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Abstract

Up to 200 words

Aims

Academic medicine is a career route that historically struggles to recruit and retain suitable doctors. The aim of this paper is to review the evidence for interventions to encourage careers in academic medicine by way of a descriptive systematic review.

Methods

Key databases were searched in February 2017. Studies that evaluated interventions to encourage careers in academic medicine and that used a pre-post analysis or included a comparison group were included. Interventions reporting only learner satisfaction were excluded. The review was specific to medical students and graduates.

Results

Twenty-four studies were identified for inclusion within the review. The included studies identified interventions across five domains: postgraduate funding, postgraduate training, mentoring, undergraduate interventions and institutional change. The papers varied in terms of strength of conclusion and method of analysis with broad, structured, well-funded programmes having the most palpable results.

Conclusions

The five domains identified offer a framework that can be used by institutions who wish to develop similar programmes. It also offers a body of research on which an evidence base can be built.

Introduction

Within academic medicine, an older workforce and high vacancy rate at lecturer and professor level (Medical Schools Council 2016) are contributing to a staffing crisis (Wilkinson 2004). The crisis has many contributing factors, two of which have an evidence base; academics earn less than their non-academic clinical colleagues, which is of particular relevance in an era of escalating student debt (Grayson, Newton, and Thompson 2012; Lambert and Holmboe 2005). Lifestyle factors are increasingly being recognised as important in medical career decision making with increasing importance being put on work-life balance and home and family life in particular (Strong et al. 2013; Newton, Grayson, and Thompson 2005; Borges et al. 2010). The consequences of this staffing crisis are difficult to predict, but given that academic medicine contributes to the training of the future healthcare workforce and the development of healthcare research we would argue that it is a high priority issue.

In 2010 Borges and colleagues performed a literature review aiming to answer the question; ‘How, when and why do physicians choose careers in academic medicine?’ (Borges et al. 2010). They found multiple, interacting factors associated with academic medicine career choice and that both the loss of interest during clinical training and debt are obstacles. A second review echoed these findings; concluding that engaging students and retaining their interest once they move on to clinical training is key to keeping them interested in an academic career (Straus et al. 2006). The authors identified the need to evaluate initiatives to reinvigorate academic medicine and recommended that these should be evaluated prospectively across multiple sites. The literature on academic training schemes lacks depth. Analysis of this literature suggests that support for such schemes is prevalent, but available schemes lack quality with deficient training time a fundamental issue (Barton 2008).

In a pertinent editorial, Dornan (Tim Dornan 2009) argued that encouraging junior doctors and medical students into academic medicine requires work towards ‘engaging them in intellectually engaging scholarship’, essentially involving early exposure, preferably in a longitudinal setting, combined with high quality role models and mentoring. Up to the present time, there has been no review that describes and assesses the efficacy of methods to encourage careers in academic medicine.

A tool which can be applied to wide range of interventions is needed in order to compare and synthesise the different approaches taken to encourage academic careers. The Kirkpatrick hierarchy or model is one such tool (Kirkpatrick 2007). This model is a relatively simple one, which may in part explain why it remains popular for programme evaluation more than thirty years since its introduction (Bates 2004). The exact wording as applied to this review is in table 1, essentially the model outlines increasing levels of measured change that an educational programme (however broadly defined) may hope to achieve. At the bottom, level 1, are learners views on their experience. While learners views on how useful they felt an educational experience to be is important to the feasibility of a programme (if the learners all hated the programme it is unlikely to be successful) it rarely tells someone evaluating a programme much more as learners generally give all sessions generally positive feedback, limiting the value of a single measure of quality. At the top of the model is benefit to patients. This is the overarching reason for most educational interventions in healthcare but is almost never measured. The middle of the model, measuring knowledge, attitudes and behaviours is

more achievable in terms of educational interventions. As well as being simple, the model is widely used and as such provides a common language that most readers of this review will be immediately familiar.

We set out to systematically review evidence regarding interventions to encourage careers in academic medicine (descriptive) and consider whether they are effective (justification).

Methods

A systematic review methodology was chosen as it aligns with our research questions, allowing synthesis of the entire published evidence base within the specified area of interest. We will consider justification (whether certain techniques work and which work best) and description (details of the interventions to support replication) (Cook 2009).

Literature search and data sources

On the 10th February 2017, we searched key databases (EMBASE, Medline, PsycINFO and CINAHL, SCOPUS, Wiley InterScience Journals, Science Direct (Elsevier) and Oxford Journals). A standardised search with the terms “academic medicine” and “career*” was used. We initially attempted a more detailed search with more terms, but on completion of a scoping search found that despite many more papers being found, there was no increase in relevant papers and several key texts were missed. Finally, we hand searched reference lists of included articles.

Study selection and eligibility criteria

Throughout this paper, the term ‘postgraduate’ refers to time after receiving a medical degree and ‘undergraduate’ to time prior to graduating from medical school. There was no limitation on dates or language. Below in Table 1 is the inclusion and exclusion criteria.

[table 1 near here]

The inclusion and exclusion criteria removes papers that report only post hoc participant satisfaction which despite often being reported and vital to the feasibility of an educational intervention cannot confidently be correlated with effectiveness (Prystowsky and Bordage 2001). The inclusion criteria of a before and after design or inclusion of a comparison group represents the reviews focus on effectiveness of the reported interventions. The final question ‘are the outcomes of the study on one of the levels of Kirkpatrick’s hierarchy?’ excluded papers that could not be effectively evaluated in the next stage of the review. Educational interventions are expected to have outcomes on Kirkpatrick’s hierarchy (Bates 2004) therefore if this was not clear from the manuscript then the manuscript was deemed to be of limited utility for the review. This study focused on interventions to encourage careers in academic medicine, which are educational interventions in the broadest sense and can therefore be classified along Kirkpatrick’s hierarchy. Aligning results of studies to the Kirkpatrick model allows for a common language of programme evaluation to be adopted.

Conference abstracts were not included but efforts were made to identify subsequent published work based on their content. Articles that focused on academic careers and either gender or under-represented minorities were included if an intervention to encourage participation was present but if they were exploring medical careers in general they were excluded.

Two authors reviewed all titles and abstracts independently. Potentially relevant papers were reviewed in full and any areas of disagreement solved by meeting and reaching consensus. If it was not entirely clear if the paper met the specified criteria the manuscript was obtained for further review.

Quality assessment and data extraction

The corresponding author conducted the literature search and data extraction independently, to attempt to alleviate any possible bias (Eva 2008) the review was conducted utilising much of the methodology established by the Best Evidence Medical Education (BEME) group (Hammick, Dornan, and Steinert 2010), with the pragmatic modifications of an individual person extracting the data. We also decided to include papers that would normally be excluded due to having a low strength of conclusion, as the results themselves may be relevant. The method was agreed and established with other members of the research team.

The characteristics of the studies to be included were extracted under a number of headings and aimed to provide a brief synopsis of each paper to allow synthesis of key findings along with the level on Kirkpatrick's hierarchy (Figure 1). In addition the strength of the results, using the BEME systematic review tool (Hammick, Dornan, and Steinert 2010), (Figure 2) was included. This tool was chosen due its international recognition and the teams familiarity with it. The conduct of the review, and its subsequent write up, was mapped to the STORIES statement to ensure excellent reporting standards (Gordon and Gibbs 2014).

During initial review of the included studies it was clear that the studies divided into five separate domains based on the primary focus of the intervention; postgraduate training, postgraduate funding, undergraduate interventions, mentoring and institutional change. There is some overlap between these domains. Dividing the papers by the main focus of their intervention allowed for easier interrogation for common themes by both the research team and hopefully for the reader.

[figure 1 near here]

[figure 2 near here]

Results

Searching NHS (National Health Service) Evidence (an online portal allowing simultaneous searching of several databases) yielded 1193 citations. Four hundred and twelve duplicate citations were removed leaving 781 titles and abstracts for review. Abstract review excluded 712 leaving 69 papers to be retrieved and processed with the manuscript screening tool. Forty-seven papers were removed at this stage leaving 22 for inclusion in the literature review (see figure 3). The SCOPUS search yielded one further paper (Cox et al. 2012) as did hand searching of reference lists (Garman, Wingard, and Reznik 2001). A table containing details of each included study is available as an online supplement.

[figure 3 near here]

Quality and characteristics of included studies

Two papers focused on postgraduate funding (Jagsi et al. 2007; Eloy et al. 2014), twelve on postgraduate training (Thorndyke et al. 2006; Sanfey et al. 2011; Ries et al. 2012; Ries et al. 2009; Garman, Wingard, and Reznik 2001; Dannels et al. 2008; McDade et al. 2004; Daley, Wingard, and Reznik 2006; Wingard, Garman, and Reznik 2004; Segal et al. 2006; Champion et al. 2016; Chang et al. 2016), three on mentoring programmes (Mayer et al. 2013; Varkey et

al. 2012; Farag et al. 2012), five related to interventions targeted at medical students (Funston, Young, and Lomas 2011; Solomon et al. 2003; Coleman, Blatt, and Greenberg 2012; Choi et al. 2013; Areephanthu et al. 2015) and two on institutional change (Fried et al. 1996; Villablanca et al. 2013). Of the twenty-four papers, thirteen (54%) had a before and after designs, ten were case control studies (42%) and one reported action research (4%). The strength of outcomes, as described in figure 3, varied with two (8%) papers having a strength of one i.e. “no clear conclusions can be drawn”, five (21%) papers a strength of two, ten (42%) papers a strength of three and seven (29%) a strength of four i.e. “clear and very likely to be true”. No studies were rated as five, unequivocal findings. One study (4%) was from the United Kingdom, two (8%) were from both Canada and the USA with the remaining twenty-one (88%) being solely USA based.

Postgraduate funding

A university specific award of \$US 50,000, aimed at providing bridging funding for women researchers during childbearing years, correlated with greater promotion and retention when compared to unsuccessful applicants. The programme also appeared to be cost effective (Jagsi et al. 2007). Receipt of a specialty specific grant was associated with a higher h-index when compared to specialists who did not receive funding. The finding was statistically significant but only for those with between ten and twenty years of publication experience (Eloy et al. 2014). The h-index is a measure of the number of articles an individual has published and how often they are cited and while it is objective it is, as the authors point out, not without weaknesses (Alonso et al. 2009).

Postgraduate training

Two studies meeting the inclusion criteria evaluated a specific yearlong external leadership development programme for senior US and Canadian women faculty. The first was a before and after study which demonstrated statistically significant improvement in self-rated knowledge and skills related to leadership 11 months after completion of the programme (McDade et al. 2004). The second study replicated the before and after findings but also compared the results with those who applied for the programme but were unsuccessful and a matched control group who did not apply, finding statistically significant improvements in self-rated indicators of skills, knowledge and attitudes relating to leadership and administration (Dannels et al. 2008). A similar finding was observed in two separate university specific programmes (Thorndyke et al. 2006; Sanfey et al. 2011).

A long running faculty development programme was evaluated in five papers. The programme is associated with improved self-rated academic skills compared with non-participants (Garman, Wingard, and Reznik 2001), a statistically significant 67% increase in staff retention (Ries et al. 2009), a third study replicated the improved retention; it also aimed to evaluate academic success for participants compared with controls but was underpowered to do so (Ries et al. 2012). A fourth paper looked at the same cohort, this time from the perspective of under-represented minorities, and found an increase in retention from 58% to 80% in the school of medicine and from 75% to 90% in academic medicine, these results were not statistically significant (Daley, Wingard, and Reznik 2006). The final paper outlined a return on investment analysis and concluded that for every US dollar spent on the programme the department saved US\$1.49 on recruitment costs (Wingard, Garman, and Reznik 2004). Although each of these five studies has their own particular weaknesses, when taken as a body of evidence a conclusion that the programme is effective and value for

money can be made with a degree of confidence, something rarely seen when evaluating such programmes.

A ten month faculty development programme comprising protected time, focused teaching and peer mentoring and targeted at mid-career faculty increased self-rated knowledge, skills, attitudes compared with controls and increased connectivity post intervention (Campion et al. 2016)

Orthopaedic trainees who completed a research year were more likely to have an academic element to their practice (25% versus 6.3%) than their peers who did not complete a research year. They also had more publications, though this finding was not statistically significant (Segal et al. 2006).

A large study from the US studied over three thousand women who had completed one of three national career development programmes tailored towards women in academic medicine. The authors compared retention in this group with over eighteen thousand women who had not completed the programme and greater than forty-three thousand men finding that participants in the programme were less likely to leave academic medicine (Chang et al. 2016).

Mentoring

While a number of the papers in the previous section included mentoring as part of wide postgraduate training initiatives (Thorndyke et al. 2006; Ries et al. 2012; Ries et al. 2009; Garman, Wingard, and Reznik 2001; Daley, Wingard, and Reznik 2006; Wingard, Garman, and Reznik 2004) there were some that reported utilising it independently. A mentoring programme, focused on women in academic medicine, was found to improve a range of self-assessed domains in two separate studies conducted at different time intervals within the same institution (Mayer et al. 2013; Varkey et al. 2012). A smaller study, based in an academic department of anaesthesia, failed to find any difference in self-reported ratings of the importance of mentoring pre- and post-intervention (Frag et al. 2012).

Undergraduate interventions

A British university clinical research society, established by students and facilitated by faculty, organised a lecture series culminating in a national conference and found an increase in self-reported interest in academic careers (Funston, Young, and Lomas 2011). A residential course on teaching and academic skills with thirteen participants demonstrated a positive trend in short-term pre-post measures of self-efficacy and commitment to academic medicine (Coleman, Blatt, and Greenberg 2012). A much larger summer research programme, which reported approximately 1000 participants over 25 years, was limited in its evaluation by only having pre-post data for 96 respondents and for one question (Solomon et al. 2003).

Over one hundred medical students completed a funded mentored research fellowship that ran parallel to their usual undergraduate studies. The extra work didn't appear to have a negative impact on the students progress and they had a modest increase in academic success. A confounding factor is that the participants had, on average, higher test scores on admission to medical school (Areephanthu et al. 2015).

Choi et al. (Choi et al. 2013) examined the academic output and career position of graduates of selected neurosurgical training programmes in the US comparing those who had graduated with joint MD-PhD degrees with those who had a standard MD. Twenty per cent of the 613 trainees had both MD and PhDs and were more likely to hold academic appointments and to have received significant research funding than those with only a MD. They concluded that a strong correlation exists between obtaining both degrees and active participation in research.

Institutional change

Two studies looked at institutional wide approaches to try and improve retention of faculty in a US University Medical School setting. The first, from Baltimore, asked if an institutional strategy utilising faculty education, mentoring and academic rewards could help alleviate some of the gender-based obstacles to women in academic medicine. They had some success, particularly in the number of women considering leaving academic medicine, finding that 'interventions increased the optimism of women faculty about their careers and decreased the disparity between women's high interest in remain in academic medicine and their low expectations that they would' (Fried et al. 1996). A study from California used a multifaceted approach to try and improve knowledge, awareness and use of flexible career policies and found significant positive change in these domains as measured by the Work, Family and Satisfaction Survey (Villablanca et al. 2013).

Discussion

To our knowledge this is the first review to amalgamate the available evidence on the state of the art in terms of encouraging academic careers. The included studies were heterogeneous both in size, quality and applied intervention but similar in their ability to detect correlation but not causation.

Funding, in a specific context, is correlated with increased promotion and retention and is likely to offer good value for money (Jagsi et al. 2007). In a different context, but of higher risk of bias due to methodological concerns, funding is correlated with scholarly impact (Eloy et al. 2014). What is unclear is that if these grants are an indicator of academic success and that if they were not available whether or not comparable achievements would have occurred though an alternative route. It should be noted that funding is required for all the successful interventions and that other changes without funding seem unlikely to succeed.

Comprehensive leadership programmes and faculty development programmes for postgraduate medical education faculty and researchers have been reported in the literature more than any other type of intervention meeting the inclusion criteria of this review. While each paper taken individually has considerable methodological weaknesses that make the findings difficult to rely upon, taken together the argument for their implementation is strong. The single study examining a dedicated postgraduate research year for clinical trainees is insufficient to make a statement for or against their efficacy.

Both studies looking at mentoring in terms of academic medicine are limited by a lack of a control group and by having a small number of participants. The authors, in both cases, limited their conclusions to finding an increased level of academic skill post-participation, noting the inherent frailties in self-reported measures. The relative paucity of evidence for isolated mentoring schemes contrasts to that of faculty development schemes, most of which incorporate mentoring, for which the literature is more substantial.

It would seem that running an undergraduate society, facilitating a summer research project and providing academic focused teacher training are all well received by participants but lack any real evidence of efficacy in encouraging academic careers. The positive correlation between academic careers and obtaining both MDs and PhDs is not surprising and the paper makes no claims or causation. Even if such programmes merely facilitate career progression for those who decide on an academic career early on, this alone is likely to be sufficient justification for their continued existence.

The two papers exploring institutional change acknowledge an oft-neglected possible reason for the reported decline in academic careers. While other industries strive to make work possible and appealing for the entire workforce, medicine, and in particular academic medicine, seems to have fallen behind in implementing policies that recognise the increasing importance workers place on work-life balance. The papers provide evidence that an institutional approach can help with retention perhaps by addressing work-life imbalance.

Looking at the results as a whole it seems that interventions aimed at faculty are more effective than interventions targeted at those in post graduate training, which in turn are more effective than interventions targeted at undergraduates. It may be more accurate to say that there is more evidence for effectiveness for interventions targeting more senior staff. Another way of thinking about it could be proximity to academia; the closer someone is to an academic career the more they can be influenced by interventions aiming to encourage such a career.

This review reveals a limited amount of evidence as to what works in encouraging academic careers. The five domains highlighted herein offer areas for further exploration and an evidence base on which to build. It is likely that many interventions are being run at institutions internationally but that these have not been reported in the literature. It is vital that these interventions are analysed in a scholarly fashion and made available to inform new and developing programmes.

One factor that is alluded to, but not discussed in any depth, in the papers found in this review is the impact of role modelling. The literature around medical career decision making highlights role modelling as a key feature (Passi et al. 2013) and despite its notable absence in the identified literature, this could be considered in future endeavours to encourage academic careers.

This systematic review has identified five types of intervention aimed at encouraging careers in academic medicine. Of these, formalised postgraduate training programmes have the most evidence both in terms of quality and quantity. These programmes often combine academic skills, leadership and mentoring. They have been evaluated by pre- and post- self-assessment of skills and confidence, academic output and via an economic evaluation.

The other four domains: postgraduate funding, undergraduate interventions, mentoring and institutional change have less convincing evidence but nothing to suggest that they should not be considered in programmes going forward. Career choice is a complex longitudinal process and it would seem likely that a combination of interventions aimed at increasing awareness, removing barriers and creating opportunities for academic practice will be more successful than a single discrete programme.

Limitations

The key limitation of this review is that a single author performed the search and extraction. The detailed reporting of methodology and use of recognisable tools helps to negate some of the possible bias. It is possible that relevant articles were not identified during the search. By using English language search terms we effectively excluded reports in other languages. The methodology also excluded rigorous qualitative studies, which may provide valuable insights into perceptions of academic careers.

Practice Points

- Funding research careers encourages research careers
- Retaining staff can be cheaper than recruiting
- Combining mentoring, funding and training probably works
- Undergraduate interventions are little studied

Notes on Contributors

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Declaration of Interest

The authors state that they have no declarations of interest to report.

Illustrations and Tables

Table 1. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Undergraduate medical students or postgraduate medical professions / graduates	Other health professional groups or mixed groups of professionals
Intervention specifically targeted at encouraging a career in academic medicine	Papers reporting on issues relating to academic careers without interventions, such as a survey of current opinion or an editorial
Studies including either a before and after design or a comparison group.	Studies reporting only a single measure of learner or participant satisfaction.
Focus on medical academic careers, defined in the broadest terms as combining clinical work with scholarly work such as teaching or research	Focus on clinical career routes or other health profession routes Focus on gender or ethnic specific issues of career development without considering academic careers specifically
Outcomes on any level of Kirkpatrick's hierarchy	No outcomes measured
Any published peer reviewed papers	None peer reviewed papers and conference proceedings

Kirkpatrick hierarchy

- **Level 1 Participation** - covers learners' views on the learning experience, its organisation, presentation, content, teaching methods, and aspects of the instructional organisation, materials, quality of instruction
- **Level 2a Modification of attitudes/perceptions** - outcomes here relate to changes in the reciprocal attitudes or perceptions between participant groups toward intervention/simulation
- **Level 2b Modification of knowledge/skills** - for *knowledge*, this relates to the acquisition of concepts, procedures and principles; for *skills* this relates to the acquisition of thinking/problem-solving, psychomotor and social skills
- **Level 3 Behavioural change** - documents the transfer of learning to the workplace or willingness of learners to apply new knowledge & skills.
- **Level 4a Change in organisational practice** - wider changes in the organisational delivery of care, attributable to an educational program
- **Level 4b Benefits to patient / clients** - any improvement in the health & well being of patients/clients as a direct result of an educational program.

Figure 1. Kirkpatrick's hierarchy as applied to reviewed articles.

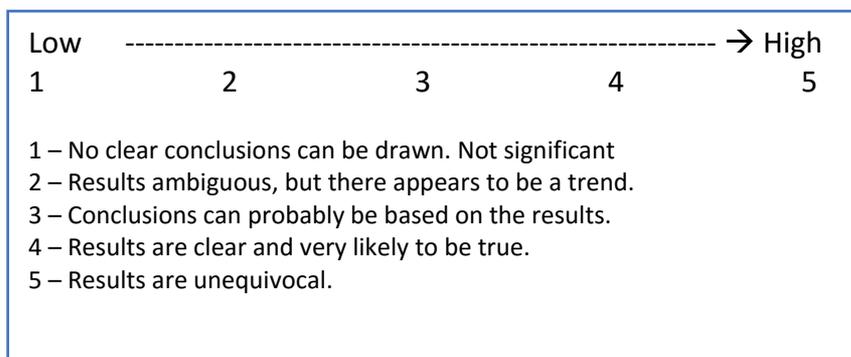


Figure 2. Tool used to grade strength of results of articles reviewed.

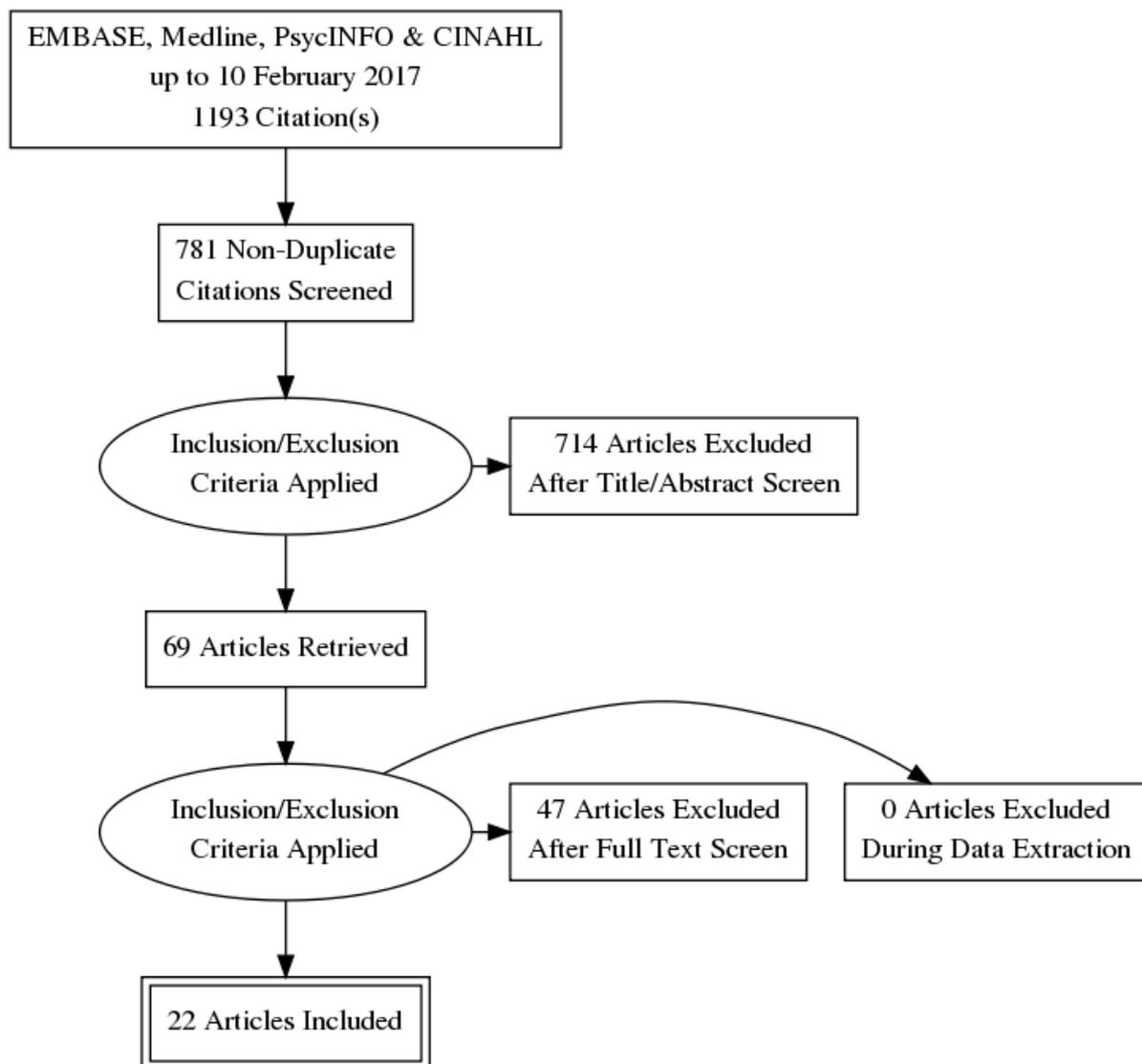


Figure 3. Flow diagram demonstrating the search and paper selection on the NHS Evidence platform.

References

- Alonso, S, F J Cabrerizo, E Herrera-Viedma, and F Herrera. 2009. "H-Index: a Review Focused in Its Variants, Computation and Standardization for Different Scientific Fields." *Journal of Informetrics* 3 (4): 273–289. doi:10.1016/j.joi.2009.04.001.
- Arephanthu, Christopher James, Raevti Bole, Terry Stratton, Thomas H Kelly, Catherine P Starnes, and B Peter Sawaya. 2015. "Impact of Professional Student Mentored Research Fellowship on Medical Education and Academic Medicine Career Path.." *Clinical and Translational Science* 8 (5): 479–483. doi:10.1111/cts.12289.
- Barton, John Roger. 2008. "Academic Training Schemes Reviewed: Implications for the Future Development of Our Researchers and Educators." *Medical Education* 42 (2). Blackwell Publishing Ltd: 164–169. doi:10.1111/j.1365-2923.2007.02978.x.
- Bates, Reid. 2004. "A Critical Analysis of Evaluation Practice: the Kirkpatrick Model and the Principle of Beneficence." *Evaluation and Program Planning* 27 (3). Pergamon: 341–347. doi:10.1016/j.evalprogplan.2004.04.011.

- Borges, Nicole J, Anita M Navarro, Amelia Grover, and J Dennis Hoban. 2010. "How, When, and Why Do Physicians Choose Careers in Academic Medicine? a Literature Review." *Academic Medicine* 85 (4): 680–686. doi:10.1097/ACM.0b013e3181d29cb9.
- Campion, MaryAnn W, Robina M Bhasin, Donald J Beaudette, Mary H Shann, and Emelia J Benjamin. 2016. "Mid-Career Faculty Development in Academic Medicine: How Does It Impact Faculty and Institutional Vitality?." *The Journal of Faculty Development* 30 (3). NIH Public Access: 49–64.
- Chang, Shine, Page S Morahan, Diane Magrane, Deborah Helitzer, Hwa Young Lee, Sharon Newbill, Ho-Lan Peng, Michele Guindani, and Gina Cardinali. 2016. "Retaining Faculty in Academic Medicine: the Impact of Career Development Programs for Women.." *Journal of Women's Health (2002)* 25 (7). Mary Ann Liebert, Inc. 140 Huguenot Street, 3rd Floor New Rochelle, NY 10801 USA: 687–696. doi:10.1089/jwh.2015.5608.
- Choi, Bryan D, Michael R DeLong, David M DeLong, Allan H Friedman, and John H Sampson. 2013. "Impact of PhD Training on Scholarship in a Neurosurgical Career." *Journal of Neurosurgery*, December, 1–6. doi:10.3171/2013.11.JNS122370.
- Coleman, Michelle M, Benjamin Blatt, and Larrie Greenberg. 2012. "Preparing Students to Be Academicians: a National Student-Led Summer Program in Teaching, Leadership, Scholarship, and Academic Medical Career-Building.." *Academic Medicine* 87 (12): 1734–1741. doi:10.1097/ACM.0b013e318271cfd6.
- Cox, Timothy M, James Brimicombe, Diana F Wood, and D Keith Peters. 2012. "The Cambridge Bachelor of Medicine (MB)/Doctor of Philosophy (PhD): Graduate Outcomes of the First MB/PhD Programme in the UK.." *Clinical Medicine (London, England)* 12 (6). Royal College of Physicians: 530–534. doi:10.7861/clinmedicine.12-6-530.
- Daley, Sandra, Deborah L Wingard, and Vivian Reznik. 2006. "Improving the Retention of Underrepresented Minority Faculty in Academic Medicine.." *Journal of the National Medical Association* 98 (9): 1435–1440.
- Dannels, Sharon A, Hisashi Yamagata, Sharon A McDade, Yu-Chuan Chuang, Katharine A Gleason, Jean M McLaughlin, Rosalyn C Richman, and Page S Morahan. 2008. "Evaluating a Leadership Program: a Comparative, Longitudinal Study to Assess the Impact of the Executive Leadership in Academic Medicine (ELAM) Program for Women." *Academic Medicine* 83 (5): 488–495. doi:10.1097/ACM.0b013e31816be551.
- Dornan, Tim. 2009. "Recruitment to Academic Medicine.." *Medical Education* 43 (4). Blackwell Publishing Ltd: 300–302. doi:10.1111/j.1365-2923.2009.03294.x.
- Eloy, Jean Anderson, Peter F Svider, Michael Setzen, Soly Baredes, and Adam J Folbe. 2014. "Does Receiving an American Academy of Otolaryngology–Head and Neck Surgery Foundation Centralized Otolaryngology Research Efforts Grant Influence Career Path and Scholarly Impact Among Fellowship-Trained Rhinologists?." *International Forum of Allergy & Rhinology* 4 (1): 85–90. doi:10.1002/alr.21224.
- Eva, Kevin W. 2008. "On the Limits of Systematicity." *Medical Education* 42 (9). Blackwell Publishing Ltd: 852–853. doi:10.1111/j.1365-2923.2008.03140.x.
- Farag, Ehab, Alaa A Abd-Elsayed, Edward J Mascha, and Jerome F O'Hara. 2012. "Assessment of an Anesthesiology Academic Department Mentorship Program.." *The Ochsner Journal* 12 (4): 373–378.
- Fried, L P, C A Francomano, S M MacDonald, E M Wagner, E J Stokes, K M Carbone, W B Bias, M M Newman, and J D Stobo. 1996. "Career Development for Women in Academic Medicine: Multiple Interventions in a Department of Medicine.." *JAMA : the Journal of the American Medical Association* 276 (11): 898–905.

- Funston, Garth M, Adam M H Young, and David Lomas. 2011. "Cambridge University Clinical Research Society: Promoting Academic Medicine.." *Medical Education* 45 (11): 1134–1135. doi:10.1111/j.1365-2923.2011.04109.x.
- Garman, K A, D L Wingard, and V Reznik. 2001. "Development of Junior Faculty's Self-Efficacy: Outcomes of a National Center of Leadership in Academic Medicine.." *Academic Medicine* 76 (10 Suppl): S74–S76.
- Gordon, Morris, and Trevor Gibbs. 2014. "STORIES Statement: Publication Standards for Healthcare Education Evidence Synthesis.." *BMC Medicine* 12 (1). BioMed Central: 143. doi:10.1186/s12916-014-0143-0.
- Grayson, Martha S, Dale A Newton, and Lori F Thompson. 2012. "Payback Time: the Associations of Debt and Income with Medical Student Career Choice." *Medical Education* 46 (10). Blackwell Publishing Ltd: 983–991. doi:10.1111/j.1365-2923.2012.04340.x.
- Hammick, Marilyn, Timothy Dornan, and Yvonne Steinert. 2010. "Conducting a Best Evidence Systematic Review. Part 1: From Idea to Data Coding. BEME Guide No. 13." *Medical Teacher* 32 (1). Informa UK Ltd UK: 3–15. doi:10.3109/01421590903414245.
- Jagsi, Reshma, Joan R Butterson, Rebecca Starr, and Nancy J Tarbell. 2007. "A Targeted Intervention for the Career Development of Women in Academic Medicine.." *Archives of Internal Medicine* 167 (4): 343–345. doi:10.1001/archinte.167.4.343.
- Kirkpatrick, Donald. 2007. *The Four Levels of Evaluation*. American Society for Training and Development.
- Lambert, Emily M, and Eric S Holmboe. 2005. "The Relationship Between Specialty Choice and Gender of U.S. Medical Students, 1990-2003.." *Academic Medicine* 80 (9): 797–802.
- Mayer, Anita P, Janis E Blair, Marcia G Ko, Salma I Patel, and Julia A Files. 2013. "Long-Term Follow-Up of a Facilitated Peer Mentoring Program." *Medical Teacher*, November. Informa UK Ltd. London, 1–7. doi:10.3109/0142159X.2013.858111.
- McDade, Sharon A, Rosalyn C Richman, Gregg B Jackson, and Page S Morahan. 2004. "Effects of Participation in the Executive Leadership in Academic Medicine (ELAM) Program on Women Faculty's Perceived Leadership Capabilities.." *Academic Medicine* 79 (4): 302–309.
- Medical Schools Council. 2016. "A Survey of Staffing Levels of Medical Clinical Academics in UK Medical Schools as at 31 July 2015," June, 1–46. <http://www.medschools.ac.uk/SiteCollectionDocuments/MSc-survey-2016.pdf>.
- Newton, Dale A, Martha S Grayson, and Lori Foster Thompson. 2005. "The Variable Influence of Lifestyle and Income on Medical Students' Career Specialty Choices: Data From Two U.S. Medical Schools, 1998-2004.." *Academic Medicine* 80 (9): 809–814.
- Passi, Vimmi, Samantha Johnson, Ed Peile, Scott Wright, Fred Hafferty, and Neil Johnson. 2013. "Doctor Role Modelling in Medical Education: BEME Guide No. 27.." *Medical Teacher* 35 (9). Taylor & Francis: e1422–e1436. doi:10.3109/0142159X.2013.806982.
- Prystowsky, J B, and G Bordage. 2001. "An Outcomes Research Perspective on Medical Education: the Predominance of Trainee Assessment and Satisfaction.." *Medical Education* 35 (4). Blackwell Science Ltd: 331–336. doi:10.1046/j.1365-2923.2001.00910.x.
- Ries, Andrew, Deborah Wingard, Anthony Gamst, Catherine Larsen, Elizabeth Farrell, and Vivian Reznik. 2012. "Measuring Faculty Retention and Success in Academic Medicine.." *Academic Medicine* 87 (8): 1046–1051. doi:10.1097/ACM.0b013e31825d0d31.
- Ries, Andrew, Deborah Wingard, Cindy Morgan, Elizabeth Farrell, Sharon Letter, and Vivian Reznik. 2009. "Retention of Junior Faculty in Academic Medicine at the

- University of California, San Diego..” *Academic Medicine* 84 (1): 37–41.
doi:10.1097/ACM.0b013e3181901174.
- Sanfey, Hilary, Ilene Harris, Sue Pollart, and Alan Schwartz. 2011. “Evaluation of the University of Virginia Leadership in Academic Medicine Program..” *Teaching and Learning in Medicine* 23 (4): 347–358. doi:10.1080/10401334.2011.611773.
- Segal, Lee S, Kevin P Black, Edwards P Schwentker, and Vincent D Pellegrini. 2006. “An Elective Research Year in Orthopaedic Residency: How Does One Measure Its Outcome and Define Its Success?.” *Clinical Orthopaedics and Related Research* 449 (August): 89–94. doi:10.1097/01.blo.0000224059.17120.cb.
- Solomon, Solomon S, Stephen C Tom, James Pichert, David Wasserman, and Alvin C Powers. 2003. “Impact of Medical Student Research in the Development of Physician-Scientists..” *Journal of Investigative Medicine* 51 (3): 149–156.
- Straus, Sharon E, Christine Straus, Katina Tzanetos, International Campaign to Revitalise Academic Medicine. 2006. “Career Choice in Academic Medicine: Systematic Review..” *Journal of General Internal Medicine* 21 (12). Springer-Verlag: 1222–1229.
doi:10.1111/j.1525-1497.2006.00599.x.
- Strong, Erin A, Rochelle De Castro, Dana Sambuco, Abigail Stewart, Peter A Ubel, Kent A Griffith, and Reshma Jagsi. 2013. “Work–Life Balance in Academic Medicine: Narratives of Physician-Researchers and Their Mentors.” *Journal of General Internal Medicine* 28 (12). Springer US: 1596–1603. doi:10.1007/s11606-013-2521-2.
- Thorndyke, Luanne E, Maryellen E Gusic, John H George, David A Quillen, and Robert J Milner. 2006. “Empowering Junior Faculty: Penn State's Faculty Development and Mentoring Program..” *Academic Medicine* 81 (7): 668–673.
doi:10.1097/01.ACM.0000232424.88922.df.
- Varkey, Prathibha, Aminah Jatoi, Amy Williams, Anita Mayer, Marcia Ko, Julia Files, Janis Blair, and Sharonne Hayes. 2012. “The Positive Impact of a Facilitated Peer Mentoring Program on Academic Skills of Women Faculty..” *BMC Medical Education* 12 (1): 14.
doi:10.1186/1472-6920-12-14.
- Villablanca, Amparo C, Laurel Beckett, Jasmine Nettiksimmons, and Lydia P Howell. 2013. “Improving Knowledge, Awareness, and Use of Flexible Career Policies Through an Accelerator Intervention at the University of California, Davis, School of Medicine..” *Academic Medicine* 88 (6): 771–777. doi:10.1097/ACM.0b013e31828f8974.
- Wilkinson, David. 2004. “ICRAM (the International Campaign to Revitalise Academic Medicine): Agenda Setting.” *British Medical Journal* 329 (7469). BMJ Group: 787–789.
doi:10.1136/bmj.329.7469.787.
- Wingard, Deborah L, Karen A Garman, and Vivian Reznik. 2004. “Facilitating Faculty Success: Outcomes and Cost Benefit of the UCSD National Center of Leadership in Academic Medicine..” *Academic Medicine* 79 (10 Suppl): S9–S11.