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Systematic review of new medics' clinical task experience by country

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Abstract

Objectives: There is a need for research which informs on the overall size and significance of clinical skills deficits among new medics, globally. There is also the need for a meta-review of the similarities and differences between countries in the clinical skills deficits of new medics.

Design: A systematic review of published literature produced 68 articles from Google/Google Scholar, of which nine met the inclusion criteria (quantitative clinical skills data about new medical doctors).

Participants: One thousand three hundred twenty-nine new medical doctors (e.g. foundation year-1s, interns, post-graduate year-1 doctors).

Setting: Ten countries/regions.

Main outcome measures: One hundred twenty-three data points and representation of a broad range of clinical procedures.

Results: The average rate of inexperience with a wide range of clinical procedures was 35.92% (lower confidence interval [CI] 30.84, upper CI 40.99). The preliminary meta-analysis showed that the overall deficit in experience is significantly different from 0 in all countries. Focusing on a smaller selection of clinical skills such as catheterisation, IV cannulation, nasogastric tubing and venepuncture, the average rate of inexperience was 26.75% (lower CI 18.55, upper CI 35.54) and also significant. England presented the lowest average deficit (9.15%), followed by New Zealand (18.33%), then South Africa (19.53%), Egypt, Kuwait, Gulf Cooperation Council countries and Ireland (21.07%), after which was Nigeria (37.99%), then USA (38.5%) and Iran (44.75%).

Conclusion: A meta-analysis is needed to include data not yet in the public domain from more countries. These results provide some support for the UK General Medical Council's clear, detailed curriculum, which has been heralded by other countries as good practice.

Keywords

clinical skills, foundation doctors, induction/orientation, medical education, medical interns

the overall size and significance of the deficit across different countries. There is also the need for research which compares the size of the deficit between countries. It is important to harmonise induction curricula in different countries because there is a high level of demand for medical professionals, globally,⁴ and good opportunities for their mobility between health systems. Some countries' professional associations, such as the UK General Medical Council, have presented clear guidelines about educational and induction curricula, whereas some countries have not yet done this.² As a step towards finding out whether these country differences matter, this article explores and presents a systematic review of the similarities and differences between countries in the clinical skills deficits of new medics.

Methods

Searching

The search produced 68 articles. Figure 1 is a flow diagram based on Quality of Reporting of Meta-analyses (QUOROM), showing the process of searching, screening and evaluating articles, and a summary of the reasons for exclusion. Appendix 1 shows the QUOROM checklist statements. This systematic review began with a search of Google Scholar for articles about new doctors' clinical skills. Search words included 'clinical skills', 'new medic', 'new doctor', 'newly qualified doctor'. This produced 42 articles, two of which were included.^{1,2} The search was repeated on Google web to include non-indexed journals from more countries and also adding regionally used labels (e.g. 'medical interns') and country names. This produced 26 articles, seven of which were included.^{5–11}

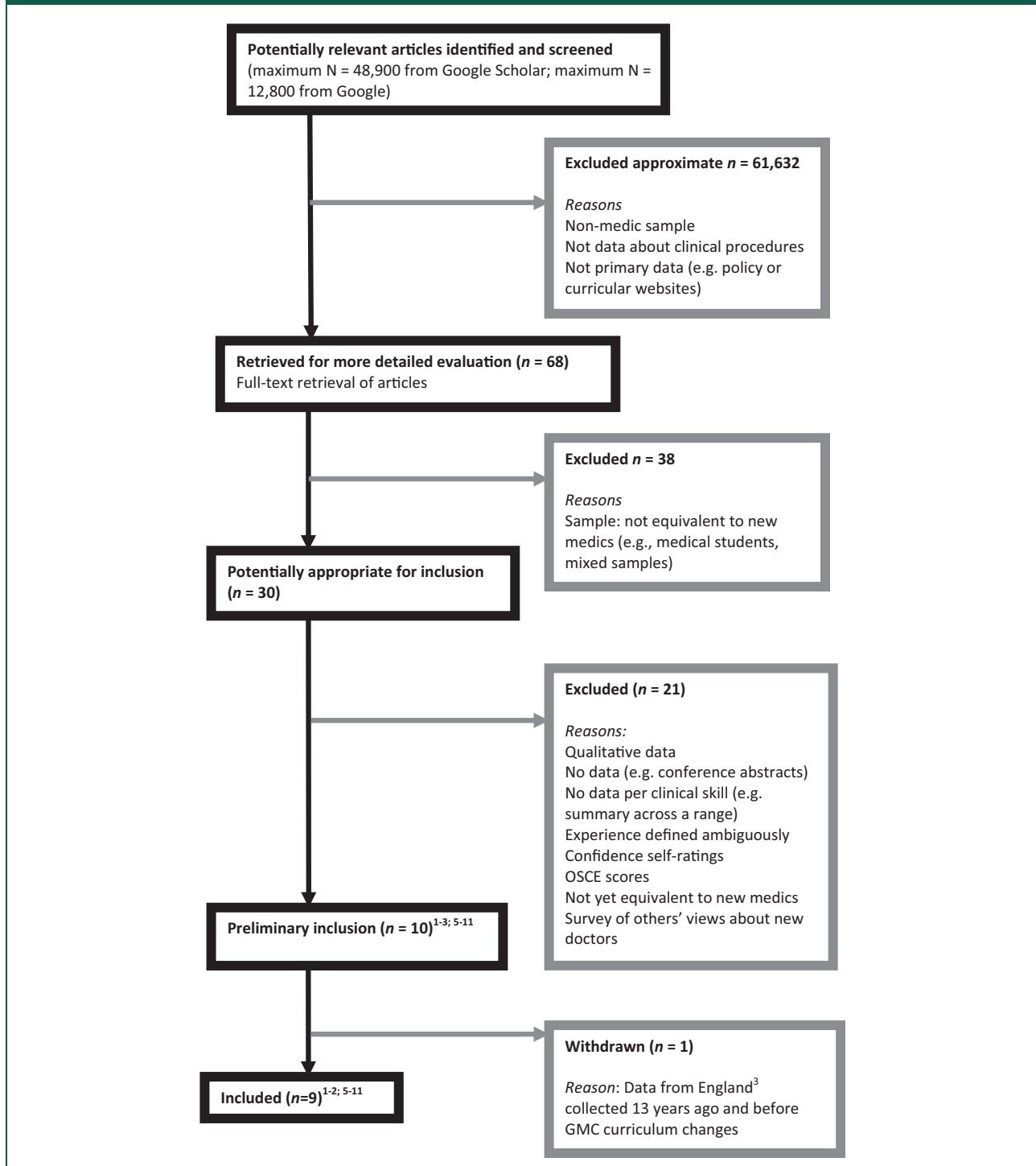
Selection

The criteria for inclusion were as follows: the data should be published and quantitative; the sample

Introduction

There is some research about deficits in new medical doctors' experiences with different clinical tasks,^{1–3} but there is a need for research which informs on

Figure 1. A flow diagram showing the process of searching, screening and evaluating articles, and a summary of the reasons for exclusion.



should be new medical doctors or at an equivalent level; the article should report the percentage of respondents with experience or inexperience in each clinical skill or provide scores that can be

converted into percentages. There was no *a priori* definition of experience; articles which used comparable methods of operationalising experience were included.

Validity assessment

Nine articles met all criteria, and their extracted data are reported in Table 1. Details of the articles' raw scores and conversions to percentages are reported below.

Data abstraction

The searches, conversions of data into percentages and calculations were conducted by the author manually and using SPSS.

Study characteristics

The first article¹ provided data from 30 postgraduate year-1 doctors (PGY1s) in New Zealand, who were asked about their clinical skills at the start of their postgraduate year and again at the end. Data from Time-1 were used for this analysis. The PGY1s were given a 134-item questionnaire and asked to rate their experience with a procedure using a 0 to 5 scale, whereby 0 = 'never heard of the procedure or skill'; 1 = 'know the principle'; 2 = 'observed, or done on a model'; 3 = 'done with supervision or assistance'; 4 = 'have done independently'; 5 = 'very comfortable with this skill – mastered'.^{1(pp.1–2)} The researchers then coded responses of 3 or higher as experience, and the percentages reported represented the respondents who had performed a given skill under supervision, independently or mastered it. The second article² provided data from Egypt, Kuwait, Gulf Cooperation Council countries and Ireland. There were 91 medical interns who indicated the number of times they had performed each clinical skill, and therefore the researchers reported the percentage that had never performed each skill. The third article⁵ represented data from 100 medical clerks (equivalent to medical interns). The authors measured the frequency of clerks who have performed each task under observation <2 times, 2–5 times, 6–9 times and >10 times. The fourth article⁶ represented data from 91 foundation year-1 doctors; they were recruited from 16 NHS trusts in the Mersey Deanery region of England. The authors asked them to rate their preparedness for each task on a scale ranging from 1 to 5, and they operationalised good preparedness as a score of 'quite well prepared' or better. The fifth article⁷ represented data from 89 newly qualified doctors in South Africa, who were surveyed about their internship experiences with different tasks. They responded using a scale ranging from 1 to 5, whereby 4 represented the ability to perform the task independently and 5 the ability to teach it

to someone. The sixth article⁸ represented data from 681 PGY1s (medical interns) in USA. The authors also surveyed medical programme directors to identify the tasks that 66% of them believe are tasks that medical interns should be able to perform independently without prompting or coaching. The seventh article⁹ represented data from 84 medical students in Nigeria who had just completed their last lecture. The authors reported the number of students with 0 attempts of each clinical procedure; an attempt was defined as the number of times the procedure had been successfully performed. The eighth article¹⁰ represented data from 93 graduates in Nigeria who were about to begin their medical internships. The study focused on urethral catheterisation, and the authors reported the percentage who responded that they could do this under supervision or independently. The ninth article¹¹ represented data from 70 medical interns in Nigeria and focused on episiotomies, a procedure frequently expected of interns in Nigeria.

Quantitative data synthesis

From the first article,¹ each value was subtracted from 100 to obtain the percentage of respondents who had never performed a given skill under supervision, independently or mastered it (listed in Table 1). The data from the second article² were extracted and reported in Table 1. The data extracted into Table 1 from the third article⁵ represented the percentage with the least experience (<2 times). From the fourth article,⁶ the frequency of the new doctors who rated themselves as being less than 'quite well prepared' was converted into a percentage and listed in Table 1. The scores from the fifth article⁷ were converted into percentages; the levels of inexperience in Table 1 were then calculated by subtracting these values from 100. The percentages of interns in the sixth article⁸ who responded that they cannot independently perform a task which 66% of medical programme directors said is expected of medical interns were calculated for Table 1 (excluding management or judgement tasks not measured in other studies and also including clinical procedures measured by several other articles in the current review). From the seventh article,⁹ the data in Table 1 are the percentage of respondents who had not successfully attempted each procedure. The data extracted from the eighth article¹⁰ represented the percentage who responded that they could not perform the procedure under supervision or independently. The data extracted from the ninth article¹¹ represented the percentage of interns who had not ever performed the procedure.

Table 1. Proportion of new doctors without sufficient task experience, by country.[†]

Task	Proportion without experience (%) [†]	Data	Country
1. Abscess drainage	40	5	Iran
2. Abscess drainage	53	1	New Zealand
3. Abscess drainage	40	8	USA
4. Abscess examination and drainage	17.6	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
5. Airway care	5.2	6	England
6. Anaesthetic (local)	12.4	7	South Africa
7. Anaesthetic (local)	7	1	New Zealand
8. Anaesthetic (local)	13.3	6	England
9. Anorectoscopy, proctoscopy/ sigmoidoscopy	34.1	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
10. Application of traction	79	1	New Zealand
11. Arterial blood gas	61	8	USA
12. Arterial blood sampling	100	9	Nigeria
13. Arterial puncture	1.7	6	England
14. Arterial puncture	7	1	New Zealand
15. Artificial ventilation	42.9	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
16. Assessment of level of consciousness (GCS)	23	1	New Zealand
17. Bag/mask skills	45.24	9	Nigeria
18. Bandage/strapping application	23	1	New Zealand
19. Bimanual palpation of adnexae	3	1	New Zealand
20. Blood (phlebotomy)	28	8	USA
21. Blood (phlebotomy)	40	5	Iran
22. Blood film – examination of	47.3	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
23. Blood glucose (glucometer use)	13	8	USA
24. Breech delivery	36.4	7	South Africa
25. Cannulation (IV)	91	5	Iran
26. Cannulation (IV)	4.76	9	Nigeria
27. Cannulation (IV)	0	1	New Zealand

(continued)

Table 1. Continued.

Task	Proportion without experience (%) [†]	Data	Country
28. Cannulation IV	15.4	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
29. Catheterisation (surgical)	8.8	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
30. Catheterisation (urethral)	13.2	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
31. Catheterisation	38	5	Iran
32. Catheterisation	34	7	South Africa
33. Catheterisation	21	8	USA
34. Catheterisation (urinary)	45.2	9	Nigeria
35. Catheterisation (urethral)	7.5	10	Nigeria
36. Catheterisation (female)	33	1	New Zealand
37. Catheterisation (Foley's)	6.6	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
38. Catheterisation (male)	7	1	New Zealand
39. Catheterisation (urethral)	15	6	England
40. Central venous catheter insertion	59.3	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
41. Cerumen removal	35	8	USA
42. Cervical collar application	70	1	New Zealand
43. Cervical smear	56	5	Iran
44. Cervical smear	10	1	New Zealand
45. Cervical/vaginal speculum examination	0	1	New Zealand
46. Chest drain insertion	83	1	New Zealand
47. Chest tube insertion	96	5	Iran
48. Closed reduction of a fracture	70	1	New Zealand
49. Corneal foreign body removal	63	1	New Zealand
50. CVP insertion	21.6	7	South Africa
51. Detection of foetal heart sounds	7	1	New Zealand
52. Dressing wound	5	5	Iran
53. Ear canal foreign body removal	76	1	New Zealand
54. ECG	8.1	6	England

(continued)

Table 1. Continued.

Task	Proportion without experience (%) [†]	Data	Country
55. EKG	24	8	USA
56. Endotracheal intubation	50.5	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
57. Endotracheal intubation	17	1	New Zealand
58. Endotracheal intubation	64	8	USA
59. Epistaxis (anterior) packing	67	8	USA
60. Fundoscopy	26.4	7	South Africa
61. I&D	7.6	7	South Africa
62. Injection (subcutaneous, intra-dermal, intramuscular, intravenous)	1.6	6	England
63. Insertion of thoracic drainage	58.2	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
64. Intercostal drain insertion	13	7	South Africa
65. Intramuscular injection	10	1	New Zealand
66. Intravenous insertion	1	5	Iran
67. IV administration	34	8	USA
68. IV antibiotic administration	29.76	9	Nigeria
69. IV infusion	13.1	9	Nigeria
70. IV infusions	3.3	6	England
71. IV medication	18.3	6	England
72. Joint aspiration	73.6	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
73. Joint aspiration	72	5	Iran
74. Joint aspiration	77	1	New Zealand
75. Joint dislocation – reduction	67	1	New Zealand
76. Laceration repair (second degree perineal)	15	8	USA
77. Laceration repair (simple)	87	8	USA
78. Lumbar puncture	50	5	Iran
79. Lumbar puncture	3	7	South Africa
80. Lump excision	21.4	7	South Africa

(continued)

Table 1. Continued.

Task	Proportion without experience (%) [†]	Data	Country
81. Microscopy – blood smear	72	8	USA
82. Microscopy – urine	77	8	USA
83. Microscopy (microbio. specimens)	57.1	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
84. Nasal packing	90	1	New Zealand
85. Nasogastric tube insertion	0	5	Iran
86. Nasogastric tube placement	63	1	New Zealand
87. Nasogastric tubing	15	6	England
88. Nasogastric tubing	90.48	9	Nigeria
89. Nasogastric tubing	38	8	USA
90. Operative intubation	42.9	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
91. Pelvic examination	60	5	Iran
92. Pericardiocentesis	81.3	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
93. Plaster application to a fracture	47	1	New Zealand
94. Pleural and peritoneal fluid aspiration	86	5	Iran
95. Resuscitation (administering cardiopulmonary)	24.2	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
96. Resuscitation (adult CPR with intubation)	12.6	7	South Africa
97. Resuscitation (cardiac defibrillation)	56.0	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
98. Resuscitation (cardio pulmonary cerebral)	93	5	Iran
99. Resuscitation (newborn)	63	1	New Zealand
100. Resuscitation (paediatric with intubation)	27.6	7	South Africa
101. Resuscitation (paediatric)	18.6	7	South Africa
102. Securing airway	30.8	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
103. Spirometry	61	8	USA
104. Spirometry and peak flow	24.2	6	England
105. Splinting	69	5	Iran

(continued)

Table 1. Continued.

Task	Proportion without experience (%) [†]	Data	Country
106. Supra pubic aspiration	87	5	Iran
107. Suturing	0	5	Iran
108. Suturing	5	7	South Africa
109. Suturing (simple, wound)	10	1	New Zealand
110. Throat culture	8	8	USA
111. Treatment of tension pneumothorax	58.2	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
112. Urine dipstick	11	8	USA
113. Urine examination (microscopic/dipstick)	22.0	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
114. Vaginal delivery	49	8	USA
115. Vaginal delivery	11	7	South Africa
116. Vaginal delivery and episiotomy	40	5	Iran
117. Vaginal delivery with episiotomy	4.3	11	Nigeria
118. Venepuncture	11	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
119. Venepuncture	3	1	New Zealand
120. Venepuncture	13.1	9	Nigeria
121. Venepuncture and IV cannulation	1.6	6	England
122. Venous cut-down	71.4	2	Egypt, Kuwait, Gulf Cooperation Council, Ireland
123. Wet mount and KOH study	34	8	USA

[†]Interpretations of the table should take into consideration how each article defined experience (see Methods).

Results

The significance of the rate of task inexperience across the 123 data points was calculated using a one-sample *t*-test with bootstrapping. This showed that the rate of task inexperience is significantly different from 0 at $p \leq .05$, with t ($df=122$) = 14.01, $p=0.001$. The bootstrapping used a simulation of 1000 bootstrap samples and showed a bias level of .01, standard error = 2.51. The mean level of task inexperience was 35.92% and the standard deviation

(SD) 28.44%. The 95% lower confidence interval (CI) of this difference was 30.84% and the 95% upper CI was 40.99%.

The average rate of inexperience was significantly different from 0 in all countries, with separate one-sample *t*-tests all producing $p \leq .05$. The average inexperience in South Africa was 17.90% (lower CI = 12.87, upper CI = 23.40), t ($df=13$) = 6.41, $p = .001$. In Iran, the average inexperience was 51.33% (lower CI = 36.39, upper CI = 66.11), t ($df=17$) = 6.49, $p = .001$. In USA, the average inexperience was

41.95% (lower CI=32.10, upper CI=52.30), t ($df=19$)=7.84, $p=.001$. In Nigeria, the average inexperience was 35.34% (lower CI=15.60, upper CI=55.90), t ($df=9$)=3.18, $p=.011$. In England, the average inexperience was 9.75% (lower CI=5.57, upper CI=14.62), t ($df=10$)=4.13, $p=.002$. In New Zealand, the average inexperience was 37.89% (lower CI=26.33, upper CI=48.89), t ($df=27$)=6.35, $p=.001$. In Egypt, Kuwait, Gulf Cooperation Council countries and Ireland, the average inexperience was 40.11% (lower CI=31.07, upper CI=49.73), t ($df=21$)=8.21, $p=.001$.

A meta-analysis then calculated the combined t value, Winer's Z_c , using the formula¹² $Z_c = \sum t \div \{\sum[df/(df-2)]\}$. This gave $Z_c = 42.61 \div 8.74 = 4.88$. The critical t value at $df=50$ for $p \leq .01$ is 2.68, meaning that $Z_c = 4.88$ is significant at $p \leq .01$. This showed that the overall level of task inexperience across countries is significant.

Analysis on a smaller set of clinical skills

Some country datasets represented a much wider variety of clinical tasks than the datasets from other countries. The analysis of the average level of inexperience in each region was therefore replicated, but this time restricting the analysis to clinical tasks that commonly occur across the different articles. This restricted list of tasks had 37 data points and included catheterisation, IV cannulation, IV administration, venepuncture and nasogastric tubing. The average deficit in experience across all countries, focusing on this smaller selection of clinical skills, was 26.75% (lower CI 18.55, upper CI 35.54). The small number of data points from each geographic region (e.g. 3 data points) meant that inferential statistics were not appropriate for country-by-country comparisons.

Looking at the mean deficits in five countries, the average level of inexperience with the smaller selection of clinical skills was still comparable to the average level of inexperience with the wider range (in Table 1) in five countries. These were England, Iran, Nigeria, USA and South Africa. In South Africa, the mean level of inexperience with the selected clinical tasks was 19.53% (SD=15.60; lower CI=-19.23, upper CI=58.29). In Iran, the mean level of inexperience with the selected clinical tasks was 44.75% (SD=37.48; lower CI=-14.89, upper CI=104.39). In the USA, the mean level of inexperience with the selected clinical tasks was 38.5% (SD=16.66; lower CI=11.98, upper CI=65.02). In Nigeria, the mean level of inexperience with the selected clinical tasks was 37.99% (SD=37.78; lower CI=6.40, upper CI=69.58). In England, the mean level of inexperience with the selected clinical tasks was 9.15%

(SD=7.73; lower CI=1.04, upper CI=17.26). In New Zealand, the mean level of inexperience with the selected clinical tasks was 18.83% (SD=24.64; lower CI=-7.03, upper CI=44.70) and substantially lower than the average level of inexperience with the whole range of 28 skills in Table 1 (37.89%). The same was true in Egypt, Kuwait, Gulf Cooperation Council countries and Ireland, where the mean level of inexperience with the selected clinical tasks was 21.07% (SD=24.85; lower CI=-5.02, upper CI=47.15) and substantially lower than the average from Table 1 (40.11%).

The average skills deficits, from largest to smallest, were as follows: Iran, then USA, Nigeria, the combination of Egypt, Kuwait, Gulf Cooperation Council countries and Ireland, followed by South Africa, then New Zealand, then England.

Discussion

Statement of principal findings

The average rate of inexperience with clinical tasks spanning 123 data points was 35.92% across England, Egypt, Gulf Cooperation Council countries, Iran, Ireland, Kuwait, New Zealand, Nigeria, South Africa and USA. Calculations showed that the overall rate of clinical task inexperience is significantly different from 0 and therefore, as a global average, important. However, there are country differences. Within a selected range of procedures, the average skills deficits, from largest to smallest, were as follows: Iran, followed by USA, then Nigeria, followed by the combination of Egypt, Kuwait, Gulf Cooperation Council countries and Ireland, then South Africa, followed by New Zealand, then England. Foundation year-1 doctors in England therefore presented the smallest average skills deficit.

Strengths and weaknesses of the study

This systematic review offers a useful focus on new medics, presents a broad range of clinical skills and involves data spanning over 10 countries. This review is preliminary because of a lack of access to unpublished data from more countries. Second, the acceptable level of experience for new medics can vary from one clinical skill to another⁸ and therefore a follow-up meta-analysis should take this into account.

Strengths and weaknesses in relation to other studies

There is no known systematic review of this kind but, compared to the methodology in non-review studies,

this study could have benefited from a standardised measure of clinical task experience. Interpretations of Table 1 must therefore take into account the way in which each article measured task experience.

Meaning of the study: possible mechanisms and implications for clinicians or policymakers

A universal approach to medical education is needed, given the global demand for medical professionals. The lower deficit rate in England provides some support for the UK General Medical Council's clear, detailed induction curriculum, which has been heralded by other countries as good practice.² This research shows that the UK General Medical Council's curriculum should be implemented in more countries. Clinically, the data are useful in identifying the potential skills deficits among newly qualified recruits from other countries and the inductions that should be provided.

Unanswered questions and future research

Further research is needed to include unpublished data from more countries. Follow-up primary research should measure task inexperience in a universal format, also clarifying the conditions under which the experience was gained (patients vs. simulations). Some studies defined 'task experience' differently than others, and therefore (to allow a full meta-analysis) future research should ensure that clinical task experience is measured in a standard format.

Declarations

Competing interests: None declared

Funding: None declared

Ethical approval: Ethical approval for this research was not required from the School/Department ethics committee because no human data were collected. The data reported are secondary data representing the results of publically available research.

Guarantor: CK

Contributorship: CK devised the study, conducted the systematic review, extracted, inputted and analysed the data in SPSS, and authored the write-up.

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Appendix I. QUOROM checklist.

Heading	Subheading/Descriptor	Reported (Y/N)	Page number
Title	Identified as a systematic review	Y	Title page (p.1)
Abstract	Structured format	Y	Abstract page (p.1)
	Objective	Y	Abstract page (p.1)
	Data sources	Y	Abstract page (p.1)
	Review methods	Y	Abstract page (p.1)
	Results	Y	Abstract page (p.1)
	Conclusion	Y	Abstract page (p.1)
	Introduction		Y
Methods	Searching	Y	Methods page (p.1)
	Study selection	Y	Methods page (pp.1–2)
	Validity assessment	Y	Methods page (p.3)
	Data abstraction	Y	Methods page (p.3)
	Study characteristics	Y	Methods page (p.3)
	Quantitative data synthesis	Y	Methods page (p.3)
Results	Trial flow	Y	Figure 1 (p.2)
	Study characteristics	Y	Table 1 columns (pp.4–8)
	Quantitative data synthesis	Y	Table 1 columns (pp.4–8) and analysis pages (pp.8–9)
Discussion		Y	Pages 9–10