heterogenous on the exterior, that are then appropriately themed. The compilation is the last step
200 through which the results are compiled into meaningful conclusions.

201

202 **Fig 3. Overview of the data analysis process.**

203

204 Step 1. Decontextualisation: For each course, the course description served as the meaning unit,
205 keywords related to research ethics served as condensed meaning unit. A coding list was created for each
206 course as follows:

207 I. If keywords were observed in the description and the course title was indicative of a course
208 specialized in research ethics (e.g. “research ethics” course, “responsible conduct of
209 research” course), we coded “Yes - dedicated” for that course.

210 II. If the description included keywords related to research ethics, but the course title and
211 description were indicative of other contents unrelated to research ethics, we coded “Yes –
212 imbedded” for that course.

213 III. If the course did not include any keywords related to research ethics, we coded “No” for
214 that course.

215

216 Step 2. Recontextualisation: The condensed meaning units were put back and compared with the original
217 description text to make sure all relevant keywords related to research ethics have been captured. Then,
218 all other text words in the description were considered dross and excluded from further analysis.

219

220 Step 3. Categorization and theming:

221 I. Subcategories

222 a. Core and elective courses coded as “Yes – dedicated”.

223 b. Core and elective courses coded as “Yes – imbedded”.

224 c. Core and elective courses coded as “No”.

225 II. Categories

226 a. Programs that included subcategory (a) or (b).

227 b. Programs that included subcategory (a).

228 c. Programs that included subcategory (b) but not (a).

229 d. Programs that included subcategory (c) but not (a) or (b).

230 e. Programs that did not include any of the subcategories (a), (b), or (c).

231 III. Themes

232 Category (a) was themed as programs that offer some form of research ethics education in one
233 or more of their courses.

234 Category (b) was themed as programs that offer one or more dedicated research ethics course.

235 Category (c) was themed as programs that offer research ethics education imbedded into one or
236 more of their courses.

237 Category (d) was themed as programs that do not offer research ethics education in any form.
238 Category (e) was themed as programs that were difficult to assess for research ethics education
239 offerings due to lack of sufficient information online.

240

241 Step 4. Compilation: results were compiled and used to draw meaningful conclusions as discussed later
242 in this article.

243

244

245 **Results**

246 **RCR in Jordan**

247 Our search revealed 19 universities in Jordan that have a pharmacy school or department with only 7 of
248 those offering mixed course-work and research-project master's degree in pharmacy (Table 2). The total
249 number of pharmacy master programs offered in the 7 universities was 10 (Table 3). All 10 programs
250 stated a completion requirement to conduct a research project. With the exception of the University of
251 Jordan (JU) and Jordan University of Science and Technology (JUST), all other universities that offer
252 pharmacy master's degree programs, reported offering neither a dedicated course on research ethics nor
253 research ethics-integrated formal discussions within an existing course. The school of pharmacy at the
254 University of Jordan (JU) offers a Master of Science (MSc) Clinical Pharmacy program with one
255 obligatory course in "research methodology" that includes RE instruction as one component of the
256 course. The imbedded RE material is focused on research involving humans with emphasis on informed
257 consent and role of an institutional review board, authorship and publication ethics, conflict of interest,
258 data confidentiality, and research misconduct (fabrication, falsification, and plagiarism) [S1 Table]. Most
259 of these topics align with the NIH federal requirements for RCR. The master program in Pharmaceutical
260 Sciences offered by the same school, however, does not discuss research ethics in any of its courses,
261 despite having a research project completion mandate. The school of pharmacy at Jordan University of
262 Science and Technology (JUST) offers three master programs, each with an obligatory "research
263 methodology" course, which includes some discussion of ethical issues related to research. The same
264 topics were covered in the three courses with focus on human research, animal research, and research
265 misconduct, all of which align with the NIH mandates (Table 3 and S1 Table).

266 **Table 2. List of Universities with Pharmacy Schools/Departments in Jordan**

| # | Name of University | Private University | City | Pharmacy master program(s) with thesis track |
|----|---|--------------------|--------|---|
| 1 | Jordan University of Science and Technology | No | Irbid | I. Clinical Pharmacy II. Pharmaceutical Technology III. Medicinal chemistry and Pharmacognosy |
| 2 | University of Jordan | No | Amman | I. Clinical Pharmacy II. Pharmaceutical Sciences |
| 3 | Yarmouk University | No | Irbid | None |
| 4 | Hashemite University | No | Zarqa | None |
| 5 | Zarqa University | Yes | Zarqa | None |
| 6 | Balqa Applied University | | Irbid | None |
| 7 | Philadelphia University at Jordan | Yes | Jarash | None |
| 8 | Mutah University | No | Karak | None |
| 9 | German Jordanian University | No | Amman | None |
| 10 | Applied Science University | Yes | Amman | Pharmaceutical Sciences |
| 11 | Al Ahliyya Amman University | Yes | Balqa | Pharmaceutical Studies |
| 12 | Middle East University Jordan | Yes | Amman | None |
| 13 | Al Zaytoonah University | Yes | Amman | Pharmaceutical Sciences |
| 14 | University of Petra | Yes | Amman | Pharmaceutical Sciences |
| 15 | Jerash Private University | Yes | Jarash | None |
| 16 | Amman Arab University | Yes | Amman | None |
| 17 | American University of Madaba | Yes | Madaba | None |
| 18 | Al Isra University Amman | Yes | Amman | Pharmacy |
| 19 | Jadara University | Yes | Irbid | None |

267

268

269 **Table 3. Pharmacy master programs by mixed course-work/research offered by Jordanian**
 270 **universities and their research ethics (RE) education offerings.**

| Pharmacy master program | RE courses offered |
|-------------------------|--------------------|
|-------------------------|--------------------|

| | No | Yes | | N/A |
|---|----|------------------|-------------------|-----|
| | | Dedicated (C, E) | Integrated (C, E) | |
| <i>The University of Jordan</i> | | | | |
| Clinical Pharmacy | - | 0 | 1 (C) | - |
| Pharmaceutical Sciences | ✓ | 0 | 0 | - |
| <i>Jordan university of Science and Technology</i> | | | | |
| Clinical Pharmacy | - | 0 | 1 (C) | - |
| Pharmaceutical Technology | - | 0 | 1 (C) | - |
| Medicinal Chemistry and pharmacognosy | - | 0 | 1 (C) | - |
| <i>Applied Science University</i> | | | | |
| Pharmaceutical Studies | ✓ | 0 | 0 | - |
| <i>Al Ahliyya Amman University</i> | | | | |
| Pharmaceutical Studies | ✓ | 0 | 0 | - |
| <i>Al Zaytoonah University</i> | | | | |
| Pharmaceutical Sciences | ✓ | 0 | 0 | - |
| <i>University of Petra</i> | | | | |
| Pharmaceutical Sciences | ✓ | 0 | 0 | - |
| <i>Al Isra University Amman</i> | | | | |
| Pharmacy | ✓ | 0 | 0 | - |

271 Dedicated: number of standalone RE courses offered by a program; Integrated: number of courses in a
 272 program that integrate RE discussions; N/A: no enough information to assess RE education offerings; C:
 273 Core course; E: elective course.
 274

275 **RCR beyond Jordan - globally**

276 According to the information available online, the total number of pharmacy master programs with mixed
 277 course-load and research requirement offered by the top 10 universities by subject of pharmacy and
 278 pharmacology is 20 programs. Of the 20 programs, two programs (10%) offer a dedicated research ethics
 279 course, eight programs (40%) offer research ethics education material that is integrated into one or more
 280 of the program's courses, and two programs (10%) contain neither a dedicated course of research ethics
 281 nor a course that integrates research ethics material. Another eight programs (40%) were difficult to

282 assess for research ethics instruction offerings because the course description of these programs was
 283 either missing or incomplete. (Table 4 and S2 Table).

284

285 **Table 4. Pharmacy master programs by mixed course-work/research offered by the top 10**
 286 **universities ranked by subject of pharmacy and pharmacology (QS ranking, 2017) and their**
 287 **research ethics (RE) education offerings. Universities are listed based on their ranking in the top**
 288 **10 list (highest to lowest).**

| Pharmacy master program | RE courses offered | | | |
|--|--------------------|------------------|-------------------|-----|
| | No | Yes | | N/A |
| | | Dedicated (C, E) | Integrated (C, E) | |
| <i>University of Harvard (no programs are offered)</i> | | | | |
| <i>University of Monash</i> | | | | |
| Master of Clinical Pharmacy | - | 0 | 1 (C), 1 (E) | - |
| <i>University of Cambridge (no mixed programs are offered)</i> | | | | |
| <i>University of Oxford</i> | | | | |
| Pharmacology | - | - | - | ✓ |
| <i>University of California, San Francisco</i> | | | | |
| Clinical Research | - | 1 (C) | 0 | - |
| <i>University of Nottingham</i> | | | | |
| Drug Discovery and Pharmaceutical Sciences | - | - | - | ✓ |
| <i>King's College London</i> | | | | |
| Clinical Pharmacology | - | 0 | 4 (C) | - |
| Drug Development Science | - | 0 | 4 (C) | - |
| Pharmacology | - | 0 | 2 (C) | - |
| Biopharmaceuticals | - | - | - | ✓ |
| Pharmaceutical Analysis and Quality Control | - | - | - | ✓ |
| Pharmaceutical Technology | ✓ | - | - | - |
| Pharmacy Practice | ✓ | - | - | - |
| <i>University College London</i> | | | | |
| Medicinal Natural Products and Phytochemistry | - | - | - | ✓ |

| | | | | |
|--|---|-------|-------|---|
| Pharmaceutics | - | 0 | 1 (C) | - |
| Drug Discovery and Development | - | 0 | 2 (C) | - |
| Drug Discovery and Pharma Management | - | 0 | 2 (C) | - |
| Pharmaceutical Formulation and Entrepreneurship | - | 0 | 1 (E) | - |
| Clinical Pharmacy, International Practice and Policy | - | - | - | ✓ |
| Drug Sciences | - | - | - | ✓ |
| <i>The University of Tokyo</i> | | | | |
| Pharmaceutical Sciences | - | - | - | ✓ |
| <i>Karolinska Institute</i> | | | | |
| Pharmaceutical Medicine | - | 1 (C) | 0 | - |

289 Dedicated: number of standalone RE courses offered by a program; Integrated: number of courses in a
 290 program that integrate RE discussions; N/A: no enough information to assess RE education offerings; C:
 291 Core course; E: elective course.
 292

293 Discussion

294 This qualitative study revealed a dearth of research ethics education for master's level pharmacy
 295 programs in Jordan. None of the programs offered a standalone research ethics course. A minority (less
 296 than half) of programs offered in Jordan integrated partial research ethics instruction into one of their
 297 core courses with a focus on human research ethics and research misconduct. Although these programs
 298 discuss research ethics themes in their courses that are aligned with what the NIH require in its mandate,
 299 these themes still do not capture the scope of topics required in the NIH guidelines [1] as many were
 300 missing and not discussed. The core components of research ethics training as indicated by the 2009 NIH
 301 mandates and the U.S. ORI include: mentor-mentee responsibilities, research misconduct, research
 302 protections of humans and animals, conflict of interest and bias, ethics of collaborative research, data
 303 management, publication and authorship ethics, peer-review, and social responsibilities [1, 13]. Globally,
 304 assessing research ethics instruction offerings was more challenging as it was entirely based on
 305 information available from online official sources, which most of the time was either incomplete or
 306 entirely missing. For global programs that we indicated to offer RE education, it was difficult to identify
 307 the topics of RE they discuss based solely on keywords from their courses description. Out of the 20
 308 global programs offered, we were able to assess the RE instruction offerings of only 12 (60%). Two out

309 of the twelve offered a standalone RE core course (2/12, 17%), two did not offer any form of research
 310 ethics instruction (2/12, 17%), and eight offered RE education incorporated into one or more courses
 311 (8/12, 67%). The ultimate can be further classified into programs that integrate RE education into only
 312 one core or elective course (2/12, 17%) or into more than one course (6/12, 50%). Based on these
 313 findings, one could conclude that formal RE education tends to be lacking globally as well. However,
 314 the lack is greater in Jordan than globally (Table 5).

315

316 **Table 5. Summary and comparison between research ethics education offerings in Jordan and**
 317 **globally**

| Theme | Jordan N (%) | Top 10 Universities Globally N (%) |
|--|-------------------------|---|
| Total number of pharmacy master programs. | 10 | 20 |
| Number of programs offering one or more dedicated research ethics course(s). | 0 | 2 (10) |
| Total number of programs offering research ethics education imbedded in one or more of their course(s). | 4 (40) | 8 (40) |
| Number of programs offering some form of research ethics education in one or more of their course(s). | 4 (40) | 10 (50) |
| Number of programs not offering research ethics education in any form. | 6 (60) | 2 (10) |
| Number of programs that were difficult to assess for research ethics education offerings due to lack of sufficient information online. | 0 | 8 (40) |

318

319 Jordan, although considered a developing country, is one of the more academically established countries
 320 in the MENA region with progressive research agendas that involve international collaborations. As
 321 inter-disciplinary research and collaboration between industrialized and developing countries grows
 322 bigger, there emerges the need for capacity building in the developing countries with respect to the
 323 responsible conduct of research as well as the ethical review process [23-25] . Numerous deficiencies
 324 were previously reported to exist in the ethics guidelines and regulations of countries in low and middle
 325 income countries in the Middle East and Africa [26, 27]. A study by Hayder et al. under the former

326 National Bioethics Advisory Commission surveyed health researchers in developing countries to explore
327 issues related to the IRB review. About half of the respondents (44%) disclosed that their projects were
328 not reviewed by an IRB review committee in their countries, of which one-third of these projects were
329 funded by a U.S. funding agency [18].

330

331 Systematic education or training in research ethics prior to enrolment in pharmacy graduate education in
332 Jordan is unlikely, as undergraduate pharmacy programs in Jordan do not have a research project
333 completion requirement [28]. Thus, one could assume that pharmacy graduate students lack appropriate
334 training and preparation in the systematic research ethics training most needed at the beginning of the
335 postgraduate program. For that reason, integrating RE education into postgraduate pharmacy programs
336 in Jordan is highly encouraged. In fact, there is a support for this type of training even among health
337 sciences faculty members in Jordan [29]. In this case, pharmacy graduate programs in JUST and JU could
338 serve as a role model in that they contain RE educational material integrated into one or more of their
339 core courses, although integrating a rather “dedicated” RE course into those master programs is highly
340 encouraged, as it was previously reported that RCR programs conducted separately from the standard
341 curricula were more effective than those imbedded into existing modules [30].

342

343 Responsible conduct of research education seems to be of great importance in responding to research
344 misconduct and promoting positive attitudes in research. A multi-institutional survey in the U.S., which
345 involved graduate students among the surveyed participants who were enrolled in RCR courses, reported
346 a wide range of plausible outcomes for RCR courses, which had greater impact on knowledge more than
347 fostering skills or attitudes [31]. Several other studies identified favorable outcomes of RCR education
348 in improving knowledge, attitudes, ethical decision making, self-reported behavior, and sense-making
349 skills [5, 32-34] although these improvements might have been described as being modest [5].

350

351 It is worth mentioning that despite the NIH training mandates, several studies failed to provide great
352 evidence of its effectiveness [5, 30, 35, 36]. This could be in part due to the fact that research ethics
353 education goals may not be clearly stated nor explicitly specified at the outset of the RCR programs [16].
354 Therefore, achievable goals need to be clearly articulated at the outset. Several recommendations were
355 addressed in the Delphi consensus panel report regarding the RCR goals and contents and how to adapt

356 the RCR programs to fit the trainees needs [13]. Kalichman and Plemmons have also recommended
357 potential goals for RCR education [16]. Another influencing factors for the effectiveness of RCR
358 educations may include lack of consensus about the contents of RCR education across different
359 institutions and programs [16, 37, 38] leading to high variability of development and implementation of
360 RCR instructions [32, 33, 37]. Furthermore, low level of institutional support [14] and uncoordinated
361 initiatives [3] may also have a negative impact on the outcomes of RCR education. In addition to
362 specifying clear goals for RCR education, several other strategies have been proposed in the literature to
363 overcome the obstacles mitigating the outcomes of RCR training, including competence-based
364 development of research ethics instructions [39, 40], applying research-based narratives assignment [41,
365 42], careful consideration of instructional designs [35, 43], applying the principles of andragogy [44] and
366 leaning theories [43, 45] to RCR education, improving mentoring strategies of RCR educators [9, 46-
367 49], and using situational factors in real research environment rather than classrooms experience [35, 50,
368 51], as well as online teaching using internet-based courses [52-55].

369

370 **Limitations**

371 There are limitations to this research that can be addressed and mitigated with further research. One
372 major limitation was the lack of available information online for some of the global programs. In
373 addition, identification of research ethics education material for global programs was based solely on
374 keywords we highlighted from the course description to reflect research ethics instruction (Table 1).
375 There is the possibility that these keywords may refer to topics unrelated to research ethics (for instance
376 key words such as issues, problems, regulatory, etc.). As such, our model of data collection and analysis,
377 may lead to an overestimation of research ethics education status rather than an underestimation. For the
378 same reason, little can be inferred about the actual content and the range of RCR topics and core areas
379 covered in the global programs. Moreover, we only included master programs that have mixed course-
380 load and research mandates. Programs that were completed entirely by coursework were excluded as
381 they do not require students to carryout research. Programs entirely focused on research were excluded
382 as well, as there was not clear information available online regarding the structure of these programs.
383 Besides, this study focused on “formal education/training,” whereas informal training may occur within
384 master programs that required students to conduct research. Using ranking systems other than the QS

385 World University Ranking (2017) may lead to results that are slightly different, as the top 10 universities
386 by subject of pharmacy and pharmacology are slightly different depending on the ranking system used.

387

388 It is worth mentioning that data collection from local programs in Jordan was more feasible compared to
389 the global programs as it was easier to reach out to schools within Jordan, when needed. For global
390 programs, we did not try to reach out to schools, rather we used information that was available online.

391

392 **Conclusions**

393 Training in the RCR for pharmacy graduate students involved in academic research is lacking to higher
394 extent in Jordan than globally as indicated in this qualitative study. Integrating a standalone RCR courses
395 into pharmacy graduate programs and widening the scope of core RCR topics discussed in existing RCR-
396 based courses is highly encouraged. On the other hand, newly established RCR training programs in the
397 MENA region such as the “Research Ethics Program in Jordan; REPJ” which was established in 2015
398 and is supported by the NIH Fogarty International Center to target young researchers from the MENA
399 region, could play an important role in building capacity among the next generation of scientists. The
400 RCR-Jordan fellows in return would play a pivotal role in raising awareness towards the importance of
401 RCR education and fostering a research culture in which the RCR principles are expected and accepted.

402

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406

407 **Disclosure statement**

408 The authors report no conflict of interest.

409

410 **Author contribution**

411 Conceptualization: CN WSA

412 Formal analysis: WSA

- 413 Investigation: WSA CN
- 414 Methodology: CN WSA
- 415 Project administration: CN
- 416 Supervision: CN
- 417 Writing – original draft: WSA
- 418 Writing – review& editing: CN WSA
- 419

420 **List of abbreviations**

- 421 RCR: Responsible Conduct of Research; JU: The University of Jordan; JUST: Jordan University of
- 422 Science and Technology; MENA: Middle East and North Africa; NIH: National Institute of Health; FIC:
- 423 Fogarty International Center; MSc: Master of Science; U.S.: The United States; QS: Quacquarelli
- 424 Symonds; ISS: International Student Survey; MERIT: Middle East Research Ethics Training Initiative;
- 425 NSF: National Science Foundation; NIFA: National Institute of Food and Agriculture; USDA: The
- 426 United States Department of Agriculture; PHS: Public Health Service; REPJ: Research Ethics Program
- 427 in Jordan.
- 428

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557
558

559

560

561 **Supporting information**

562 **S1 Table. Research ethics education offerings of pharmacy master programs in**
563 **Jordan. Listed are universities that offer master programs with mixed coursework**
564 **and research requirements.**
565

566 **S2 Table. Research ethics education offerings of pharmacy master programs in**
567 **the top 10 universities globally by subject of pharmacy and pharmacology. Listed**
568 **are all top 10 universities and all pharmacy master programs they offer by mixed**
569 **coursework and research requirements.**
570

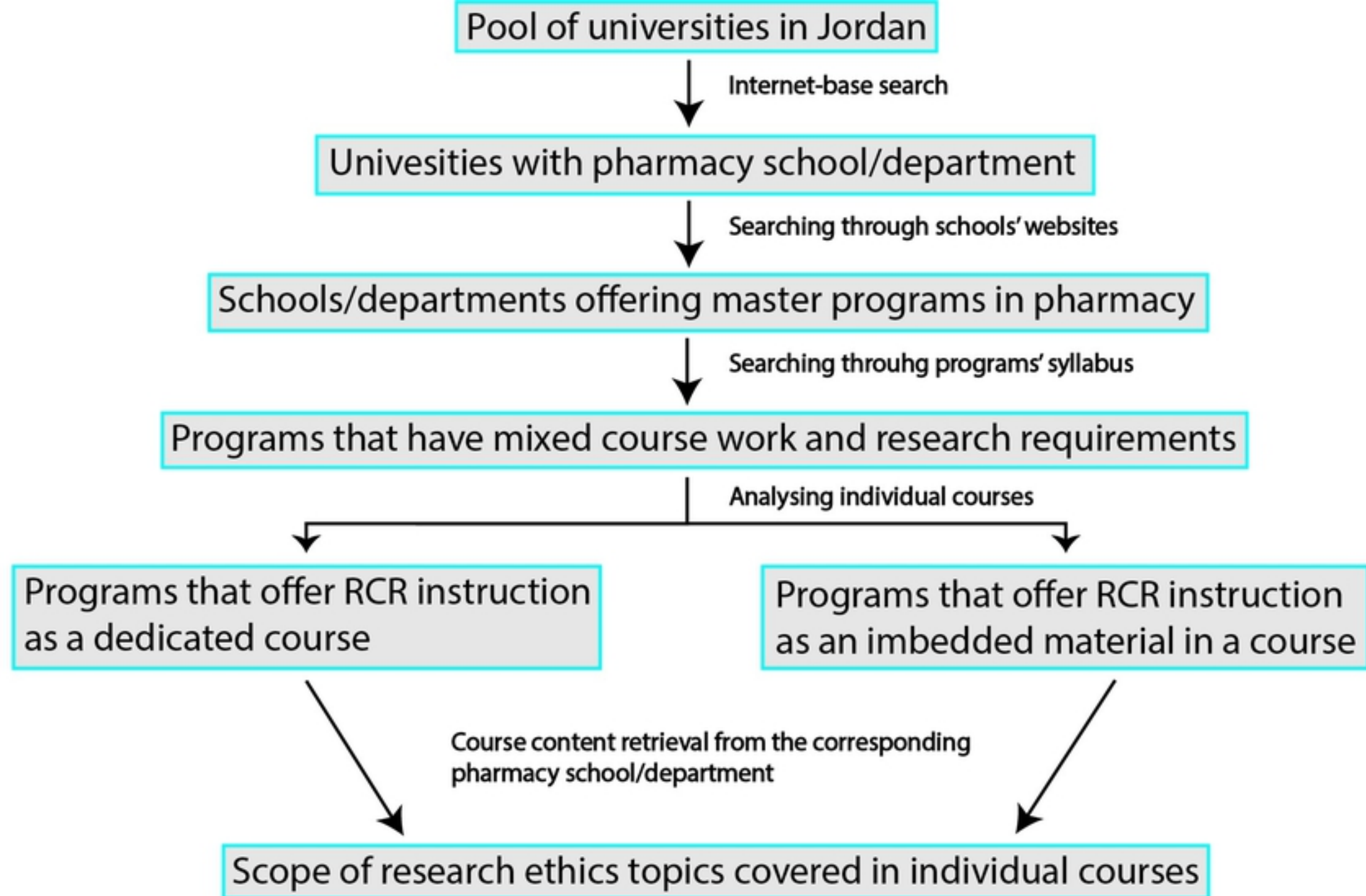


Figure 1

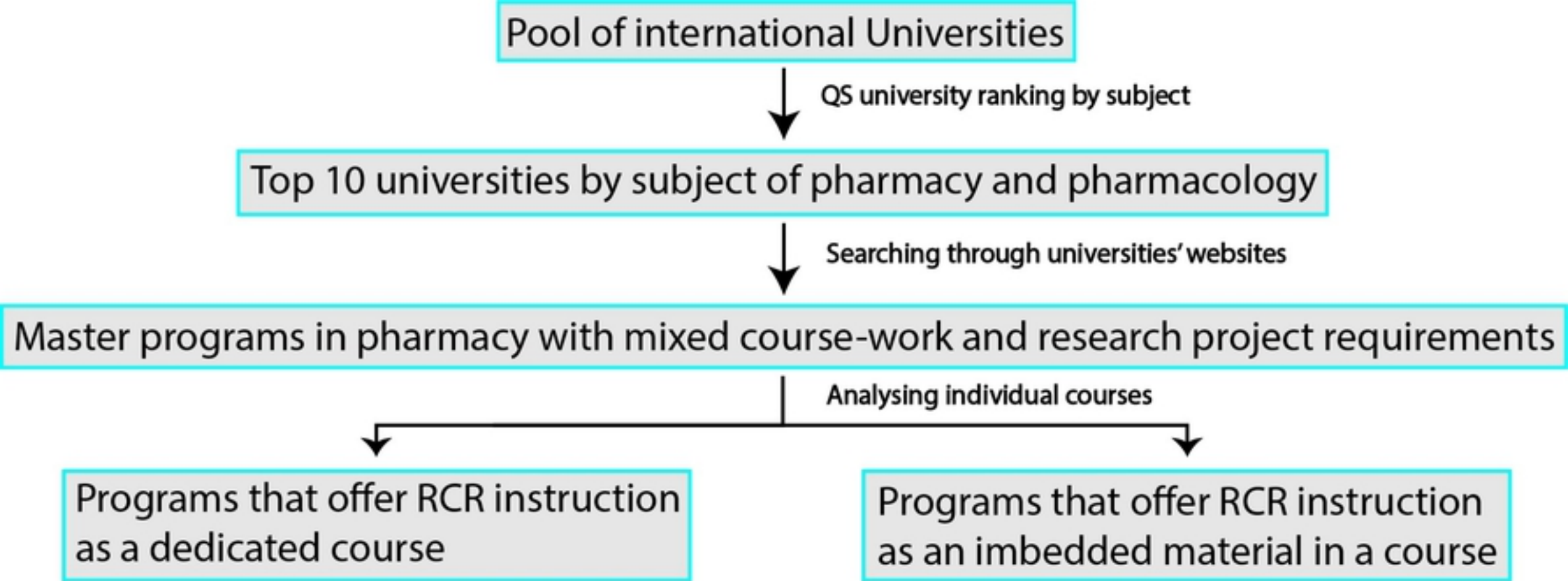


Figure 2

Step 1: Decontextualisation

Unit of analysis = Individual programs

Meaning units = Courses descriptions

Condensed meaning units = Keywords

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Step 2: Recontextualisation

Compare with the original text

Discard dross content



Step 3: Categorization and theming

Subcategorization

Categorization

Theming



Step 4: Compilation

Compiling results into meaningful conclusions

Figure 3