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Review

Personal domains assessed in multiple mini interviews (MMIs) for healthcare student selection: A narrative synthesis systematic review

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A B S T R A C T

Objectives: To examine the personal domains multiple mini interviews (MMIs) are being designed to assess, explore how they were determined and contextualise such domains in current and future healthcare student selection processes

Design: A systematic review of empirical research reporting on MMI model design was conducted from database inception to November 2017. **Data Sources:** Twelve electronic bibliographic databases.

Review Methods: Evidence was extracted from original studies, and integrated in a narrative synthesis guided by the PRISMA statement for reporting systematic reviews. Personal domains were clustered into themes using a modified Delphi technique.

Results: A total of 584 articles were screened. 65 unique studies (80 articles) matched our inclusion criteria of which seven were conducted within nursing/midwifery faculties. Six in 10 studies featured applicants to medical school. Across selection processes, we identified 32 personal domains assessed by MMIs, the most frequent being: communication skills (84%), teamwork/collaboration (70%), and ethical/moral judgement (65%). Domains capturing ability to cope with stressful situations (14%), make decisions (14%), and resolve conflict in the workplace (13%) featured in fewer than ten studies overall. Intra- and inter-disciplinary

inconsistencies in domain profiles were noted, as well as differences by entry level. MMIs deployed in nursing and midwifery assessed compassion and decision-making more frequently than in all other disciplines. Own programme philosophy and professional body guidance were most frequently cited (~50%) as sources for personal domains; a blueprinting process was reported in only 8% of studies.

Conclusions: Nursing, midwifery and allied healthcare professionals should develop their theoretical frameworks for MMIs to ensure they are evidence-based and fit-for-purpose. We suggest a re-evaluation of domain priorities to ensure that students who are selected, not only have the capacity to offer the highest standards of care provision, but are able to maintain these standards when facing clinical practice and organisational pressures.

1. Introduction

Healthcare student selection processes have been the subject of much debate and investment over many years. Internationally, renewed focus is evident in proposed enhancements to European Union (EU) legislation governing admissions criteria to nursing programmes (EU, 2013), as well as the World Health Organisation's (WHO) strategic direction for strengthening nursing and midwifery globally (WHO, 2016).

A key theme in WHO's (2016) vision is to ensure an educated, competent and motivated nursing and midwifery workforce. It is the responsibility of universities to select students who demonstrate the potential to meet the multifarious needs of patients within a diversity of complex organisations. In a competitive milieu, universities have a duty to choose admissions processes that are as valid, defensible and reliable as possible (Rodgers et al., 2013). Identifying individuals who possess the personal domains commensurate with a caring role is extremely challenging. This is because of the lack of clear consensus regarding what attributes and or values should be assessed and how (Nicholson et al., 2010). Adding complexity, the values base itself of healthcare provision, has become the focus of widespread concern, with deficiencies in the provision of compassionate care identified (Francis, 2013; McHugh et al., 2013; Keogh, 2013).

In the United Kingdom (UK), a national values-based recruitment (VBR) framework has been instigated (HEE, 2014), where nurses and midwives are recruited and selected according to the National Health Service (NHS) Constitution values (GB, DH, 2012). These values include: respect and dignity; commitment to quality of care; compassion; improving lives; working together for patients; and "everyone counts". One approach to informing final selection decisions which is embedded in the UK national VBR framework (2014) and increasingly used by universities worldwide, are multiple mini interviews (MMIs) (Eva et al., 2004a).

2. Background

MMIs are being employed in nursing, midwifery and allied health professional students' admissions processes internationally (Rees et al., 2016) having first been conceived in a medical student selection context (Eva et al., 2004a). In an MMI, applicants are required to respond to scenarios at a series of 'stations' in a timed circuit (Eva et al., 2004a). Each scenario is designed to assess pre-defined values and or attributes, referred to as "personal domains". As an assessment methodology

for healthcare student selection, MMI models vary significantly between universities from length of time at each station to numbers of stations and numbers of interviewers (Eva et al., 2004b; Eva et al., 2009; Eva et al., 2012; Callwood et al., 2014; Callwood, 2015; Pau et al., 2013; Knorr and Hissbach, 2014; Rees et al., 2016). Therefore, conducting robust meta-analyses to evaluate their utility are difficult. Narrative synthesis systematic reviews have been published exploring the reliability and predictive validity of MMIs (Knorr and Hissbach, 2014; Rees et al., 2016) with evidence regarding their ability to assess multiple domains also demonstrated (Oliver et al., 2014). However, there is a lack of consolidation of published research regarding the personal domains MMIs are being designed to assess and why.

3. The Review

3.1. Objectives

The objectives of this review are to: examine the personal domains multiple mini interviews (MMIs) are being designed to assess, explore how they were determined and contextualise such domains in current and future healthcare student selection processes.

This review is important in view of current widespread inconsistencies in MMI design and administration (Rees et al., 2016). Consolidating our knowledge on what personal domains are assessed and why is useful for universities and training organisations currently implementing MMIs, and for those who are considering their use. It is anticipated that our findings will encourage further discourse around the personal domains that are currently being prioritised and those that matter in healthcare student selection processes.

3.2. Methods

For the purposes of reporting we utilised the phrase 'personal domain' to collectively refer to the personal attributes, characteristics and values featuring in MMIs. Published guidance for the reporting of systematic reviews (Shamser et al., 2015) informed the planning and conduct of this review. The PICO (Purpose, Intervention, Comparison, Outcome) structure (Higgins and Green, 2011) was used to formulate the following questions:

In selection processes for health professionals:

- What personal domains are MMIs being designed to assess?
- How are these personal domains determined?

3.3. Search Strategy

Systematic searches of British Nursing Index, Social Sciences Premium Collection, Nursing and Allied Health Source, British Education Index, CINAHL, Educational Administration Abstracts, ERIC, Medline, PsycARTICLES, Psychology and Behavioural Sciences, PsychINFO and NHS Evidence were carried out in: January 2016 and November 2017. This was to ensure that the evidence presented was as current as possible. The cumulative findings from each search are presented. Search terms included: "multiple mini interview*" and "MMI*". Pre-specified eligibility criteria were applied to all records identified. Reference lists of all full-text articles were also examined for any studies that might have been overlooked as well as grey literature.

3.4. Study Eligibility Criteria

Studies were included if they:

- Were published as original papers in peer review journals and an English translation was available.
- Used quantitative, qualitative or mixed-methodologies to report on the implementation and evaluation of MMIs in healthcare student selection.
- Reported on at least one aspect of the research question of this review.

No date limiters were set to ensure inclusion of all published research to November 2017. Where no study data were available on one or both research questions, study authors were contacted via email. Up to three reminders were sent; if no contact was established, data were considered missing.

3.5. Article Selection and Processing

Two members of the review team independently screened all retrieved papers, having applied the eligibility criteria to the title and abstract. Full texts were sourced for all retained articles. Full text copies also aided in making a decision to include an article if insufficient information was in the title or abstract and in reaching a consensus in the case of disagreement.

3.6. Quality Appraisal

An adapted version of the United States (US) Department of Health and Human Services, National Institute of Health Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (United States (US) Department of Health and Human Services, 2013) was used to evaluate the methodological quality of included studies. This tool ensured risk of bias was reduced; this is discussed further in Section 6. A random sample of 30 out of the 99 studies were subjected to double review. Inter-reviewer agreement exceeded 93% suggesting a high level of accuracy.

3.7. Data Extraction

Microsoft® Excel spreadsheets were used to collate the data from each study. A customised data extraction form was developed to answer the review questions. This was pilot-tested with two studies in the final sample and subsequently refined. Five authors undertook data extraction. Information included: study aims, geographical location, sample size, discipline, academic level, number of MMI stations, number of assessors at each station, time spent at each station, type of station, domains assessed and origins, recommendations, limitations, (reviewer/author identified), and reviewer comments.

3.8. Synthesis of Study Findings

Due to the heterogeneity of the studies retrieved, findings were integrated in a narrative synthesis as recommended by the Guidance on the Conduct of Narrative Synthesis (Popay et al., 2006). This approach enables the synthesis of different methodologies and study designs to accommodate a range of MMI models. The percentage (%) of studies examining each type of personal domain were examined using Microsoft® Excel spread-sheets. Numbers of studies where MMIs assessed a specific domain or type of station were tabulated in 2x2 contingency tables. Studies were examined by: applicant entry level (under-graduate v. post-graduate); discipline and geographical region to uncover potential trends in domains assessed. The phrasing of some domains identified by article authors over-lapped and were not mutually exclusive, for example, 'self-awareness' and 'reflective ability'. These were defined to ensure clarity and then clustered into themes using a modified Delphi technique amongst review authors (Eubank et al., 2016).

4. Results

Once duplicates were removed, 357 articles of the 584 identified were reviewed by the research team using title and abstract (Fig. 1). Out of those, 258 were excluded as they were not relevant; full text versions of the remaining 99 were assessed for eligibility. Nine were subsequently excluded as not relevant. One study conducted in Korea (Kim et al., 2014) was identified, but no English translation was available and it was therefore excluded. The authors of 26 articles were contacted individually, requesting additional information. No information was returned by nine authors regarding domains and domain source; therefore these articles were also excluded. Ultimately, 80 articles were included in this review reporting data from 65 individual studies (Ahmed et al., 2014; Alaki et al., 2016; Alweis et al., 2015; Barbour and Sandy, 2014; Brownell et al., 2007; Callwood et al., 2014; Cameron and MacKeigan, 2012; Cameron et al., 2017; Campagna- Vaillancourt et al., 2014; Corelli et al., 2015; Cottingham et al., 2014; Cowart et al., 2016; Cox et al., 2015; Daniel-Filho et al., 2017; Dodson et al., 2009; Dore et al., 2010; Dowell et al., 2012; El Says et al., 2013; Eva et al., 2004a, 2004b, 2009, 2012; Eva and Macala, 2014; Finlayson and Townson, 2011; Foley and Hijazi, 2013; Foley and Hijazi, 2015; Fraga et al., 2013; Gale et al., 2016; Grice, 2014; Griffin and Wilson, 2012; Harris and Owen, 2007; Hecker et al., 2009; Hecker and Violato, 2011; Hissbach et al., 2014; Hofmeister et al., 2008; Hofmeister et al., 2009; Hopson et al., 2014; Humphrey et al., 2008; Husbands and Dowell, 2013; Jerant et al., 2012; Jerant et al., 2015, 2017; Jones and Forister, 2011; Kelly et al., 2014; Kim et al., 2017; Kulasegaram et al., 2010; Kumar et al., 2009; Leduc et al., 2017; Lee et al., 2016; Lemay et al., 2007; Makransky et al., 2017; McAndrew and Ellis, 2012; McBurney and Carty, 2009; McLaughlin et al., 2017; O'Brien et al., 2011; Ogunyemi et al., 2016; Oyler et al., 2014; Oliver et al., 2014; Pau et al., 2016; Perkins et al., 2013; Razack et al., 2009; Reiter et al., 2007; Roberts et al., 2008, 2009, 2014; Ross et al., 2017; Sebok et al., 2014; Shinawi et al., 2017; Singer et al., 2016; Soares et al., 2015; Taylor et al., 2015; Tavares and Mausz, 2013; Terregino et al., 2015; Thomas et al., 2015; Till et al., 2013; Traynor et al., 2017; Uijtdehaage et al., 2011; Yamada et al., 2017; Yoshimura et al., 2015).

4.1. Study Characteristics

Forty-seven studies (73%) tested MMIs to facilitate selection of students at undergraduate level. The number of studies conducted within pharmacy (n=7) nursing (n=6), dentistry (n=5) or veterinary medicine (n=3) student selection were considerably lower than those in medicine (60%; n=39). Five additional studies were conducted in other faculties including midwifery, paramedic practice, occupational therapy and psychology. In terms of the studies' origin, 58% (n=37) were conducted in North America, 20% (n=13) in Europe and the remaining Middle East countries (n=6), Australia (n=4), Far East countries (n=3) or South America (n=1).

4.2. Generic Domains Assessed by MMIs

All but two studies (n=63; 95%) contributed data on domains. The studies assessed 67 individual but not mutually exclusive MMI domain constructs. Once over-lapping domains were clustered (using a modified Delphi technique amongst review authors, Eubank et al., 2016) 32 themes were identified (Table 1A). Within-study analyses

indicated that MMIs assessed a median of six domains, ranging from three to 19 domains. The top-five domains were: communication skills (84%), teamwork/collaboration (70%) ethical and moral judgement (65%), critical thinking (48%) and empathy (43%). Domains capturing an ability to cope with stressful situations (14%) make decisions (14%) and resolve conflict in the work place (13%) featured in fewer than ten studies. Responsibility (10%), prioritisation (5%), creativity (5%) and time-management (3%) were infrequently assessed by MMIs in the reviewed studies (Table 1A).

4.3. Domains Assessed by Applicant Entry Level

Regardless of entry level, communication skills featured at the top of the ranking (Table 1B). Teamwork/collegiality were more frequently assessed in post-graduate rather than under-graduate level (82% v. 62%). A trend was found, whereby a greater proportion of MMIs conducted at the post-graduate (versus under-graduate) level assessed applicants' management skills (24% v. 6%). In contrast, empathy was assessed in a greater proportion of under-graduate level MMIs (49% v. 18%). Ability to cope with stressful situations and resilience were assessed to a greater degree in undergraduate (versus post-graduate) level (15% v. 6%) but notably, this applied to a minority of studies (eight in total).

4.4. Domains Assessed by Discipline

Across the seven nursing and midwifery faculty studies, communication skills, empathy, respect for others, honesty/integrity, teamwork and critical thinking were the top domains prioritised ($\geq 50\%$ of studies). MMIs used in nursing and midwifery assessed compassion and decision-making more frequently than in all other disciplines (Table C). In medical faculty studies communication skills, teamwork and ethical and moral judgement were the top three personal domains assessed ($\geq 50\%$ of studies); these were followed by professionalism and selfawareness. In all other disciplines, ethical and moral judgement communication skills, critical thinking and teamwork were prioritised ($\geq 50\%$ of studies). 'Non-medical' faculties only rarely assessed professionalism or adaptability/capacity for change compared to medical faculties.

4.5. Domains assessed by discipline and applicant entry level

Empathy was the focus of undergraduate MMIs whereas motivation and conflict resolution skills were more frequently assessed at the postgraduate level (Table 1D). For under-graduate medicine, the top five domains that were frequently included in MMIs were communication skills, ethical and moral judgement, teamwork, empathy and honesty. While the top three domains for post-graduate medicine were similar to under-graduate medicine, there appears to be a greater emphasis on self-awareness and professionalism in post-graduate medicine (Table 1D). In all other disciplines, there was an equally strong emphasis on applicants' communication, teamwork, ethical and moral judgement and critical thinking skills regardless of entry level. Adaptability and tolerance of uncertainty featured relatively frequently in both undergraduate and post-graduate medicine (32%–33%) but only rarely in other disciplines

irrespective of entry level (Table 1D). Of note, response to stress and resilience were assessed more frequently in undergraduate (24%) than post-graduate medicine (8%) or any other discipline without any observable entry level trends (4%).

4.6. Domains Assessed by Study Origin

A greater proportion of MMIs deployed outside North America assessed applicants' ethical and moral judgement (70% v. 61%), motivation/ ambition (44% v. 17%), problem-solving skills (33% v. 26%), work experience (26% v. 17%), research motivation (19% v. 11%) and decision- making skills (19% v. 11%). Fifty-six percent of studies conducted in North America deployed MMIs that assessed applicants' skills for critical thinking compared to 37% in other geographical regions. Moreover, MMIs used in North America more frequently assessed respect for others (33% v. 15%), adaptability (31% v. 19%), honesty/integrity (36% v. 26%), advocacy (11% v. 4%) and creativity (8% v. 0%).

4.7. Sources of Domains

In 39 studies (49%), the authors used their Institute's own philosophy and internal validity assessment to determine domains to be assessed. In 29 studies (48%), the authors relied on guidance from their professional body (Table 2), while in seven studies (12%) the four domains cited by Eva et al. (2004a) were adopted. Twelve studies did not specify the origins of the domains assessed in their MMI models. Where different sources for the development of domain profiles were combined, professional body guidance and internal programme philosophy was the most frequently cited combination. Five studies (8%) explicitly detailed a blue-printing development process, none of which were in nursing or midwifery admissions. In nursing and midwifery faculties (n=7), programme philosophy most frequently (71%) guided selection of personal domains assessed in MMIs, while two studies also used guidance from the Nursing and Midwifery Council in England and Northern Ireland (Callwood et al., 2014; Traynor et al., 2017).

5. Evidence Strength and Risk of Bias

The majority of studies were rated good-fair for the criteria listed for observational cohort and cross-sectional studies including reliability and validity (US Department of Health and Human Services, 2013). Notably, all studies included were single site except one (Jerant et al., 2017) and were therefore potentially exposed to confounding variables within universities. No quasi-experimental or randomised control designs were identified in the search thereby limiting the strength of evidence elicited.

6. Discussion

We identified 32 personal domains being assessed by MMIs across healthcare student selection processes, the most frequent being communication skills irrespective of entry level, discipline or geographical origin. The ability to cope with stressful situations, resilience skills and conflict resolution were assessed in 13–14%

of the studies the minority of which were in nursing or midwifery. Differences were noted by entry level as well as intra- and inter-disciplinary inconsistencies in the domain profiles assessed. The origins of domain were stated in eight in 10 studies, with own programme philosophy and professional body guidance being cited as sources for MMI development in close to half the studies; a blue printing process was only explicitly detailed in 8% of studies.

The effectiveness of student selection processes has a direct impact on the future healthcare workforce. Current EU legislation for vocational programmes like nursing and midwifery does not stipulate specific admissions criteria (EU, 2013). However, the importance of assessing non-cognitive personal domains during selection processes is becoming increasingly recognised (Patterson et al., 2016).

The widespread adoption of MMIs necessitates greater consideration of the personal domains MMIs are assessing and how these are determined. MMIs should be designed to capture the personal characteristics, which enable healthcare providers to sustain the highest standards of care provision in spite of endemic organisational pressures. Construct validity is an important issue for such selection processes. It is necessary to recognize that 'validity' relates the meaning of the scores generated by the assessment rather than the assessment method itself i.e. does the test measure what it intends to measure (Schuwirth and Van der Vleuten, 2011). Therefore, scores depend on a number of different variables including the content of the assessment, the cognitive ability of the individual undertaking the assessment and the context within which the assessment is taken. While the design of MMIs aims to minimise the deleterious impact of context and interviewer bias (Eva et al., 2004a), these factors should be taken into consideration when evaluating MMIs.

Sixty per cent of the studies in this review report findings from medical student cohorts. This is not thought to be representative of the number of HEIs and training organisations using MMIs across healthcare student selection processes (Health Education England, HEE, 2014), but a reflection of those HEIs who have published data. Nursing, midwifery and allied healthcare professional training and education programmes should be developing their own theoretical frameworks for MMIs and these should be transparent and evidence based.

A range of domains appear to be prioritised across healthcare professions selection processes with a clear emphasis on: communication skills; ethical and moral judgement/integrity, teamwork/collaboration and critical thinking. These domains concur with profession-specific and international perspectives of important shared personal qualities for health professions (Frenk et al., 2010; WHO, 2016). We know that MMIs can be designed to intentionally focus on one or multiple domains. We also acknowledge that personal domains can be multidimensional constructs (Oliver et al., 2014); for example, 'teamwork/ collaboration' also requires 'communication skills' and selfawareness. It is unclear how this complexity either adds to or potentially challenges the effectiveness of MMIs. Moving forward, it is important to promote discourse around the personal domains MMIs are purportedly assessing and develop our understanding of the challenge to better target and assess important personal constructs.

Compassion is explicitly featured in less than a quarter of the studies included in this review and empathy in fewer than half. Interestingly both featured in the nursing and midwifery-specific studies. A striking lack of focus on empathy and compassion was noted at the post-graduate level regardless of discipline. This might be a reflection of

the homogeneity associated with post-graduate applicants who have already gone through selection processes where other personal domains were considered more important. Notable is the underpinning philosophy associated with all health-related professions, who state their aim to educate caring practitioners (Frenk et al., 2010; WHO, 2016). It is pertinent to consider why empathy and compassion do not feature more highly in MMI domain profiles.

A decline in the quality and standard of compassionate care has been identified amongst healthcare professionals (Francis, 2013). This is in spite of aspirational qualities relating to caring, honesty and justice reported by some nursing students (Feller, 2014). The erosion of personal domains due to organisational pressure is well documented (Paley, 2014; Hojat et al., 2009; Zimmerman et al., 2005; Nuemann et al., 2011). Joinson (1992) first reported what she conceptualised as 'compassion fatigue' amongst nurses. This is more recently described and attributed to the effects of the work environment and collegial attitudes by Jack (2017). Maben et al. (2009) reported that student nurses' ideals were compromised or crushed by structural and organisational constraints. An increase in cynicism and decrease in idealism is a recognised part of students' journey through medical school (Hafferty, 1991; Feudtner et al., 1994; Drybe et al., 2005; Stratta et al., 2016).

The pervasive deficiencies in the provision of compassionate care identified in the UK National Health Service (Francis, 2013) have been attributed in part to cognitive blindness (Paley, 2014) and attrition of personal domains. Role-modeling and ensuring personal congruence with institutional mission statements and policies have attempted to mitigate against external organisational pressures. However, concerns remain regarding the potential impact the stresses associated with increased exposure to the clinical practice environment may have on healthcare professionals' personal domain profiles. This has added significance for student selection processes where findings from this review suggest personal domains like 'resilience' and 'ability to cope with stressful situations' are not prioritised.

In relation to how personal domain profiles were decided upon, most of the included studies used only professional body guidance and internal review with 8% explicitly detailing a blue-printing process. This raises important questions about the origins of domain profiles and whether there is a place for a generic set of domains (Frenk et al., 2010).

7. Strengths and Limitations of this Study

This review attempts to provide previously unpublished insights into the domains MMIs are being designed to assess and to contextualise these findings in the personal profiles of student nurses, midwives and allied healthcare professionals as they face the challenge of meeting the needs of service users. A caveat to the findings in that the evidence incorporated in this review offers single university perspectives (with the exception of Jerant et al., 2017) limited by lack of robust comparison and control group inclusion. Articles were included only when an English translation was available. This decision resulted in the exclusion of one study. Missing information in published articles and subsequent non-response to enquiry by authors resulted in six studies being excluded, which might have an impact on our findings. However, it is reasonable to assume that the volume of studies included in

this review has provided us with an accurate picture of current trends in the personal domains being assessed by MMIs.

8. Conclusion

Healthcare professionals are critical in the delivery of essential health services; they bring people-centred care into communities where they are needed the most. Being able to identify the personal domains that foster the provision of sustained, high quality care characterised by meaningful encounters with patients is extremely challenging. This review identifies what MMIs are being designed to assess across healthcare student selection processes and how they are determined. A clear outcome is the apparently limited published evidence base for MMI use specifically in the context of nursing, midwifery and allied health professions selection processes. There is also a potential dissonance between the attribute domains which are being prioritised and the reality of what is required in clinical practice. The authors suggest that domains focusing on individuals' ability to manage the competing demands of everyday health care practice within pressurised organisations should be given greater consideration. The domains assessed appear to reflect some common conceptions of important inter-personal characteristics. In accordance with national and international recommendations (WHO, 2016) further work is warranted to validate the importance of these characteristics in the advancement of selection processes. This has important implications for health professional education and training institutions wishing to refine their MMI models. It is anticipated that the findings of this review will lead to wider discourse around what personal qualities should feature in MMI selection processes to ensure their fitness for purpose.

9. Future Inquiry

Nursing, midwifery and allied healthcare professional focused research is suggested, including well-designed studies exploring associations between domains assessed at selection and clinical practice performance measures, which specifically reflect these domains.

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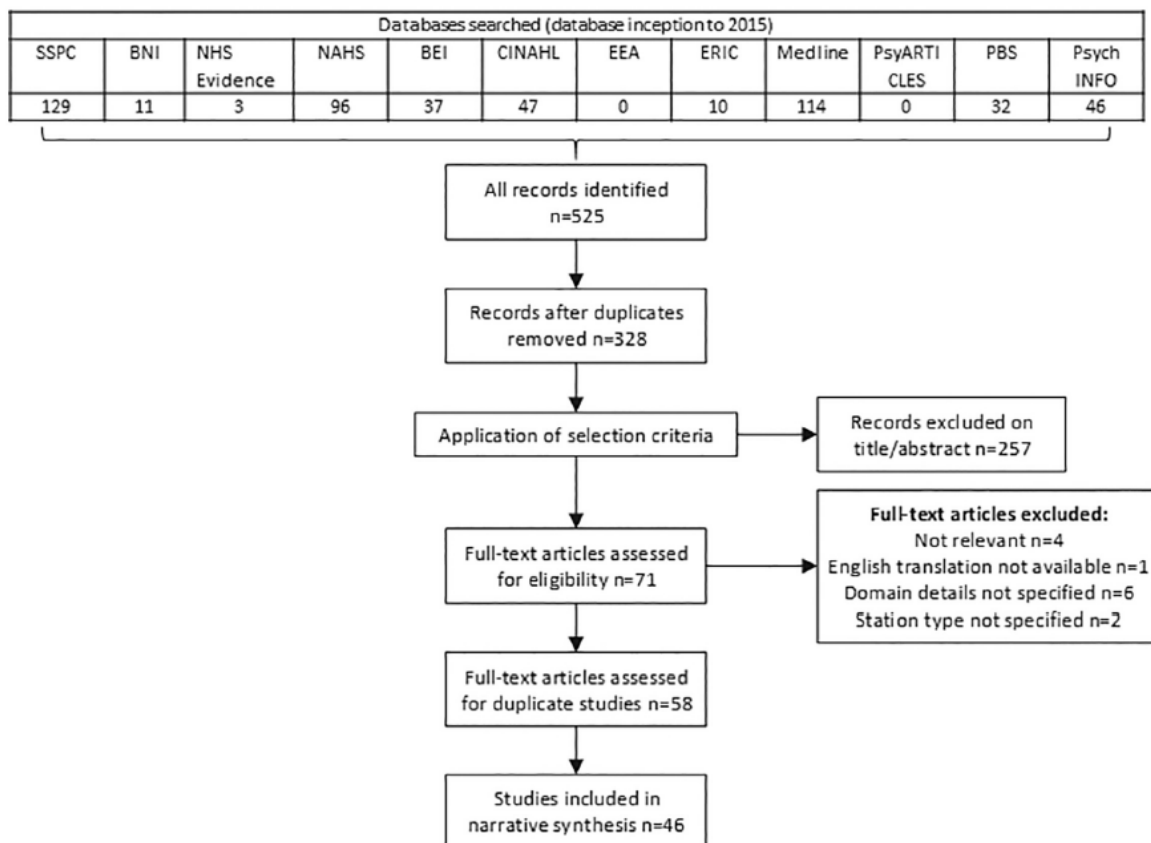


Fig. 1. Flow diagram of paper identification and selection.

Table 1

Matrix of the 32 personal domain themes identified in the reviewed studies, and mapped by entry level and/or by discipline.

	A. All studies (n=63) ^a		B. By entry level				C. By discipline						D. By entry level and by discipline							
			Entry level: Under-graduate (n=45) ^b		Entry level: Post-graduate (n=17)		Medicine (n=38) ^c		Nursing/ midwifery (n=6) ^d		Any other discipline ^e (n=19)		Under-graduate medicine (n=25) ^f		Post-graduate medicine (n=12)		Under-graduate, any other discipline (n=20) ^g		Post-graduate, any other discipline (n=4)	
Domain	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Communication/ interpersonal skills/ written communication	53	84.1	37	78.7	15	88.2	34	89.5	5	83.3	14	73.7	22	88.0	11	91.7	15	75.0	3	75.0
Teamwork/ collaboration/ collegiality	44	69.8	29	61.7	14	82.4	27	71.1	3	50.0	14	73.7	16	64.0	10	83.3	13	65.0	3	75.0
Ethical & moral judgement/ academic integrity/ social justice/research ethics/disclosure of error	41	65.1	31	66.0	10	58.8	24	63.2	2	33.3	15	78.9	18	72.0	6	50.0	13	65.0	3	75.0
Critical thinking	30	47.6	22	46.8	8	47.1	13	34.2	3	50.0	14	73.7	9	36.0	4	33.3	13	65.0	3	75.0
Empathy/ emotional maturity ^h	27	42.9	23	48.9	3	17.6	13	34.2	5	83.3	9	47.4	11	44.0	1	8.3	12	60.0	2	50.0
Honesty/ integrity	20	31.7	17	36.2	3	17.6	12	31.6	3	50.0	5	26.3	11	44.0	1	8.3	6	30.0	2	50.0
Self-awareness/ reflection	19	30.2	11	23.4	7	41.2	14	36.8	2	33.3	3	15.8	7	28.0	6	50.0	4	20.0	0	0.0
Problem-solving	18	28.6	14	29.8	4	23.5	10	26.3	2	33.3	7	36.8	8	32.0	2	16.7	6	30.0	1	25.0
Motivation/ initiative/ ambition/ professional goals	18	28.6	14	29.8	4	23.5	11	28.9	1	16.7	6	31.6	9	36.0	2	16.7	5	25.0	2	50.0
Professionalism/ reliability	16	25.4	9	19.1	6	35.3	15	39.5	0	0.0	1	5.3	9	36.0	5	41.7	0	0.0	1	25.0
Adaptability/tolerance of uncertainty/ capacity for change/responsiveness to feedback/self-regulation/ trainability	16	25.4	10	21.3	5	29.4	13	34.2	0	0.0	3	15.8	8	32.0	4	33.3	2	10.0	1	25.0
Respect for others (difference and diversity, privacy and dignity)/ Cultural competency, awareness, etc.	16	25.4	12	25.5	4	23.5	12	31.6	3	50.0	1	5.3	8	32.0	4	33.3	4	20.0	0	0.0
Work experience/ community contributions	13	20.6	10	21.3	3	17.6	7	18.4	1	16.7	5	26.3	5	20.0	2	16.7	5	25.0	1	25.0
Compassion ^h	11	17.5	8	17.0	3	17.6	6	15.8	2	33.3	3	15.8	4	16.0	2	16.7	4	20.0	1	25.0
Commitment to care/ altruism/ person-centredness	10	15.9	9	19.1	1	5.9	6	15.8	1	16.7	3	15.8	5	20.0	1	8.3	4	20.0	0	0.0
Knowledge of health care system/ current issues	10	15.9	7	14.9	3	17.6	9	23.7	0	0.0	1	5.3	6	24.0	3	25.0	1	5.0	0	0.0
Response to stress/ resilience	9	14.3	7	14.9	1	5.9	8	21.1	1	16.7	0	0.0	6	24.0	1	8.3	1	5.0	0	0.0
Research motivation/ scholarship/Attitude towards learning/ personal development	9	14.3	7	14.9	2	11.8	8	21.1	1	16.7	0	0.0	6	24.0	2	16.7	1	5.0	0	0.0
Decision-making	9	14.3	8	17.0	1	5.9	7	18.4	2	33.3	0	0.0	6	24.0	1	8.3	2	10.0	0	0.0
Conflict resolution	8	12.7	4	8.5	4	23.5	6	15.8	0	0.0	1	5.3	3	12.0	3	25.0	1	5.0	0	0.0
Proficiency in basic practice skills/ patient safety	8	12.7	4	8.5	4	23.5	6	15.8	0	0.0	2	10.5	2	8.0	4	33.3	2	10.0	0	0.0
Management skills/ resource management skills	7	11.1	3	6.4	4	23.5	6	15.8	0	0.0	1	5.3	3	12.0	3	25.0	0	0.0	0	0.0
Responsibility/ reliability/ accountability	6	9.5	3	6.4	3	17.6	4	10.5	1	16.7	1	5.3	2	8.0	2	16.7	1	5.0	0	0.0
Advocacy	5	7.9	3	6.4	2	11.8	4	10.5	1	16.7	0	0.0	2	8.0	2	16.7	1	5.0	0	0.0
Personal skills: Ability to summarise/ IT knowledge/ information management/ self-directed learning	5	7.9	4	8.5	1	5.9	2	5.3	0	0.0	3	15.8	1	4.0	1	8.3	3	15.0	0	0.0
Interest in the School and reason/ understanding of the School's nature/ suitability for the School	4	6.3	2	4.3	2	11.8	0	0.0	0	0.0	4	21.1	0	0.0	0	0.0	2	10.0	2	50.0
Creativity	3	4.8	3	6.4	0	0.0	1	2.6	0	0.0	2	10.5	1	4.0	0	0.0	2	10.0	0	0.0
Giving and taking instructions	3	4.8	3	6.4	0	0.0	3	7.9	0	0.0	0	0.0	3	12.0	0	0.0	0	0.0	0	0.0
Prioritisation	3	4.8	2	4.3	1	5.9	3	7.9	0	0.0	0	0.0	2	8.0	1	8.3	0	0.0	0	0.0
Time management	2	3.2	1	2.1	1	5.9	2	5.3	0	0.0	0	0.0	1	4.0	1	8.3	0	0.0	0	0.0
Open mindedness/non-judgemental	1	1.6	1	2.1	0	0.0	0	0.0	0	0.0	1	5.3	0	0.0	0	0.0	1	5.0	0	0.0
Leadership	1	1.6	1	2.1	0	0.0	1	2.6	0	0.0	0	0.0	1	4.0	0	0.0	0	0.0	0	0.0

Note: yellow markings highlight instances where personal domains were assessed in at least 1 in 3 studies.

^aOnly studies with no missing data on personal domains are included.^bOccupational therapy, paramedic practice, dentistry, veterinary medicine, pharmacy, psychology.^cCompassion and empathy were considered different constructs and were not grouped together.^dOne study with missing data on study level.

Table 2Sources of personal domains assessed by MMIs in the reviewed studies ($N = 61^a$).

Source of personal domain	<i>n</i>	%
Programme philosophy/internal opinion/school educational goals	30	49.2
Professional body	29	47.5
General Medical Council (GMC)	5	8.2
General Dental Council UK	1	1.6
CanMEDS	10	16.4
Nursing and Midwifery Council (NMC)	2	3.3
Pharmacy accreditation	1	1.6
Association of American Veterinary Colleges	2	3.3
Irish Medical Council	1	1.6
Canadian Association of Occupational Therapists	1	1.6
Accreditation Council for Graduate Medical Education (ACGME)	3	4.9
Association of American Medical Colleges	1	1.6
Northern Ireland Practice and Education Council for Nursing and Midwifery	1	1.6
International Medical University (IMU) competencies	1	1.6
Literature review	13	21.3
Direct reference to Eva et al. (2004a, 2004b) seminal paper	7	11.5
State blueprinting	5	8.2
Commercially marketed material/company (ProFitHR Candidate Assessment System)	2	3.3
Previously published validated scenarios	2	3.3
Consultation with other institutions	1	1.6
Not specified	12	19.7
Single-source approach and consultation	40	65.6
Multi-source approach and consultation	21	34.4

^a Only studies with no missing data on sources of personal domains are included.