

1 TITLE PAGE

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3 **A model to facilitate research uptake in health care practice and policy development for low-**
4 **resource countries**

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36 ABSTRACT

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38 BACKGROUND: Despite the availability of numerous models for knowledge translation into health
39 care practice and policy development, research uptake remains low in resource-limited countries.
40 Recent reports have indicated that this trend of low research uptake is likely to continue for some time
41 in low-resource countries unless initiatives to promote research uptake strategies consider challenges
42 faced by these countries. This paper aimed to develop a tailored model to enable the optimal uptake
43 of public health research findings for health care practice and policy development in a low-resource
44 country.

45

46 APPROACH: The study used a two-phase exploratory sequential approach. Qualitative data were
47 collected through semi-structured interviews with 21 participants. Quantitative data were collected
48 through an online cross-sectional survey administered to 212 respondents who conducted research
49 studies in the study area between 2014 to 2019.

50

51 HIGHLIGHTS: The findings indicated a lack of awareness of research results and champions to lead
52 engagements among research stakeholders. Researchers also fail to align public health research
53 projects to existing local contexts and available resources as well as establish and sustain beneficial
54 collaboration between all research stakeholders. The survey indicated a total of 13 factors needed for
55 research uptake, namely four individual factors (support, experience, motivation & time factor); four
56 organisational factors (research agenda, funding, resources & partnerships), and five research
57 characteristics factors (gatekeeping, local research committees, accessibility of evidence, quality of
58 evidence and critical appraisal skills). The Spearman's correlation coefficient revealed that of the 13
59 factors, only six factors had a significant positive correlation with research uptake, namely: support,
60 experience, motivation, time factor, resources, and critical appraisal skills.

61

62 CONCLUSION: In the context of research uptake for healthcare practice and policy development, we
63 consider this model unique and appropriate for low-resource countries in that it integrated the PARIHS
64 framework with the logical framework to streamline the research uptake process.

65

66 KEYWORDS: Healthcare Policy, Healthcare Practice, Low-resource countries, Research Uptake,
67 Model

68

69

70 BACKGROUND

71

72 For a considerable period, private funders, governments and individual researchers have been funding
73 research projects to produce a foundation of health-related knowledge for healthcare practice and
74 policy development. Yet, the gap between research produced and research uptake is increasingly
75 being recognised as a challenge by scholars in the conversation around health policy formation [1].
76 The situation is worse in low-resource countries where enormous time-lags between discovery and
77 integration in practice and policy development is affected by a shortage of resources and competing
78 priorities [2]. Scholars have indicated that the trend is likely to continue for some time in low-resource
79 countries unless initiatives to promote research uptake strategies consider challenges faced by these
80 countries [3].

81

82 Relationships between health researchers and end-users have varied. In some instances, limited
83 engagements have negatively affected health research uptake for practice and policy development
84 [4]. Generally, researchers produce research evidence that requires end-users such as policymakers
85 and health practitioners to have analytical skills and clinical knowledge necessary to adopt and
86 implement the research evidence. In this instance, end-users become involved in the research
87 project's tail-end when findings are ready for dissemination through presentations or publication in
88 academic journals. Ultimately, it renders the process of knowledge translation into practice and policy
89 development as an uncoordinated activity between knowledge producers and knowledge users rather
90 than a holistic process [5].

91

92 The concept of 'research 'uptake' is intended to close the gap by affording end-users and relevant
93 stakeholders an opportunity to be immersed in shaping the research project in one way or another, so
94 they know about the existing research project [6]. Grobbelaar defines 'research uptake' as a process
95 by which knowledge generated through research enters the domain of audiences such as
96 practitioners, scholars, end-users, policymakers in government and other agencies [7]. Accordingly,
97 research uptake starts from the inception of a research project. The Development Research Uptake
98 in Sub-Saharan Africa emphasised that research uptake is a comprehensive process that focuses on
99 the entire research cycle, from the proposal right through to practice and policy development [8]. This
100 process is significant for all stakeholders as they become aware and can shape the project from the
101 onset, stimulating interest in the research project [6,7,8].

102

103 The successful implementation of research uptake is a joint effort. It requires a mirrored identification
104 and selection of appropriate stakeholders from the onset of a research project to stimulate ownership
105 and understanding among stakeholders. Uprety indicates that when research uptake is embedded

106 within relevant programmes, the probability of research outcomes being considered for its intended
107 audience becomes high [9]. According to the United Kingdom's Department for International
108 Development, there are varied healthcare research stakeholders and include anyone with the potential
109 or an interest in health research [10]. Importantly, Reed et al. recently argued that a health research
110 stakeholder has a possible two-way interaction of influence, either influencing or influenced by
111 organisational actions, decisions, policies, practices, or goals [11]. A further important part is that
112 engaging stakeholders begins with mapping who are the relevant stakeholders [12]. Essentially,
113 engagements and communications with relevant stakeholders are integral in realising health
114 research's impact [13]. The mapping process is facilitated by determining each stakeholder's potential
115 interest and the nature and extent of the required engagement to facilitate research uptake [14].

116

117 MODELS AND FRAMEWORKS ASSOCIATED WITH RESEARCH UPTAKE

118

119 Increasing demands for accountability from research stakeholders have placed pressure on
120 researchers to provide information systematically, timely, and thoroughly to funders and end-users
121 [15]. To comply with the demands for accountability, various theories, frameworks and models have
122 been developed in a quest to describe the process of implementing research findings for healthcare
123 practice and policy development [16]. The table below depicts a fraction of prominent models and
124 frameworks associated with research uptake. Most of these frameworks/models have been used in
125 high-income countries to determine the impact of health research, accountability (value for money),
126 advocacy (increase awareness), and the learning purposes for identifying opportunities, challenges,
127 and successes emanating research performed in an institution.

128

129

Table 1

130

131 Most of these developed frameworks were tailored to the context of respective countries of origin,
132 which were mainly high-income countries. There is a common assertion from scholars that public
133 health research uptake depends on considering several local barriers and applying tailored research
134 uptake strategies to overcome those barriers [28]. While there seems to be an agreement on
135 developing tailored strategies for research uptake, traditionally, very little is done actively to promote
136 research uptake. Hence, the researchers in this study developed a tailored model for research uptake,
137 which is easy to understand and practical to solve real-life problems. The novelty of the research
138 uptake model discussed in this paper promotes accountability by all research stakeholders. The local
139 research committee plays a central role in availing essential strategies to enable research uptake in
140 low-resource countries.

141

142 THEORETICAL FRAMEWORK

143
144 The Promoting Action on Research Implementation in Health Services (PARIHS) framework,
145 advanced by Rycroft-Malone, guides the study's overall conduct [29]. The PARIHS framework was
146 developed and tested in international arena research within the nursing fraternity to signify the
147 complexities of undertaking research uptake [30]. The study could not wholesomely adopt the PARIHS
148 framework guiding statements; instead, statements were amended for the framework to suit the local
149 context. The PARIHS framework views successful research uptake as a function of the relationships
150 between three domains: evidence, context, and facilitation. In other words, for research uptake to
151 succeed, there should be clarity about the strength of evidence used, the environment (context) in
152 which research will be used, and the method required for facilitating research uptake [31]. The PARIHS
153 framework for determining research uptake factors was integrated with the logical framework to offer
154 a more practical approach towards improving research uptake [32].

155 156 RESEARCH DESIGN AND METHODS

157
158 The study followed a mixed-methods design with an exploratory sequential approach to develop a
159 model for the uptake of research for healthcare practice and policy development [33]. Inductive
160 reasoning was used during phase one of the study, followed by deductive reasoning during phase two.
161 Phase three of this study mainly focused on abductive reasoning to develop a model for the uptake of
162 research. This blending of data types yields greater validity of research results using the richness and
163 breadth of qualitative findings, coupled with quantitative data precision, to comprehensively
164 understand the studied phenomenon [34].

165 166 *Study setting*

167
168 The study was conducted in Mpumalanga Province, located in the north-eastern part of South Africa,
169 sharing borders with Mozambique to the east and Eswatini to the south-east. The province shares
170 common borders with Limpopo Province to the north, Gauteng Province to the west, Free State
171 Province to the south-west and Kwa-Zulu Natal to the south-east. It has a population size of just over
172 4.6 million people, representing 7.8% of the total country's population [35]. Due to the international
173 borders and health challenges associated with people's migration across borders [36], the province is
174 an ideal research hub for several research organisations. Public health research in Mpumalanga
175 Province is carried out in all three districts, namely Gert Sibande, Nkangala, and Ehlanzeni District
176 Municipalities, which share 23 district hospitals, five tuberculosis specialised hospitals, three regional

177 hospitals, two tertiary hospitals, and 279 primary healthcare facilities. These facilities service just over
178 90% of the Mpumalanga Province population [37].

179

180 *Population and Sampling*

181

182 According to data from internal records (research files) of our province, 399 public health research
183 studies were conducted from 2014 to 2019. This translates to an equivalent of 67 public health
184 research studies conducted per annum. Postgraduate students conducted research studies for
185 academic purposes, research institutions for academic or non-academic reasons, and in-house
186 research, mainly for quality improvement plans. We, therefore, used 399 primary investigators who
187 conducted public health research studies as the primary sources of data for both the qualitative and
188 quantitative phases of this study. Initially, participants were not categorised as researchers, frontline
189 workers, programme managers, senior managers or directors at higher education institutions, but
190 participants were allowed to categorise themselves into any group. For this first cohort, non-probability
191 purposive sampling was used [38]. In phase two of this study, no sampling procedures were used, as
192 the total target population was studied.

193

194 *Data Collection Methods*

195

196 This study was conducted through a phased approach.

197

198 ***Phase one: Qualitative Phase***

199

200 The first phase of this study involved a qualitative approach intended to explore and describe key
201 stakeholders' perceptions of research uptake in healthcare practice and policy development from an
202 insider's perspective [39]. The findings contributed to the development of an online questionnaire for
203 phase two of this study.

204

205 *Data Generation*

206 Semi-structured interviews were used, organised around an interview guide to generating data for this
207 phase [40]. With permission from participants, we audio-recorded the interviews to be transcribed later
208 in preparation for data interpretations. Participants who were interviewed included frontline workers
209 (7), researchers (6), programme managers (4), senior managers or directors at higher education
210 institutions (4) who are knowledgeable and experienced about the focus of the study. A total of 21
211 interviews were conducted to gather information from as many perspectives on the uptake of research
212 findings in healthcare practice and policy development. A journal was used for taking detailed field

213 notes during the interviews [41]. Although each interview lasted for about 42 minutes, the overall time
214 spent with the interviewee was approximately 90 minutes.

215

216 *Data Analysis*

217

218 Interviews were transcribed verbatim in preparation for data analysis and interpretation. Transcripts
219 were read repeatedly to develop a final edited set of transcripts ready for analysis. All transcripts in
220 Word format were uploaded onto the Atlas. Ti 7.5.18 software program for further analysis. The data
221 analysis process followed guided thematic analysis proposed by [42]. To enhance the analysis'
222 credibility, two coders independently reviewed the data. Transcripts were carefully read to develop a
223 general understanding of the data. Ideas that came to mind were recorded by writing short memos. A
224 qualitative codebook contained statements of the codes for the database. After completing the data
225 analysis, a meeting was held with the independent coder to finalise the findings. In addition to using
226 an audio recorder, a paper trail (reflective journal) was kept to track all the study's steps and processes
227 to ensure confirmability.

228

229 ***Phase two: Quantitative Phase***

230

231 The qualitative phase findings were quantitatively tested in a structured online questionnaire including
232 all stakeholder groups (i.e. researchers, programme managers, frontline workers and senior managers
233 or directors).

234

235 *Data Collection*

236

237 After establishing the total number of research studies that were conducted within the sampled period
238 (from the year 2014 to 2019), an online email Likert Scale (5 scales) survey questionnaire [43] was
239 sent to all identified stakeholders who conducted research in our province to assess whether research
240 uptake relates to healthcare practice and policy development.

241

242 Initially, a questionnaire was sent to five respondents for piloting purposes. These responses did not
243 form part of the study but were only used for testing purposes. Inputs from the five respondents were
244 used to modify or improve the instruments' content before being used in the main study. A statistician
245 was consulted for input, which further assisted in refining the data collection instruments. The pilot
246 study's responses were also exposed to a reliability test using 'Cronbach's alpha coefficient [44]. The
247 overall 'Cronbach's alpha for four primary constructs (Research uptake [questions B2-B6], individual
248 factors [questions C1-C21], organisational factors [questions D1-D20], and research characteristics

249 [questions E1-E20]) representing 66 items was 0.706, illustrating that the questionnaire was reliable.
250 Scholars have proposed a Cronbach's alpha value of 0.5 or more significant in assessing an
251 instrument's internal consistency [45].

252

253 *Data Analysis*

254

255 Data gathered from research records were collected using REDCap Survey (web-based secure
256 application). SAS Version 15 and Microsoft Excel were used to analyse data with a statistician's
257 assistance.

258

259 STUDY OUTCOMES

260

261 ***Main Qualitative Findings***

262

263 *Biographical information of participants*

264

265 Table 2 indicates four programme managers, four directors of various institutions (three from academic
266 institutions and one from a private healthcare institution), six researchers, and seven frontline staff
267 members who participated in the semi-structured interviews. Most participants (57%) were females.
268 Three participants were aged 25-34 years (14%), five aged 35-44 years (24%), six were aged 45-54
269 years (29%), and seven were aged 55-64 years (33%), with a mean age of 47.6. In total, participants
270 had a mean of 19.4 years of work experience.

271

272 Table 2

273

274 *Overview of the themes*

275

276 The analyses indicated six main themes attributed to research uptake for healthcare practice and
277 policy development.

278

279 1. Understanding of the concept: Research uptake

280

281 A repeated and persistent theme was that research uptake is vital in ensuring that health research
282 findings find their way into healthcare practice and policy development; otherwise, there is no point in
283 conducting research. Participants emphasised research uptake as a process requiring adequate

284 involvement of all relevant stakeholders for the duration of the research project, and two cases are
285 used to illustrate this:

286

287 *'Research uptake, I think it's these activities that contribute to the use of research in practice and*
288 *that also will influence policy or decision making to those people that are supposed to make a*
289 *decision for the department.'* (Participant 4)

290

291 *'What is vital is that, from very, very early on, we [short pause affirming that it is currently not*
292 *happening] researchers should be talking and engaging with people in the services, at different*
293 *levels: provincial, district, national.'* (Participant 7)

294

295 2. Research use for decision-making

296

297 A fair requirement for considering research evidence was good quality research, conforming to
298 rigorous, acceptable standards of scientific investigation as indicated by participants. Participant 10
299 described adequate and quality research concerning his daily routine practice.

300

301 *'So, in my environment, we are recipients of outputs of research and that informs what we do, from*
302 *time to time. Even the strategies that we utilise in doing them, they are usually based on research.'*
303 (Participant 10)

304

305 Another persistent theme was that for research uptake to occur, the quality of research findings ought
306 to be acceptable to research users. In this regard, a participant said the following:

307

308 *'So, if you have reliable data, then you can actually focus on the real problem areas.'* (Participant
309 12)

310

311 Some participants acknowledged a growing trend of using raw administrative/clinical data (*informal*
312 *research*) for decision-making. It appeared that the driving force behind using *informal research* was
313 often the need to make quick decisions.

314

315 *'Our environment is very, very fast-paced, so we do not always have the luxury of waiting to conduct*
316 *full structured formal research before we take decisions. We can just identify a problem...we go*
317 *through the steps of a typical research but it's a very quick process where we identify a problem*
318 *and we say which method will be used to understand what is the problem.'* (Participant 10)

319

320 3. Role of government

321
322 Most participants indicated that the government is lagging in promoting research uptake as they
323 seemed not to be research or academically oriented. This results in research not adequately prioritised
324 and selective in picking which areas of health conditions must be prioritised.

325
326 *'[Looking distressed about lack of research uptake] ...we also feedback to district management*
327 *and...provincial management ...to district management and to the facilities, like the hospital*
328 *management, they were not very receptive.'* (Participant 13)

329
330 Participant 21 indicated an existing and continuing culture of insufficiently prioritising research within
331 various government departments.

332
333 *'...as a department, I will be talking as a department, we don't take research seriously, to be honest.*
334 *We don't take research as one of the key aspect(s) in the department.'* (Participant 21)

335
336 4. Research uptake stakeholders

337
338 Unlike part-time researchers, there are those whose core function is research. These are students at
339 universities who research the duration of their master's degrees or PhD, and international researchers
340 affiliated with independent research units who arrive for a specified period to conduct research. One
341 of the challenges experienced with these researchers was that their primary focus was on getting their
342 studies published.

343
344 *'When the research ends and I want information to go back to the community, it's so hard to get*
345 *because they're out the field now. They don't really care about us,... about the community here.*
346 *They care about their peer-reviewed papers. So, while they're busy writing peer-review papers,*
347 *they're not thinking about what ... this mean(s) for South Africa, ... the South Africans.'* (Participant
348 5)

349
350 The need for researchers, research units and funders to give back to the province and assist with local
351 up-skilling and capacitating was deemed imperative for research uptake.

352
353 *'I would like to see our young scientists being up-skilled and doing research that's relevant for us*
354 *without people coming in from outside doing the research and taking what they want back out. I*
355 *feel very strongly about that. I feel that it's fine to have people coming in to up-skill and allow our*

356 *younger generation to be the future, not people coming in and going out and not capacitating*
357 *locally.'* (Participant 6)

358

359 5. Dissemination of research findings

360

361 Participants indicated insufficient dissemination of relevant information and results regarding research
362 projects within the local settings.

363

364 *'So, is it the understanding of clinicians on the ground that this research is going to benefit their*
365 *practice? And that comes to really how does it get communicated back?'* (Participant 3)

366

367 This was further identified as an essential research uptake gap that needs to be addressed.

368

369 *'...most of the time research gets conducted, a lot of research gets conducted, and you don't get*
370 *to know the results, the recommendations, and how that can inform policy. So, it's a gap to me.'*
371 (Participant 19)

372

373 6. The local research committee

374

375 On a critical note, most participants mentioned the local research committee's need to develop health
376 research priorities and agenda. Once developed, research conducted in the province should be
377 aligned with research priorities, which, as noted by participants, does not always occur in practice.
378 The following narratives by the participants were some of the envisioned roles for the health research
379 committee:

380

381 *'Then you could use your committee to read those, decide what are important for uptake, and*
382 *channel those up to decision makers at the right level in the province where you really hope that*
383 *there will be uptake at the right policy level. That's what I think how you could use your committee*
384 *and that could be really effective.'* (Participant 17)

385

386 There was also confusion and frustration expressed on who to contact within the department.

387

388 *'They need to be more visible. And we have to understand mostly the roles of that committee. I*
389 *think perhaps there is a gap there in terms of their roles and functions.'* (Participant 2)

390

391

392 **Main Quantitative Research Results**

393
394 The statistical analysis of research uptake factors that emerged from the interviews is presented.

395
396 *Biographical information of respondents*

397
398 In Table 3, the age group composition for this study is illustrated. Of the total 212 respondents, 55
399 (26%) were aged between 35-44 years, followed by 25-34 years, which contributed 54 (26%)
400 respondents. It could thus be noted that those with ages 25-34 years, 35-44 years and 45-54 years
401 represented approximately 77% of the sample size.

402
403 Table 3

404
405 Both the median and the mode scores were 3, representing the age group 35-44 years. The mean
406 age for respondents was 43.7, ± 0.7 standard deviation, which indicates a heterogeneous sample
407 regarding age. Overall, the 'respondents' age groups suggest that they were reasonably experienced
408 to provide insight into research uptake factors. Qualifications obtained by respondents were of
409 particular importance for this study. As reflected in Table 3, about 12% of the respondents had an
410 undergraduate qualification degree or equivalent. This leaves approximately 88% of the respondents
411 with a postgraduate qualification, of whom 13 (6%) had an honours degree, and 92 (44%) had a
412 master's degree. Respondents with a doctorate and above contributed 38% of the study population.

413
414 Respondents were asked to indicate their employment sector during the completion of the
415 questionnaire. The researcher could thereby attempt to establish the pattern that mainly contributed
416 to health research in the province, which was also significant for this study. The majority of the 212
417 respondents who conducted research were from institutions of higher learning (universities and
418 colleges for obtaining a degree or diploma), contributing approximately 36.0%, while 35% were
419 working at government institutions. The remaining participants either worked for the public sector
420 (16%), were full-time students (6%), or other (7%). Cross-tabulating, the employment sector with work
421 experience revealed that the most experienced respondents had ten years or more work experience
422 and contributed 39% of the sample size.

423
424 In comparison, the least experienced had between zero to two years' work experience, contributed
425 only 2% of the sample size. Cumulatively, respondents who had five years and above contributed
426 approximately 72% of the sample size. The result revealed that those with ten or more years' work

427 experience were four times more likely to contribute to health research than those with zero to two
428 years, three times more likely than those with two to five years' work experience, and just above one
429 times more likely to contribute to health research than those with between five to ten years' work
430 experience. From Table 3, it is evident that researchers accounted for 37% of the respondents, with
431 senior managers and frontline workers accounting for 23% and 22%, respectively, of the sample size.
432 Policy/programme managers only contributed 18% of the sample size for this study. Approximately
433 62% of frontline workers who participated in this survey were from government institutions. A total of
434 39% of programme managers who participated in this study were from government institutions, while
435 a further 39% were programme managers at higher education institutions. Senior managers who
436 participated in this study included 42% of directors from institutions of higher learning and 33% of
437 directors from government institutions. Private institutions contributed 23% of the senior managers of
438 the sample size.

439

440 *Factors Affecting Research Uptake*

441

442 Considering this research area is new in the current setting, the items were tested using Exploratory
443 Factor Analysis (EFA) to measure the items' internal consistency and determine the number of factors
444 and items for each construct. EFA is a technique that statistically explores the underlying factors of a
445 variable through factor rotation based on factor loading values so that researchers assume that some
446 indicators may be related to several factors [46]. EFA was conducted in this study and employed
447 principal component analysis (PCA) as the factor extraction method and a Varimax rotation as the
448 rotation method.

449

450 The EFA indicated a total of 13 components from the survey responses which were categorised as
451 individual factors (support, experience, motivation & time factor), organisational factors (local research
452 agenda, funding, resources & partnerships), and research characteristic factors (gatekeeping process,
453 local research committee, accessibility of evidence, quality of evidence & critical appraisal skills).
454 Figure 1 indicates the average mean on research uptake factors per classification. A mean average
455 of 3.00 showed that respondents were neither agreeing nor disagreeing with the listed items of factors
456 affecting research uptake. In contrast, a mean average of 1.00 indicated a strong disagreement and
457 5.00 strong agreement with detailed items

458

459

Figure 1

460

461 In comparison with the other groups of respondents, researchers had higher mean average values on
462 the variables 'time factor' (mean= 3.69), 'support' (mean= 3.55), 'resources' (mean= 3.72), 'research

463 agenda' (mean= 2.94), 'partnerships' (mean= 2.93), and 'critical appraisal skills' (mean= 4.10).
464 Whereas, senior managers/directors had higher mean average scores on the variables: 'experience'
465 (mean= 4.41), 'motivation' (mean= 4.54), 'private funders' (mean= 2.93), and the 'quality of research
466 evidence' (mean= 3.48) compared to the other groups of respondents.

467
468 Figure 2 illustrates the average overall mean for research uptake factors against respondents'
469 employment sector, namely government employee, private or non-governmental research institution,
470 universities or institutions of higher learning, student at academic institution, and other or unemployed.

471
472 Figure 2

473
474 The results show similar patterns regarding the overall mean averages among respondents as per the
475 employment sector. However, the mean averages for government employees were lower on a number
476 of variables than for respondents from other employment sectors. Evidently from the figure above, low
477 average mean scores for government employees were observed in almost all variables except on
478 'critical appraisal skills', 'gatekeeping processes' and 'research committees' in comparison with the
479 other employment sectors. Variables 'time factor' (mean score = 2.68), 'support' (mean score = 2.32),
480 and 'resources' (mean score = 2.4) were the most predominant outliers with low mean average scores
481 for government employees.

482
483 *Spearman's Correlation*

484
485 A correlation was conducted to examine a relationship between research uptake and various potential
486 predictors [47].

487
488 1. Individual factors

489
490 The results indicated that there was a significant positive association between research uptake and
491 research experience ($r_s[212] = 0.421, p < 0.01$), and research uptake and motivation ($r_s[212] = 0.398,$
492 $p < 0.01$). These suggest a moderate concurrence between research uptake and the two variables
493 (experience and motivation). However, there was a significant positive association between research
494 uptake and time factor ($r_s[212] = 0.283, p < 0.01$), and research uptake and support ($r_s[212] = 0.260,$
495 $p < 0.01$). The results suggest a weak concurrence between research uptake and the two variables
496 (time factor and support).

497
498 2. Organisational factors

499 Results of the Spearman correlation indicated that there was a non-significant weak positive
500 association between research uptake and organisational factors of ($r_s[212] = 0.172, p < 0.05$) for
501 resources, ($r_s[212] = 0.079, p < 0.01$) for local research agenda, ($r_s[212] = 0.088, p < 0.01$) for
502 partnerships, and very weak positive association of ($r_s[212] = 0.007, p < 0.01$) for funding. However,
503 there was a significantly strong positive correlation of ($r_s[212] = 0.565, p < 0.01$) between partnerships
504 and local research agenda.

505

506 3. Research characteristics

507

508 Furthermore, the results of the Spearman correlation indicated that there was a significant weak
509 positive association between research uptake and critical appraisal skills of ($r_s[212] = 0.203, p < 0.01$).
510 There was a non-significant weak positive association between research uptake and the other
511 research characteristic factors. However, there seems to be a significant moderate association
512 between critical appraisal skills and quality of evidence ($r_s[212] = 0.340, p < 0.01$), and between
513 accessibility of evidence and quality of evidence ($r_s[212] = 0.403, p < 0.01$).

514

515 DESIGNING THE RESEARCH UPTAKE MODEL

516

517 As an exploratory study seeking to understand factors associated with research uptake for healthcare
518 practice and policy development, the researchers adopted the logical framework to develop a research
519 uptake model with the hope of improving the uptake of research findings to practice and policy. In
520 terms of utilisation of the logical framework, an important consideration is that logical framework is a
521 bottom-up approach that begins by observing views from the target group on the assessment of the
522 phenomenon investigated and their needs [48]. The approach enabled the development of a user-
523 friendly tailored model which is practical to apply despite limited resources. This incorporated the
524 establishment of specific long-term outcomes as it is necessary when applying a logical framework
525 [49].

526

527 ***Research uptake model structure***

528

529 Based on the findings of the two phases (qualitative and quantitative) of the current study, the essential
530 elements of the research uptake model for healthcare practice and policy development in a low-
531 resource setting are visually represented in Figure 3.

532

533

Figure 3

534

535 In this research uptake model, the evidence domain of the PARIHS framework was associated with
536 individual factors affecting research uptake as was evident within the empirical research phases of
537 this study. The research uptake model proposes that for low-resource countries, support, time,
538 motivation and experience represent the initial stimulating process of the research planning stage
539 (inputs). As a result, a well-motivated health research stakeholder will have the urge to successfully
540 contribute to research uptake initiatives. Furthermore, an experienced health research stakeholder will
541 enhance the health research uptake systems' credibility.

542
543 The context domain of the PARIHS framework is associated with both the local research committee
544 (LRC) for quality assurance and research project permission stages of the model. The research results
545 confirmed the factor 'resources' and several strategies which are critical for these stages. It is clear
546 from the empirical data that the local research committee is essential to creating strategies to facilitate
547 research uptake. Implementing the model depends on the availability of an up-to-date research
548 repository for enabling communication between research users and producers (activities).

549
550 The facilitation domain of the PARIHS framework was associated with three stages of the research
551 uptake model: rolling-out (intermediate outputs), facilitated uptake (outputs), and research impact
552 stages (outcomes). The empirical research phases of this research confirmed the critical appraisal
553 skills as essential for these stages. For a successful research uptake, from stage two to stage six of
554 the model, the LRC assumes an active role in facilitating the processes. Timeous feedback and
555 consistent engagements are the cornerstones of this research uptake model (outputs). They are
556 critical to sustaining interest and buy-in for the research project. A significant investment is needed in
557 low-resource countries to improve critical appraisal skills for practitioners and policy developers to
558 impact health outcomes. The subsequent section provides details on how this model could be used to
559 enhance research uptake.

560

561 ***Research uptake model elements***

562
563 The current research uptake model indicates that improving research uptake can only be successful
564 when the process is systematically and logically managed.

565

566 *Research planning stage*

567

568 The stage refers to the drafting of a research proposal to conduct a study. This process is either done
569 in-house, outsourced, or initiated by a third party in the study's current settings. Importantly,
570 participants in this current study highlighted the need for all relevant stakeholders to be involved during

571 the initial stages of the research for research uptake to succeed. Scholars agree that research uptake
572 benefits from involving research stakeholders in the design, execution and dissemination phases of a
573 research project [7,8,50]. Institutionalising a culture that supports research uptake through
574 researchers, decision-makers, and relevant personnel within the institutions would aid with the
575 implementation process.

576

577 *Local research committee for quality assurance*

578

579 The use of LRCs in preparing contextual knowledge and expertise for promoting research uptake has
580 been established in the literature [50]. This model suggests that LRCs should serve as a bridge
581 between research producers and research users by proactively availing different strategies to enable
582 research uptake. These strategies include an up-to-date local research agenda, capacity building
583 strategy, research appraisal strategy, research communication strategy and stakeholder engagement
584 strategy.

585

586 *Research project permission*

587

588 Following the approval of a research project by an ethics committee, the research is uploaded to the
589 research repository for the gatekeeper's permission process. A well-designed research repository will
590 facilitate communication between researchers and gatekeepers by providing updates on the status of
591 the research while also serving as a storage facility for research documents. Since most low-resource
592 countries are affected by a shortage of resources, personnel and competing priorities [2], this paper
593 proposes that a research project should be evaluated based on two fundamental questions:

594

595 First, the availability of resources at the local institutions to support the research, these include
596 personnel, facility equipment, availability of space, and others. Failure to understand these
597 requirements from the onset of a research project could result in misunderstanding, which could have
598 a devastating effect on an organisation (service delivery) and the researcher, and this without any
599 malice being intended. The LRC is expected to decide to either accept, review, or as a last resort,
600 reject the research project. Second, the suitability of the research project for adoption and subsequent
601 research uptake. In this instance, LRCs consider its strategic research documents in consultation with
602 experts in a related field to determine whether the project addresses any locally identified research
603 priorities.

604

605 *Rolling-out stage*

606

607 This stage refers to the actual data collection process. Not enough can be said about effective
608 communication, which is perhaps one of the most critical missing links observed in this current study.
609 All stakeholders must receive regular feedback during the data collection process [51]. This is
610 important to highlight research progress, challenges, and engage with stakeholders to solicit research
611 ideas. Should the research project meet the criteria for adoption by the LRC, stakeholders are
612 identified. These would include experts nominated because of expertise in a particular field of study,
613 who will play a significant role in further assisting and 'shaping' the research project for successful
614 research uptake. Relevant experts could be clinical experts, decision-makers, and a community
615 member, all of whom may provide different expertise.

616

617 *Facilitated research uptake and research impact*

618

619 When communicating research findings, it is also important to understand the types of audience for
620 which the research is intended to benefit research uptake. This refers to produced research evidence
621 that must be disseminated to appropriate audiences using an appropriate platform. Research findings
622 deemed suitable for healthcare practice and policy development are adopted by stakeholders to inform
623 practice and policy. All research findings/reports are uploaded on the repository for future access and
624 utilisation of the information. A successful research uptake study should improve service delivery or
625 healthcare practice, advances in policies, improved research capacity, and improved health research
626 systems. The benefits are improved patients' outcomes [52].

627

628 LIMITATIONS

629

630 Research uptake is a complex process that requires the involvement of all relevant stakeholders, and
631 the researchers felt that several stakeholders were left out in this study, which is a selection bias. In
632 developing this model for low-resource countries, the researchers could not gather data from two key
633 stakeholders for research uptake. These include members of the public and politicians in leadership
634 who are responsible for policies. It would have been beneficial in this study to get their views and
635 strategies for improving research uptake. De Freitas established the importance of involving lay
636 citizens in research projects [53]. This enables them to have a voice in health decision-making
637 processes to improve the quality of health research, healthcare practice and public health
638 interventions. Furthermore, the need to speak to politicians in a more engaging narrative with the
639 attention on returns on investment is critical to research uptake [54].

640

641 CONCLUSION

642

643 Several conclusions were drawn from the results that could be generalised across the general study
644 population. It is clear from the empirical data that the LRC is critical in creating strategies which will
645 facilitate research uptake, whereas the success of implementing the model depends on the availability
646 of up-to-date research repository for enabling communication between research users and producers
647 (activities). The findings suggest that it is critical to institutionalise a culture that supports research
648 uptake through the engagement of researchers, decision-makers, and relevant personnel within the
649 institutions to facilitate buy-in at the initial phase of the research process; this would aid with the
650 implementation process. It is also critical to governments, particularly in low-resource countries, to
651 invest substantially in developing strong research skills amongst government employees and retaining
652 such skilled healthcare workers contributing to research uptake. Timeous feedback and consistent
653 engagements are the cornerstones of this research uptake model (outputs).

654
655 This model is unique in that it successfully integrated the PARIHS framework with the logical
656 framework to streamline the research uptake process for public healthcare practice and policy. The
657 model encourages specific behaviours and activities associated with research uptake for individual
658 stakeholders through the development of various essential strategies. Despite the model providing a
659 comprehensive list of activities required for a successful research uptake process, the researchers are
660 mindful that all the processes detailed in the model were designed specifically to address issues
661 associated with low-resource countries as identified during the model conducting of the study.
662 However, the model and its application can be modified for use in other settings based on conditions
663 associated with respective settings, such as resource availability and critical appraisal skills. The
664 model process is cyclic in nature, allowing a continuous engagement between the LRC, researchers,
665 and all other relevant public health research uptake stakeholders. This assists in curtaining the existing
666 gap between research producers and research users whilst promoting long-lasting partnerships.

667

668 LIST OF ABBREVIATION/ACRONYMS

669

670 CAHS: Canadian Academy of Health Sciences

671 DRUSSA: Development Research Uptake in Sub-Saharan Africa

672 EFA: Exploratory Factor Analysis

673 KTA: Knowledge to Action

674 LRC: Local Research Committee

675 OMRU: Ottawa Model of Research Use

676 PARIHS: Promoting Action on Research Implementation in Health Services

677

678

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826

827 END MATERIALS

828

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830 the process and sharing their time, knowledge, and perspectives regarding
831 factors affecting research uptake in low-resourced settings.

832

833 *Author contributions:* Both authors were involved in conceptualising the article. The first author
834 collected the data; both authors were involved in the data analysis and writing
835 of the article. Both authors read and approved the final version.

836

837 *Disclosure statement:* The content is solely the responsibility of the authors.

838

839 *Ethics and consent:* Ethical conduct was considered in terms of control over the process, and a
840 high degree of was placed on the research participants. All participants gave
841 written informed consent anonymity and confidentiality were provided for all.
842 Permission to conduct the study was sought from the Research and Ethics
843 Committee of the University of South Africa (Department of Health Studies
844 (HSHDC/712/2017). The study was also approved by the Provincial Health
845 Research Committee in Mpumalanga (MP_201711_006).

846

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849

850 *Paper context:* Research uptake is significant to healthcare practice and policy development.
851 However, research uptake is a lengthy, complicated process, and despite a
852 growing body of literature on effective strategies, many low-resourced
853 countries continued to struggle. To our knowledge, there is no other research
854 uptake model developed for low-resourced countries uncovered during the
855 appraisal of literature that considered improving research uptake despite
856 limited resources. The primary value of the research uptake model is its
857 usability in low-resource countries experiencing competing priorities. The
858 model encourages specific behaviours and activities associated with research
859 uptake for individual stakeholders. Not only does it lead to a better working
860 relationship between researchers and research users, but it is vital for making
861 an improved decision about Public Health.

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863 *Data availability:* Supplementary data is available at the Health Research Policy and Systems
864 Journal online, and additional data that support these finds are available from
865 the authors on reasonable request.
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Model or framework and Origin	Description	Limitations	Sources
CAHS framework: The Canadian Academy of Health Sciences (CAHS) framework is mainly referred to as the CAHS Payback Framework, adapted from the payback model developed by Buxton and Hanney in 1996.	The framework aims to capture specific impacts in multiple domains, at various levels, and for a wide range of audiences to determine how research activity influences decision making.	Labour intensive and could require substantial investment in some circumstances, and the framework itself is tailored to the Canadian context.	[17,18].
IOWA model: The Iowa Model was founded by a group of nurses from the University of Iowa Hospitals, Iowa Clinics, and Nursing College in 1994.	The model is intended to use research findings to improve healthcare quality, monitor healthcare costs, and improve nursing practice.	Although the literature has shown increasing trends in applying this model, many low-resource countries lack interest in using the model, mainly due to healthcare practice barriers such as lack of time, relevant research studies, resources, and insufficient organisational support.	[19,20,21].
Ottawa Model of Research Use: The Ottawa Model of Research Use (OMRU) was established by Logan and Graham in the late nineties for use by policymakers with an interest in evidence-based research for healthcare practice by practitioners and researchers.	The model assists administrators to control factors that will influence the likelihood of organisational-level changes occurring and how the changes occur. In this model, patients play a significant role when the innovation is developed, implemented and evaluated	Using OMRU requires considerable time and resources to plan and implement strategies to change practice. The model does not yet provide detailed information on specific strategies to use in various circumstances to translate new knowledge. This could likely results in limited use in low-resource countries.	[22].
Knowledge-to-Action framework: First reported in 2006, the Knowledge to Action (KTA) framework is a	The KTA Framework is based on the analysis of 31 planned action theories to offer a holistic view of the phenomenon by integrating	The framework does not prescribe specifically what needs to be done at each phase, making it difficult for	[23].

<p>conceptual evidence-based framework developed in Canada in response to confusion caused by the numerous terms used to describe the process of translating knowledge into action.</p>	<p>concepts of knowledge creation and action (Action cycle). It is viewed as a cyclical process in which research features, knowledge transfer intervention, and the evaluation process lead to the identification of novel problems. KTA allows the identification of barriers to the use of knowledge, while it allows the transfer of knowledge to action into manageable sections.</p>	<p>adoption in low-resource countries.</p>	
<p>PARIHS framework: The Promoting Action on Research Implementation in Health Services (PARIHS) framework was founded in 1998 by Kitson and colleagues, to provide an alternative to existing one-dimensional models of transferring research to practice.</p>	<p>The PARIHS framework was developed and tested in an international arena, mainly for research within the nursing fraternity to signify the complexities of undertaking research uptake. The PARIHS framework views successful research uptake as a function of the relationships between three domains, namely evidence, context, and facilitation.</p>	<p>There is no scaling provided with statements of the framework (constructs are not operationalised), which implies the need for further developmental work on these measures to provide usable scores for easy application</p>	<p>[24,25].</p>
<p>STAR model of Knowledge Transformation: Founded by Stevens in the early 2000s at the Academic Centre for Evidence-Based Practice at the University of Texas Health Science Center in San Antonio.</p>	<p>The Star Model of Knowledge Transformation was aimed at providing an understanding of the cycles, nature, and characteristics of knowledge used in several aspects of evidence-based practice. The model helps in the systematic conversion of the best available evidence through different stages to impact health outcomes.</p>	<p>A disadvantage of this model is the long period it takes to translate evidence due to the rigorous practice involved in understanding the cycle.</p>	<p>[26,27].</p>

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910 **Table 2: Biographical information of participants (phase one)**

		Frontline staff (N=7)	Researchers (N=6)	Programme managers (N=4)	Academic institution & private healthcare institution (N=4)
Participants ID:		1; 3; 8; 11; 12; 13; 15	4; 6; 7; 14; 16; 18	2; 19; 20; 21	5; 9; 10; 17
Age Group: N (%): (Mean±SD) = 47.6±2.4					
25-34		2 (28.57)	1 (16.67)	0	0
35-44		2 (28.57)	1 (16.67)	0	2 (50)
45-54		2 (28.57)	3 (50)	0	1 (25)
55-64		1 (14.29)	1 (16.67)	4 (100)	1 (25)
Gender N (%)					
Female		4 (57.14)	3 (50)	3 (75)	3 (75)
Male		3 (42.86)	3 (50)	1 (25)	1 (25)
Years of work experience: N (%): (Mean±SD) = 19.4±1.9					
2-5 years		1 (14.29)	1 (16.67)	0	0
6-10 Years		1 (14.29)	2 (33.33)	1 (25)	0
11-38 years		5 (71.43)	3 (50)	3 (75)	4 (100)
Educational level: N (%)					
Degree		4 (57.14)	0	0	0
Honours degree		1 (14.29)	0	2 (50)	0
Master's degree		2 (28.57)	4 (66.67)	2 (50)	1 (25)
Doctoral degree		0	2 (33.33)	0	2 (50)
Post-doctoral degree		0	0	0	1 (25)
Employment sector: N (%)					
Government Institution		4 (57.14)	1 (16.67)	4 (100)	0
Institution of higher learning		1 (14.29)	2 (33.33)	0	3 (75)
Private institution		2 (28.57)	2 (33.33)	0	1 (24)
Student at academic institution		0	1 (16.67)	0	0

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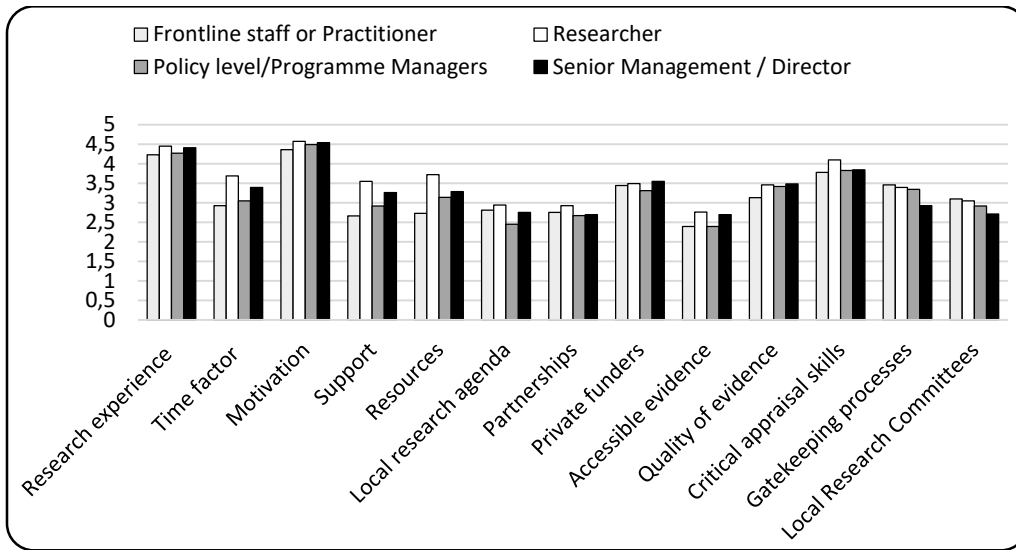
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916 **Table 3: Biographic information of respondents (phase two)**

Education versus age group								
Count								
		Age group						Total
		18-24	25-34	35-44	45-54	55-64	65+	
Education	Degree	5	10	6	1	3	1	26
	Honours degree	0	10	1	2	0	0	13
	Master's degree	0	26	24	29	13	1	93
	Doctoral degree	0	6	18	16	17	5	62
	Post-doctoral	0	2	6	5	3	2	18
Employment sector versus age group								
Employment sector	Government	2	27	14	20	11	1	75
	Universities/ Institutions of Higher Learning	0	8	24	20	18	7	77
	Private/Non-Governmental Research Institution (NGOs)	0	9	11	10	4	0	34
	Student at academic institution	2	5	4	1	0	0	12
	Other/Unemployed	1	5	2	2	3	1	14
Position versus age group								
Position	Frontline staff or Practitioner	2	23	10	6	6	0	47
	Researcher	3	22	22	16	13	3	79
	Policy level/Programme Managers	0	7	9	15	5	2	38
	Senior Management / Director	0	2	14	16	12	4	48
Work experience versus age group								
Work experience	0-2 years	1	11	8	3	0	1	24
	2-5 years	2	16	9	4	0	0	31
	5-10 years	1	22	24	12	9	1	69
	10+ years	0	2	14	33	27	7	83
	not applicable	1	3	0	1	0	0	5
Total (in each category)		5	54	55	53	36	9	212

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929 **Figure 1: Average mean on research uptake factors per classification**

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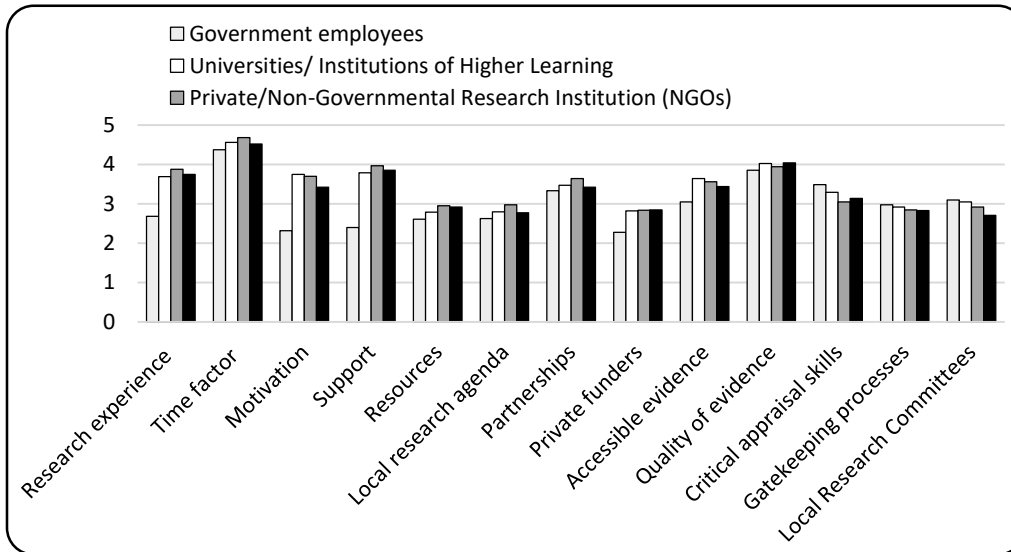
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954 **Figure 2: Average mean on research uptake factors per employment sector**

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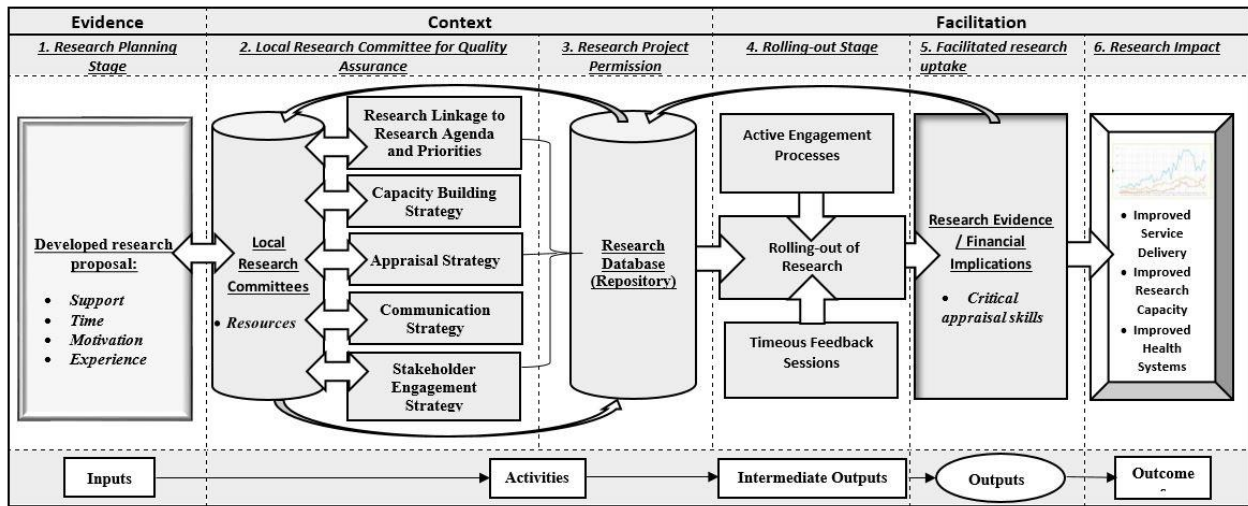
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Figure 3: Research Uptake Model for Healthcare Practice and Policy Development

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