BMJ Open

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Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2014-005658
Article Type:	Research
Date Submitted by the Author:	11-May-2014
Complete List of Authors:	Pyne, Vicky; University of Bristol, ; Ben-Schlomo, Yoav; Dept of Social Medicine
Primary Subject Heading:	Medical education and training
Secondary Subject Heading:	Medical management
Keywords:	MEDICAL EDUCATION & TRAINING, Human resource management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisational development < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

Older doctors and progression through specialty training in the United Kingdom: a cohort analysis of General Medical Council data.

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Abstract

Objective: To determine whether older age at graduation is associated with any difference in outcomes from the annual specialty training progression assessment.

Design: An open cohort of 38,308 doctors who graduated from a United Kingdom medical school with annual assessments of progression in their specialty training program with data centrally collected by the General Medical Council between 05/08/2009 to 31/07/2012.

Results: Mature junior doctors (≥ 28 years at graduation) were more likely to have problems with progression on their ARCP/RITA than their younger colleagues (Odds ratio 1.34, 95% CI 1.22, 1.49, p<0.001). This association was, if anything, even stronger (Odds ratio 1.57, 95% CI 1.41, 1.74, p<0.001) after adjustment for gender, ethnicity, type of University and specialty. The same was true when only looking at the most extreme ARCP outcome (4) which is being asked to leave their specialist programme (Odds ratio 1.81, 95% CI 1.34, 2.44, p<0.001).

Conclusions: Mature doctors are a growing part of the medical workforce and they are likely to broaden the spectrum of doctors by bring different life experience to the profession. These results suggest that they are more likely to have problems with progressing through their specialist training programme. More research is required to determine the reasons behind these associations and how mature doctors can be supported both in choosing the best training programme and in coping with the complex demands of higher training at a later stage in their lives.

Strengths of this Study

1. First study to look at how age at graduation affects a doctors chances of succeeding in their annual revalidation.
2. Quantative nature of study ensures minimal sources of bias and large volume of data ensures small p-values.
3. Results are counter to prevailing beliefs and research regarding mature medical students showing that despite doing better at university, they appear to 'do worse' once they have become doctors.
4. Continues to add to the growing literature regarding how minority groups appear to struggle more with formal performance measures of doctors.

Limitations of this Study

5. Currently no qualitative analysis of the cause of these results.

Introduction

Over the last decade, more mature students have been welcomed onto the medical training programme. Whilst they only make up around 4% of medical students in the UK[1], they are a more substantial proportion of graduates from the USA and Canada (16.7% and 14.2% were 30 or older at graduation respectively [2 3]). These students are often different in their outlook and abilities to a typical school leaver and may be better suited as both a student and future doctor. For example, the former director of the graduate entry programme at St George's Hospital Medical School has stated that "mature students… are sooner and better able to handle the responsibilities of being a doctor" and are "much more self-directed, challenging, demanding, questioning, and mature" than their younger counterparts [4]. These subjective views have some limited support from both qualitative and quantitative research during the medical school years, for example, older students appear to do better at year 3 OSCE exams [5]. Two studies have suggested that mature students cope better with the transition to clinical responsibilities feeling less confused, daunted, anxious or intimidated and more likely to describe a positive transition [6 7]. This may not merely reflect greater academic experience; greater age at program entry, as opposed to the presence of a previous degree, was a better predictor for positive attributes and attitudes related to being a doctor [8]. This may reflect stronger motivational factors that lead them to positively choose medicine as a subsequent career.

Remarkably little is known about what happens to these mature graduates after they qualify. These positive attitudes could result in very focussed and determined graduates who try to reach their choice of specialist career as quickly and efficiently as possible thereby progressing through their training rapidly. On the other hand, mature graduates are more likely to have established geographical roots and family commitments that may make handling the double burdens of career and family problematic even earlier in their training as compared to younger graduates. Anecdotal evidence from the Severn Deanery has suggested that some mature students required greater support with getting through their annual assessment (previously known as RITA - Record of In

Training Assessment) and now referred to as ARCP (Annual Review of Competence Progression). We objectively test the null hypothesis that the proportion of doctors who either require additional training time or who are asked to leave the programme is the same for both older and younger graduate doctors.

Methods

Datasource and variable definitions

The General Medical Council, who collate the national data on ARCP/RITA, kindly provided us with an anonymised extract of data for all medical doctors who had a review between 05/08/2009 to 31/07/2012. In the United Kingdom, prior to 2013, the ARCP/RITA process begins at the start of speciality training (such as surgery or primary care) and continues until completion of training (obtaining a certificate of completion of training – CCT) that enables doctors to apply for a consultant post.

Because the coding of the outcomes for ARCP and RITA do not map directly onto each other, we had to use slightly different definitions for our outcome measure of poor progression. For ARCP we used codes 3 (requires additional training time), 4 (released from the programme) and 7.3 (inadequate progress) as a composite measure of poor progression. For the RITA we used codes D (targeted training) and E (intensified or repeat training) as our poor outcome measure (see appendix 1 for the full coding scheme)[9 10]. We choose to exclude subjects with a code for insufficient evidence (as this often reflects inadequate documentation rather than poor progress per se) and those trainees on an out-of-program secondment.

Our exposure measure was based on an arbitrary age cut-off (coded as an integer value). There is no accepted standard definition of a “mature” student so we chose to define this as a graduate who was 29 years or over at the year of first registration (i.e. year of graduation). By choosing this cut-point we hoped to not include graduates who had simply taken a gap year, intercalated BSc or a prior

degree before going straight into medicine (as this should mean they are not older than 27 years) but those who would have had some years of "work" experience outside of medicine. This is similar to a previous study that defined the "older mature" as "students who have worked in other occupations for a number of years prior to making a decision to apply to medical school" [11]. For secondary analyses we further sub-divided this 'mature' group into those aged between 29 years and 31 years and those who were 32 years or older on date of first registration to examine for any dose-response effects with older age at registration and to ensure that our results were not overly sensitive to our arbitrary cut-point. We defined, a priori, a number of potential confounders or intermediaries that could be associated with being an older graduate and a greater probability of poor progression. These were gender, specialty, ethnicity, and whether the graduate had qualified from a "mature friendly" medical school that may be better able to help the older graduate cope with the future stresses of being a doctor. This last variable was operationalized as follows: We calculated the percentage of mature students graduating from the medical school and then created a binary variable if the percentage was greater than 10% - approximately the top quartile and these were mainly the new medical schools (e.g. Exeter, Brighton & Sussex etc). We could not disaggregate the London-based medical schools as they were all coded as University of London.

Statistical methods

The original dataset had multiple records for a doctor for each assessment (long format) but this could be linked by an anonymous unique identifier. We reshaped the data into wide format (one row per doctor) so each doctor is only represented once in the dataset. If the doctor had poor progression more than once, we only coded the first event. We compared simple proportions using Chi-squared tests and linear regression for continuous variables. We then calculated the crude odds ratio (95% confidence intervals, p-values) for older age at graduation and poor progression and multivariable odds ratio adjusting for gender, ethnicity (binary variable defined as non-ethnic if ticked any of the White ethnicity codes from census or ethnic minority, which included any other

code), specialty (dummy variable) and mature friendly medical school (binary variable). For specialty we used hospital medicine as the baseline group as it had the largest number of doctors. We undertook a sensitivity analysis using the most extreme outcome – leaving the training programme. As this is only explicitly coded in the ARCP outcomes, we could not use subjects with RITA assessments for this secondary analysis. We examined for potential interactions between age at registration with gender and ethnicity and either failure to progress or being asked to leave the specialty.

Results

We received a total of 110,571 records (multiple assessments per doctor). We dropped 307 records (0.3%) without a specialty code and there were 5,173 records with a missing outcome (4.7%) and 361 records (0.3%) with an ambiguous code that we could not use (99% of the missing outcome data came from 2012, when the GMC asked Deaneries to return forms even for doctors who were not having ARCPs as they were out of programme, on maternity leave or long term sick so these are not really missing outcomes - Andy Knapton, GMC personal communication). In addition, there were 7,072 records (6.4%) for out-of-program secondments and 7,737 records (7.0%) coded as insufficient evidence leaving us with 89,921records. After removing incomplete data for ethnicity, year of birth, registration, and graduating university, we were left with 83,702 records from 38,308 doctors (see figure 1) similar to the stated number of registered doctors (in Approved Practice Settings) as listed by the GMC [12]. There were 2,610 (6.8%) mature graduates (1,414 between 29 and 31 years, and 1,196 ≥ 32 years). 83.7% of assessments were ARCP and 16.3% were from the RITA. In total, 6,045 doctors (15.8%) failed at least one ARCP or RITA during the three years of recorded data and of those, 491 (1.3%) were asked to leave the specialty programme (ARCP Outcome 4).

Older doctors were more likely to be male, non-ethnic minority, and train in Primary Care or Public Health ($p<0.001$) compared to younger doctors (see web table 1). Older doctors were more likely to have problems with progression (odds ratio 1.34, 95% CI 1.22, 1.49, p-value <0.001) (table 1). After adjusting for gender, ethnicity, type of medical school, and choice of specialty, the odds ratio was further increased (OR 1.57, 95% CI 1.41, 1.74, $p<0.001$). When we broke down the older age group into three categories (non-mature, 29 to 31 years, ≥ 32 years), the trend was even more marked both with and without adjustment for other covariates (OR 1.0, 1.43, 1.74 respectively, p-value for trend <0.001 after multivariable adjustment).

Our secondary analysis using just the extreme outcome of leaving the training programme (ARCP-4) found an even greater odds ratio of failing to progress for mature students compared to non-matures (OR 1.81, 95% CI 1.34, 2.44, $p<0.001$). When we examined this by our three level age group, we observed a non-linear trend (OR for non-mature, 29 to 31 years, ≥ 32 years: 1.0, 1.29, 2.48 respectively, p-value for trend <0.001) whereby the excess risk seemed mainly limited to the oldest group (≥ 32 years) (web table 2). There was no evidence of any interactions between maturity and either gender or ethnicity on failure to progress or being asked to leave the specialty.

Discussion

This study provides strong evidence that older doctors at graduation were more likely to have problems with progression at their annual assessment and were more likely to leave their initial specialist training programme. These findings appeared to be independent of other factors, such as gender, ethnicity, type of medical school and speciality. The last showed wide variability with some specialties having higher (Obstetrics and Gynaecology) and others lower (General Practice and Public Health) rates of problems with progression. This finding is consistent with the results of a recent analysis comparing doctors who obtained their medical degree either in our outside of the

UK and testing whether the Performance and Linguistics Assessments Board examination system explained performance at ARCP [13].

As these results are unlikely to be due to chance, one must consider other possible explanations. Bias in either measurement of exposure or outcome is very unlikely as age at graduation is taken from year of registration and year of birth so should be well recorded and any coding errors are likely to be random in nature. Similarly any coding errors in the ARCP/RITA outcomes are unlikely to be differential according to age at graduation. A very small proportion of outcome data were missing and again this is unlikely to have been systematically biased. Though we attempted to control for a variety of covariates that could influence the outcome, we did not have reliable data on whether trainees were in full or part time training. The latter may be more common in mature graduates and may influence progression in training. Similarly we could not explore if there was an interaction between mature graduate status and full or part time training.

One must consider several possible explanations as to why older graduates have more problems progressing through higher training if we assume our observed associations are truly causal. (a) They may have more commitments outside of work (caring commitments for either children or parents or other personal relationship issues) that may make it harder to successfully complete all the assessments required for ARCP [11]. (b) They may find themselves committing to a specialty that may not have been their first choice in order to stay in a certain part of the country for their children or spouse. This could result in them doing less well in ARCP due a degree of ambivalence to this specialty. (c) They may have more problems passing post-graduate specialist exams which result in either additional training time or in the worst case leaving the specialty. This may be one explanation why we observed the same pattern of results with doctors of ethnic minority background who are known to have a higher failure rate with the MRCGP exam [13,14]. (d) The higher rate of leaving the programme in the oldest age group may reflect an inappropriate choice of

specialty or that older graduates, having had a past career and already made one major change, have more confidence to switch specialties than younger graduates.

These results should not be interpreted as older graduates are therefore less competent doctors. The ARCP/RITA assessments are there to monitor training progression against specific competencies and milestones and are not a direct measure of the quality of doctors. Some excellent doctors simply take longer to complete their training and may have gained additional skills and life experiences on this journey, learning more from their mistakes than their successes.

These results, however, should not be a cause for complacency. Longer training programmes exert additional financial pressures on training budgets and any doctor who leaves medicine altogether at this stage has had a lot of time and money invested into their training. The problem is not unique to older graduates as we observed that men, ethnic minorities and some specialties showed the same pattern of results.

In conclusion, mature doctors are part of the makeup of the NHS workforce and they widen the variety of doctors as well as bringing insights from past careers that is to be welcomed. While they appear to do better than their younger counterparts at university, they are more likely to have problems with specialty training in the UK. We believe that the causes for this are multi-factorial and probably not unique to the United Kingdom but generalisable to other high income countries like the USA and Canada, though this requires empirical confirmation. These results should be an impetus for further qualitative research to provide greater insights into why older graduates are more like to have difficulties in progression and direct action from training programmes so that they can identify problems at an earlier stage and provide greater support for such trainees as appropriate.

Ethical approval: We did not seek formal NHS ethical approval for this study as it was a secondary data analysis of existing data that had been anonymized to ensure data confidentiality.

Acknowledgements: The author would like to acknowledge Andy Knapton and Daniel Smith at the General Medical Council (GMC) for their support, guidance and encouragement and the GMC for providing us the data for our research. Finally, we would thank Dr. Clare Van Hamel, Associate Postgraduate Dean and Director of Severn Deanery Foundation School for her anecdotal comments that stimulated this project.

Conflicts of interest: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years. VP is a mature medical student and was therefore curious to find out how mature students perform after qualification. YBS has no conflict of interest but regularly sits on ARCP committees for Public Health trainees. No funding was required or obtained for this study.

Authors' contibutions: VP conceived of the idea for this piece of work as her student SSC and approached the GMC for data access. YBS acted as her SSC supervisor and provided support and training for the statistical analysis. VP undertook the initial data cleaning and analysis. YBS checked the analyses and undertook some additional analyses. VP drafted the first version of the paper that was then edited by YBS. All authors approved the final version of the manuscript. VP acts as the guarantor.

Transparency declaration: VP affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Data Sharing Statement: No additional data available.

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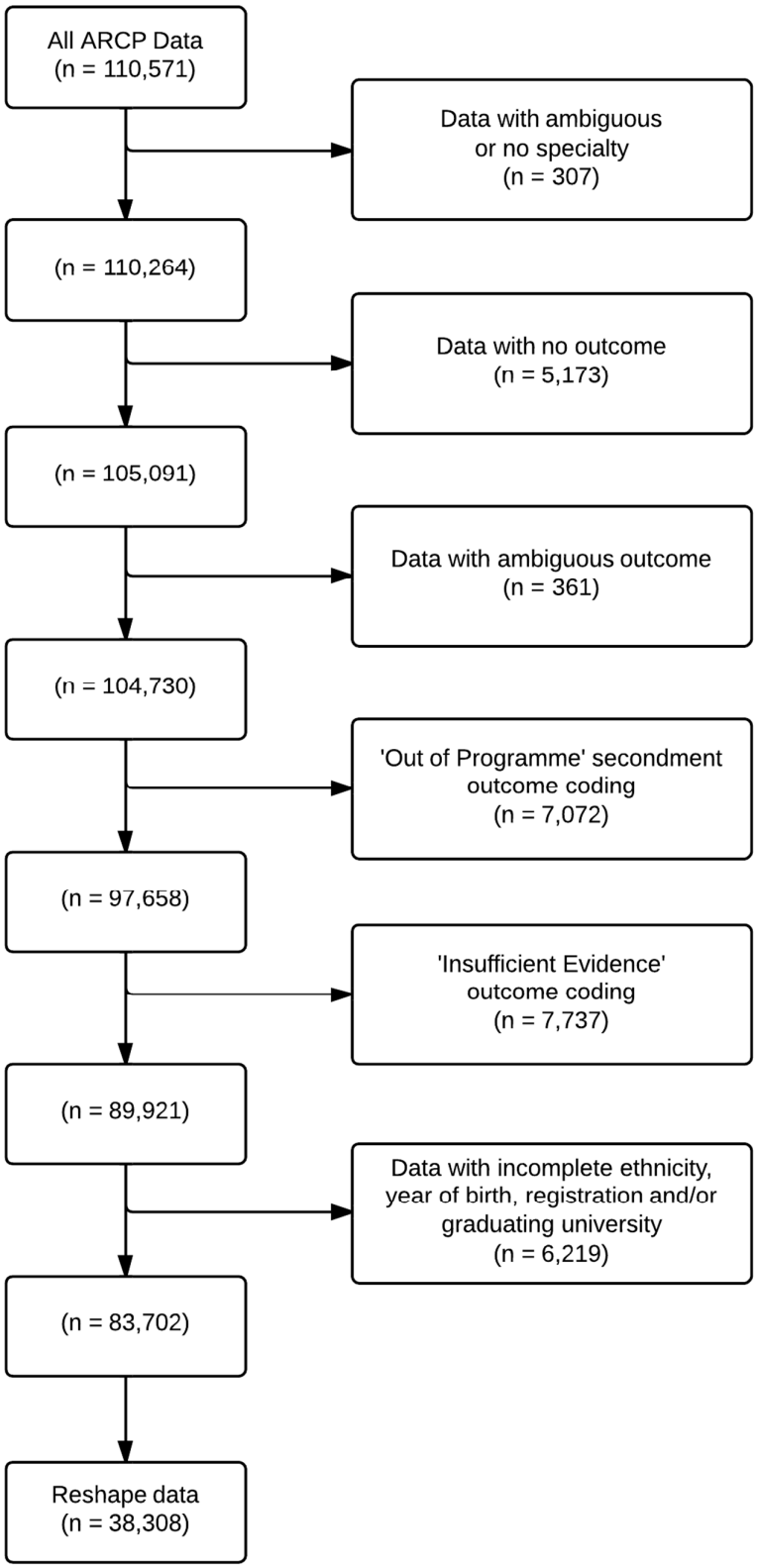
Table 1: Association between 'Mature status' and failure to progress at ARCP adjusted for a range of potential confounders.

	Model 1* OR (95% CI)	p Value	Model 2* OR (95% CI)	p Value
Older (≥28 years)	1.34 (1.22 to 1.49)	<0.001	1.57 (1.41 to 1.74)	<0.001
Normal age (≤28 years)	1.00		1.00	
Older group (29 to 31 years)	1.27 (1.11 to 1.46)	0.001	1.43 (1.24 to 1.65)	<0.001
Oldest group (≥32 years)	1.43 (1.24 to 1.65)	<0.001	1.74 (1.50 to 2.02)	<0.001
p-value for trend		<0.001		<0.001
Female gender			0.82 (0.77 to 0.87)	<0.001
Ethnic minority			1.59 (1.49 to 1.68)	<0.001
Mature Friendly University			1.18 (1.06 to 1.32)	0.003
First Specialty				
Medicine			1.00	
ACCS & related			1.00 (0.92 to 1.08)	0.93
Surgery			0.84 (0.77 to 0.91)	<0.001
GP & Public Health			0.26 (0.24 to 0.29)	<0.001
O&G			2.16 (1.91 to 2.43)	<0.001
Paediatrics			0.81 (0.72 to 0.90)	<0.001
Pathology			0.84 (0.67 to 1.06)	0.14
Psychiatry			0.51 (0.42 to 0.63)	<0.001
Radiology			0.88 (0.76 to 1.02)	0.10

*Model 1, simple odds ratio; Model 2 for binary age-group after adjustment for all covariates as shown in table except for the three level age group variable. This model was then rerun with the three level age-group and other covariates to examine for a dose-response effect

Figure 1: A flow chart showing losses of data due to incomplete or inadequate data to reach the final study sample.



Appendix 1: ACRP/RITA Outcome categories

ARCP	
Outcome 1	Satisfactory Progress
Outcome 2	Unsatisfactory Progress - Development of specific competences required, additional training time not required
Outcome 3	Unsatisfactory Progress - Inadequate progress by the trainee, additional training time required
Outcome 4	Unsatisfactory Progress - Released from the training programme with or without specified competences; trainee will be required to give up their National Training Number.
Outcome 5	Incomplete evidence presented.
Outcome 6	Recommendation for completion of training.
Outcome 7	Fixed-term specialty outcome:
Outcome 7.1	- Satisfactory progress in or completion of the LAT / FTSTA placement.
Outcome 7.2	- Development of Specific Competences Required – additional training time not required
Outcome 7.3	- Inadequate progress by trainee
Outcome 7.4	- Incomplete evidence presented
Outcome 8	Out of programme for research, approved clinical training or a career break (OOPR/OOPT/OOPC).
Outcome 9	For doctors undertaking top-up training in a training post.
RITA	
C	Satisfactory progress
D	Recommendation for targeted training
E	Records a recommendation for intensified supervision/repeated experience.
F	Records out-of-programme experience (including maternity leave)
G	Provides a final record of satisfactory progress on completion of training.

Web Table 1: Association between mature status and other covariates*

	Normal age (≤28 years)	Older group (29 to 31 years)	Oldest group (≥32 years)
Gender			
Male	43.4% (15,484)	50.7 % (717)	53.3% (637)
Female	56.6% (20,214)	49.3% (697)	46.7% (559)
Ethnic Minority			
Non-Ethnic Minority	69.7% (24,883)	77.8% (1,100)	82.5% (987)
Ethnic Minority	30.3% (10,815)	22.2% (314)	17.5% (209)
Graduating University			
Mature Friendly University	94.1% (33,580)	84.8% (1,199)	80.8% (966)
Non-Mature Friendly University	5.9% (2,118)	15.2% (215)	19.2% (230)
First Specialty			
Medicine	94.8% (9604)	2.9 (296)	2.6% (235)
ACCS & related	94.2% (5487)	3.3% (191)	2.6% (149)
Surgery	93.0% (5648)	4.2% (252)	2.9% (177)
GP & Public Health	90.1% (8190)	4.9% (446)	5% (458)
O&G	93.6% (1430)	3.3% (50)	3.1% (48)
Paediatrics	95.9% (2674)	2.6% (73)	1.6% (44)
Pathology	89.5% (505)	5.1% (29)	5.3% (30)
Psychiatry	93.5% (903)	3.9% (38)	2.6% (25)
Radiology	94.8% (1257)	2.9% (39)	2.3% (30)
TOTAL			**100% (35,698)**

*All associations were unlikely to have occurred by chance (P<0.001)

Web Table 2: Multivariable association of 'Mature status' and being asked to leave specialty at ARCP (code 4) adjusted for a range of covariates*.

	OR (95% CI)	p Value
Older (≥28 years)	1.81 (1.34 to 2.44)	<0.001
Normal age (≤28 years)		
Older group (29 to 31 years)	1.29 (0.82 to 2.03)	0.28
Oldest group (≥32 years)	2.48 (1.69 to 3.62)	<0.001
p-value for trend	<0.001	
Female gender	0.78 (0.65 to 0.94)	0.01
Ethnic Minority	1.52 (1.26 to 1.83)	<0.001
Mature Friendly University	1.24 (0.89 to 1.73)	0.21
First Specialty		
ACCS & related	0.99 (0.78 to 1.25)	0.95
Medicine	1.0	
Surgery	0.51 (0.39 to 0.68)	<0.001
GP & Public Health	0.22 (0.16 to 0.31)	<0.001
O&G	0.49 (0.25 to 0.79)	0.005
Paediatrics	0.74 (0.62 to 1.25)	0.48
Pathology	-	-
Psychiatry	0.47 (0.24 to 0.91)	0.03
Radiology	0.18 (0.07 to 0.43)	<0.0001

* Model run with binary age-group after adjustment for all covariates as shown in table except for the three level age group variable. This model was then rerun with the three level age-group and other covariates to examine for a dose-response effect

BMJ Open

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Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2014-005658.R1
Article Type:	Research
Date Submitted by the Author:	22-Sep-2014
Complete List of Authors:	Pyne, Vicky; University of Bristol, ; Ben-Schlomo, Yoav; Dept of Social Medicine
Primary Subject Heading:	Medical education and training
Secondary Subject Heading:	Medical management
Keywords:	MEDICAL EDUCATION & TRAINING, Human resource management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisational development < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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Word count 2979

Abstract

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Results: Mature junior doctors (≥ 29 years at graduation) were more likely to have problems with progression on their ARCP/RITA than their younger colleagues (Odds ratio 1.34, 95% CI 1.22, 1.49, p<0.001). This association was, if anything, even stronger (Odds ratio 1.57, 95% CI 1.41, 1.74, p<0.001) after adjustment for gender, ethnicity, type of University and specialty. The same was true when only looking at the most extreme ARCP outcome (4) which is being asked to leave their specialist programme (Odds ratio 1.81, 95% CI 1.34, 2.44, p<0.001).

Conclusions: Mature doctors are a growing part of the medical workforce and they are likely to broaden the spectrum of doctors by bring different life experience to the profession. These results suggest that they are more likely to have problems with progressing through their specialist training programme. More research is required to determine the reasons behind these associations and how mature doctors can be supported both in choosing the best training programme and in coping with the complex demands of higher training at a later stage in their lives.

Strengths of this Study

1. First study to look at how age at graduation affects a doctor's chance of succeeding in their annual revalidation.
2. Large sample size with little missing data and minimal sources of bias for exposure and outcome variables.
3. Results are counter to prevailing beliefs that mature medical students cope better with medical training as demonstrates greater problems with progression through the ARCP process.
4. Highlights the importance of other demographic and clinical factors that determine progression in training.

Limitations of this Study

5. No quantitative or qualitative data to try to understand the reasons for worse progression and to what degree these are or are not academic related.
6. ARCP data is a simple measure of adequate progression and does not capture excellence so could hide a bimodal distribution whereby mature junior doctors are also more likely to excel as well as have problems of progression.

Introduction

Over the last decade, more mature students have been welcomed onto the medical training programme. Whilst they only make up around 4% of medical students in the UK[1], they are a more substantial proportion of graduates from the USA and Canada (16.7% and 14.2% were 30 or older at graduation respectively [2 3]). These students are often different in their outlook and abilities to a typical school leaver and may be better suited as both a student and future doctor. For example, the former director of the graduate entry programme at St George's Hospital Medical School has stated that "mature students… are sooner and better able to handle the responsibilities of being a doctor" and are "much more self-directed, challenging, demanding, questioning, and mature" than their younger counterparts [4]. These subjective views have some limited support from both qualitative and quantitative research during the medical school years, for example, older students appear to do better at year 3 OSCE exams [5]. Two studies have suggested that mature students cope better with the transition to clinical responsibilities feeling less confused, daunted, anxious or intimidated and more likely to describe a positive transition [6 7]. This may not merely reflect greater academic experience; greater age at program entry, as opposed to the presence of a previous degree, was a better predictor for positive attributes and attitudes related to being a doctor [8]. This may reflect stronger motivational factors that lead them to positively choose medicine as a subsequent career.

Remarkably little is known about what happens to these mature graduates after they qualify. These positive attitudes could result in very focussed and determined graduates who try to reach their choice of specialist career as quickly and efficiently as possible thereby progressing through their training rapidly. On the other hand, mature graduates are more likely to have established geographical roots and family commitments that may make handling the double burdens of career and family problematic even earlier in their training as compared to younger graduates. Anecdotal evidence from the Severn Deanery has suggested that some mature students required greater support with getting through their annual assessment (previously known as RITA - Record of In

Training Assessment) and now referred to as ARCP (Annual Review of Competence Progression). We objectively test the null hypothesis that the proportion of doctors who either require additional training time or who are asked to leave the programme is the same for both older and younger graduate doctors.

Methods

Datasource and variable definitions

The General Medical Council, who collate the national data on ARCP/RITA, kindly provided us with an anonymised extract of data for all UK medical graduates who had a review between 05/08/2009 to 31/07/2012. In the United Kingdom, prior to 2013, the ARCP/RITA process begins at the start of speciality training (such as surgery or primary care) and continues until completion of training (obtaining a certificate of completion of training – CCT) that enables doctors to apply for a consultant post.

Because the coding of the outcomes for ARCP and RITA do not map directly onto each other, we had to use slightly different definitions for our outcome measure of poor progression. For ARCP we used codes 3 (requires additional training time), 4 (released from the programme) and 7.3 (inadequate progress) as a composite measure of poor progression. For the RITA we used codes D (targeted training) and E (intensified or repeat training) as our poor outcome measure (see appendix 1 for the full coding scheme)[9 10]. We choose to exclude subjects with a code for insufficient evidence (as this often reflects inadequate documentation rather than poor progress per se) and those trainees on an out-of-program secondment.

Our exposure measure was based on an arbitrary age cut-off (coded as an integer value). There is no accepted standard definition of a “mature” student so we chose to define this as a graduate who was 29 years or over at the year of first registration (i.e. year of graduation). By choosing this cut-point we hoped to not include graduates who had simply taken a gap year, intercalated BSc or a prior

degree before going straight into medicine (as this should mean they are not older than 27 years) but those who would have had some years of "work" experience outside of medicine. This is similar to a previous study that defined the "older mature" as "students who have worked in other occupations for a number of years prior to making a decision to apply to medical school" [11]. We further sub-divided this 'mature' group into those aged between 29 years and 31 years and those who were 32 years or older on date of first registration to examine for any dose-response effects with older age at registration. Finally for a sensitivity analysis we examined a more detailed classification of the younger baseline group into the following categories (≤ 23, 24, 25, 26, 27, 28 years). We defined, a priori, a number of potential confounders or intermediaries that could be associated with being an older graduate and a greater probability of poor progression. These were gender, specialty, ethnicity, and whether the graduate had qualified from a "mature friendly" medical school that may be better able to help the older graduate cope with the future stresses of being a doctor. This last variable was operationalized as follows: We calculated the percentage of mature students graduating from the medical school and then created a binary variable if the percentage was greater than 10% - approximately the top quartile and these were mainly the new medical schools (e.g. Exeter, Brighton & Sussex etc.). We could not disaggregate all the London-based medical schools as they were all coded as University of London.

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The original dataset had multiple records for a doctor for each assessment (long format) but this could be linked by an anonymous unique identifier. We reshaped the data into wide format (one row per doctor) so each doctor is only represented once in the dataset. If the doctor had poor progression more than once, we only coded the first event. We compared simple proportions using Chi-squared tests and linear regression for continuous variables. We then calculated the crude odds ratio (95% confidence intervals, p-values) for older age at graduation and poor progression and multivariable odds ratio adjusting for gender, ethnicity (binary variable defined as non-ethnic if

ticked any of the White ethnicity codes from census or ethnic minority, which included any other code), specialty (dummy variable) and mature friendly medical school (binary variable). For specialty we used hospital medicine as the baseline group as it had the largest number of doctors. We undertook a sensitivity analysis using the most extreme outcome – leaving the training programme. As this is only explicitly coded in the ARCP outcomes, we could not use subjects with RITA assessments for this secondary analysis. We examined for potential interactions between age at registration with gender and ethnicity and either failure to progress or being asked to leave the specialty.

Results

We received a total of 110,571 records (multiple assessments per doctor). We dropped 307 records (0.3%) without a specialty code and there were 5,173 records with a missing outcome (4.7%) and 361 records (0.3%) with an ambiguous code that we could not use (99% of the missing outcome data came from 2012, when the GMC asked Deaneries to return forms even for doctors who were not having ARCPs as they were out of programme, on maternity leave or long term sick so these are not really missing outcomes - Andy Knapton, GMC personal communication). In addition, there were 7,072 records (6.4%) for out-of-program secondments and 7,737 records (7.0%) coded as insufficient evidence leaving us with 89,921 records. After removing incomplete data for ethnicity, year of birth, year of registration, and graduating university, we were left with 83,702 records from 38,308 doctors (see figure 1) similar to the stated number of registered doctors (in Approved Practice Settings) as listed by the GMC [12]. There were 2,610 (6.8%) mature graduates (1,414 between 29 and 31 years, and 1,196 ≥ 32 years). 83.7% of assessments were ARCP and 16.3% were from the RITA. In total, 6,045 doctors (15.8%) failed at least one ARCP or RITA during the three years of recorded data and of those, 491 (1.3%) were asked to leave the specialty programme (ARCP Outcome 4).

Older doctors were more likely to be male, non-ethnic minority, and train in Primary Care or Public Health ($p<0.001$) compared to younger doctors (see web table 1). Older doctors were more likely to have problems with progression (odds ratio 1.34, 95% CI 1.22, 1.49, p-value <0.001) (table 1). After adjusting for gender, ethnicity, type of medical school, and choice of specialty, the odds ratio was further increased (OR 1.57, 95% CI 1.41, 1.74, $p<0.001$). When we broke down the older age group into three categories (non-mature, 29 to 31 years, ≥ 32 years), the trend was even more marked both with and without adjustment for other covariates (OR 1.0, 1.43, 1.74 respectively, p-value for trend <0.001 after multivariable adjustment). Our more detailed breakdown of the younger age group suggested that increased problems with progression are evident at a younger age, 26 years and above, though the oldest group (≥ 32 years) appear to have additional problems (see web table 2).

Our secondary analysis using just the extreme outcome of leaving the training programme (ARCP-4) found an even greater odds ratio of failing to progress for mature students compared to non-matures (OR 1.81, 95% CI 1.34, 2.44, $p<0.001$). When we examined this by our three level age group, we observed a non-linear trend (OR for non-mature, 29 to 31 years, ≥ 32 years: 1.0, 1.29, 2.48 respectively, p-value for trend <0.001) whereby the excess risk seemed mainly limited to the oldest group (≥ 32 years) (web table 3). There was no evidence of any interactions between maturity and either gender or ethnicity on failure to progress or being asked to leave the specialty. The results were essentially unchanged when we replaced the type of university with a dummy variable for all universities.

Discussion

This study provides strong evidence that doctors who are older at graduation were more likely to have problems with progression at their annual assessment and were more likely to leave their initial specialist training programme. These findings appeared to be independent of other factors,

such as gender, ethnicity, type of medical school and speciality. The last showed wide variability with some specialties having higher (Obstetrics and Gynaecology) and others lower (General Practice and Public Health) rates of problems with progression. This finding is consistent with the results of a recent analysis comparing doctors who obtained their medical degree either in or outside of the UK and testing whether the Performance and Linguistics Assessments Board examination system explained performance at ARCP [13]. While the null hypothesis defined 'mature' graduates as those over 28 years at first registration, additional analysis has highlighted this effect is evident for doctors as young as 26 on registration, who make up over 20% of the doctor population in this sample.

As these results are unlikely to be due to chance, one must consider other possible explanations. Bias in either measurement of exposure or outcome is very unlikely as age at graduation is taken from year of registration and year of birth so should be well recorded and any coding errors are likely to be random in nature. Similarly any coding errors in the ARCP/RITA outcomes are unlikely to be differential according to age at graduation. A very small proportion of outcome data were missing and this is unlikely to have been systematically biased. Though we attempted to control for a variety of covariates that could influence the outcome, we did not have reliable data on whether trainees were in full or part time training. The latter may be more common in mature graduates and may influence progression in training. Similarly we could not explore if there was an interaction between mature graduate status and full or part time training. In addition, ARCP is not intended to capture excellence in training but merely adequate progression. It is possible that the performance of mature graduates is bimodal so that some mature doctors actually have better outcomes but this would not be evident in our analysis.

One must consider several possible explanations as to why older graduates have more problems progressing through higher training if we assume our observed associations are truly causal. (a)

They may have more commitments outside of work (caring commitments for either children or parents or other personal relationship issues) that may make it harder to successfully complete all the assessments required for ARCP [11]. (b) They may find themselves committing to a specialty that may not have been their first choice in order to stay in a certain part of the country for their children or spouse. This could result in them doing less well in ARCP due a degree of ambivalence to this specialty. (c) They may have more problems passing post-graduate specialist exams or completing more technical skills competencies which result in either additional training time or in the worst case leaving the specialty. This may be one explanation why we observed the same difficulty with progression for doctors of ethnic minority background who are known to have a higher failure rate with the MRCGP exam [13,14]. (d) Being older, these doctors may find it harder to engage with the informal social support groups among junior doctors (either due to personal commitments or the age gap) and thus have fewer resources to call upon during challenging rotations or clinical situations. (e) The higher rate of leaving the programme in the oldest age group may reflect an inappropriate choice of specialty or that older graduates, having had a past career and already made one major change, have more confidence to switch specialties than younger graduates.

These results should not be interpreted as older graduates are therefore less competent doctors. The ARCP/RITA assessments are there to monitor training progression against specific competencies and milestones and are not a direct measure of the quality of doctors. Some excellent doctors simply take longer to complete their training and may have gained additional skills and life experiences on this journey, learning more from their mistakes than their successes.

These results, however, should not be a cause for complacency. Longer training programmes exert additional financial pressures on training budgets and any doctor who leaves medicine altogether at this stage has had a lot of time and money invested into their training. The problem is not unique to

older graduates as we observed that men, ethnic minorities and some specialties showed the same pattern of results.

In conclusion, mature doctors are part of the makeup of the NHS workforce and they widen the variety of doctors as well as bringing insights from past careers that is to be welcomed. While they appear to do better than their younger counterparts at university, they are more likely to have problems with specialty training in the UK. We believe that the causes for this are multi-factorial and probably not unique to the United Kingdom but generalisable to other high income countries like the USA and Canada, though this requires empirical confirmation. These results should be an impetus for further qualitative research to provide greater insights into why older graduates are more like to have difficulties in progression and direct action from training programmes so that they can identify problems at an earlier stage and provide greater support for such trainees as appropriate.

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Transparency declaration: VP affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Data Sharing Statement: No additional data available.

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Table 1: Association between 'Mature status' and failure to progress at ARCP adjusted for a range of potential confounders.

	Model 1* OR (95% CI)	p Value	Model 2* OR (95% CI)	p Value
Older (≥29 years) (2,610)	1.34 (1.22 to 1.49)	<0.001	1.57 (1.41 to 1.74)	<0.001
Younger group (≤28 years) (35,698)	1.00		1.00	
Older group (29 to 31 years) (1,414)	1.27 (1.11 to 1.46)	0.001	1.43 (1.24 to 1.65)	<0.001
Oldest group (≥32 years) (1,196)	1.43 (1.24 to 1.65)	<0.001	1.74 (1.50 to 2.02)	<0.001
p-value for trend		<0.001		<0.001
Female gender (21,470)			0.82 (0.77 to 0.87)	<0.001
Ethnic minority (11,338)			1.59 (1.49 to 1.68)	<0.001
Mature Friendly University (35,745)			1.18 (1.06 to 1.32)	0.003
First Specialty				
Medicine (10,135)			1.00	
ACCS & related (5,827)			1.00 (0.92 to 1.08)	0.93
Surgery (6,077)			0.84 (0.77 to 0.91)	<0.001
GP & Public Health (9,094)			0.26 (0.24 to 0.29)	<0.001
O&G (1,528)			2.16 (1.91 to 2.43)	<0.001
Paediatrics (2,791)			0.81 (0.72 to 0.90)	<0.001
Pathology (564)			0.84 (0.67 to 1.06)	0.14
Psychiatry (966)			0.51 (0.42 to 0.63)	<0.001
Radiology (1,326)			0.88 (0.76 to 1.02)	0.10

*Model 1, simple odds ratio; Model 2 for binary age-group after adjustment for all covariates as shown in table except for the three level age group variable. This model was then rerun with the three level age-group and other covariates to examine for a dose-response effect

Style Definition: Hyperlink

Older doctors and progression through specialty training in the United Kingdom: a cohort analysis of General Medical Council data.

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Word count 2979

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Abstract

Objective: To determine whether older age at graduation is associated with any difference in outcomes from the annual specialty training progression assessment.

Design: An open cohort of 38,308 doctors who graduated from a United Kingdom medical school with annual assessments of progression in their specialty training program with data centrally collected by the General Medical Council between 05/08/2009 to 31/07/2012.

Results: Mature junior doctors (≥ ~~28~~29 years at graduation) were more likely to have problems with progression on their ARCP/RITA than their younger colleagues (Odds ratio 1.34, 95% CI 1.22, 1.49, p<0.001). This association was, if anything, even stronger (Odds ratio 1.57, 95% CI 1.41, 1.74, p<0.001) after adjustment for gender, ethnicity, type of University and specialty. The same was true when only looking at the most extreme ARCP outcome (4) which is being asked to leave their specialist programme (Odds ratio 1.81, 95% CI 1.34, 2.44, p<0.001).

Conclusions: Mature doctors are a growing part of the medical workforce and they are likely to broaden the spectrum of doctors by bring different life experience to the profession. These results suggest that they are more likely to have problems with progressing through their specialist training programme. More research is required to determine the reasons behind these associations and how mature doctors can be supported both in choosing the best training programme and in coping with the complex demands of higher training at a later stage in their lives.

Strengths of this Study

1. First study to look at how age at graduation affects a ~~doctors chances~~doctor's chance of succeeding in their annual revalidation.
2. ~~Quantative nature of study ensures~~ Large sample size with little missing data and minimal sources of bias ~~and large volume of data ensures small p values.~~for exposure and outcome variables.
3. ~~3.~~ Results are counter to prevailing beliefs ~~and research regarding~~ that mature medical students ~~showing that despite doing~~cope better ~~at university, they appear to 'do worse' once they have become doctors.~~
4. ~~4.~~3. ~~Continues to add to~~with medical training as demonstrates greater problems with progression through the ~~growing literature regarding how minority groups appear to struggle more with formal performance measures of doctors~~ARCP process.
4. Highlights the importance of other demographic and clinical factors that determine progression in training.

Limitations of this Study

5. ~~Currently no~~No quantitative or qualitative ~~analysis of~~ data to try to understand the ~~cause of~~ reasons for worse progression and to what degree these ~~results~~are or are not academic related.
5. ~~5.~~6. ARCP data is a simple measure of adequate progression and does not capture excellence so could hide a bimodal distribution whereby mature junior doctors are also more likely to excel as well as have problems of progression.

Introduction

Over the last decade, more mature students have been welcomed onto the medical training programme. Whilst they only make up around 4% of medical students in the UK[1], they are a more substantial proportion of graduates from the USA and Canada (16.7% and 14.2% were 30 or older at graduation respectively [2 3]). These students are often different in their outlook and abilities to a typical school leaver and may be better suited as both a student and future doctor. For example, the former director of the graduate entry programme at St George's Hospital Medical School has stated that "mature students… are sooner and better able to handle the responsibilities of being a doctor" and are "much more self-directed, challenging, demanding, questioning, and mature" than their younger counterparts [4]. These subjective views have some limited support from both qualitative and quantitative research during the medical school years, for example, older students appear to do better at year 3 OSCE exams [5]. Two studies have suggested that mature students cope better with the transition to clinical responsibilities feeling less confused, daunted, anxious or intimidated and more likely to describe a positive transition [6 7]. This may not merely reflect greater academic experience; greater age at program entry, as opposed to the presence of a previous degree, was a better predictor for positive attributes and attitudes related to being a doctor [8]. This may reflect stronger motivational factors that lead them to positively choose medicine as a subsequent career.

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multivariable odds ratio adjusting for gender, ethnicity (binary variable defined as non-ethnic if ticked any of the White ethnicity codes from census or ethnic minority, which included any other code), specialty (dummy variable) and mature friendly medical school (binary variable). For specialty we used hospital medicine as the baseline group as it had the largest number of doctors. We undertook a sensitivity analysis using the most extreme outcome – leaving the training programme. As this is only explicitly coded in the ARCP outcomes, we could not use subjects with RITA assessments for this secondary analysis. We examined for potential interactions between age at registration with gender and ethnicity and either failure to progress or being asked to leave the specialty.

Results

We received a total of 110,571 records (multiple assessments per doctor). We dropped 307 records (0.3%) without a specialty code and there were 5,173 records with a missing outcome (4.7%) and 361 records (0.3%) with an ambiguous code that we could not use (99% of the missing outcome data came from 2012, when the GMC asked Deaneries to return forms even for doctors who were not having ARCPs as they were out of programme, on maternity leave or long term sick so these are not really missing outcomes - Andy Knapton, GMC personal communication). In addition, there were 7,072 records (6.4%) for out-of-program secondments and 7,737 records (7.0%) coded as insufficient evidence leaving us with 89,~~921records~~921 records. After removing incomplete data for ethnicity, year of birth, year of registration, and graduating university, we were left with 83,702 records from 38,308 doctors (see figure 1) similar to the stated number of registered doctors (in Approved Practice Settings) as listed by the GMC [12]. There were 2,610 (6.8%) mature graduates (1,414 between 29 and 31 years, and 1,196 ≥ 32 years). 83.7% of assessments were ARCP and 16.3% were from the RITA. In total, 6,045 doctors (15.8%) failed at least one ARCP or RITA during the three years of recorded data and of those, 491 (1.3%) were asked to leave the specialty programme (ARCP Outcome 4).

Older doctors were more likely to be male, non-ethnic minority, and train in Primary Care or Public Health (p<0.001) compared to younger doctors (see web table 1). Older doctors were more likely to have problems with progression (odds ratio 1.34, 95% CI 1.22, 1.49, p-value <0.001) (table 1). After adjusting for gender, ethnicity, type of medical school, and choice of specialty, the odds ratio was further increased (OR 1.57, 95% CI 1.41, 1.74, p<0.001). When we broke down the older age group into three categories (non-mature, 29 to 31 years, ≥ 32 years), the trend was even more marked both with and without adjustment for other covariates (OR 1.0, 1.43, 1.74 respectively, p-value for trend <0.001 after multivariable adjustment). Our more detailed breakdown of the younger age group suggested that increased problems with progression are evident at a younger age, 26 years and above, though the oldest group (≥ 32 years) appear to have additional problems (see web table 2).

Our secondary analysis using just the extreme outcome of leaving the training programme (ARCP-4) found an even greater odds ratio of failing to progress for mature students compared to non-matures (OR 1.81, 95% CI 1.34, 2.44, p<0.001). When we examined this by our three level age group, we observed a non-linear trend (OR for non-mature, 29 to 31 years, ≥ 32 years: 1.0, 1.29, 2.48 respectively, p-value for trend <0.001) whereby the excess risk seemed mainly limited to the oldest group (≥ 32 years) (web table ~~2~~3). There was no evidence of any interactions between maturity and either gender or ethnicity on failure to progress or being asked to leave the specialty. The results were essentially unchanged when we replaced the type of university with a dummy variable for all universities.

Discussion

This study provides strong evidence that ~~older~~ doctors who are older at graduation were more likely to have problems with progression at their annual assessment and were more likely to leave their

initial specialist training programme. These findings appeared to be independent of other factors, such as gender, ethnicity, type of medical school and speciality. The last showed wide variability with some specialties having higher (Obstetrics and Gynaecology) and others lower (General Practice and Public Health) rates of problems with progression. This finding is consistent with the results of a recent analysis comparing doctors who obtained their medical degree either in ~~our~~or outside of the UK and testing whether the Performance and Linguistics Assessments Board examination system explained performance at ARCP [13]. While the null hypothesis defined 'mature' graduates as those over 28 years at first registration, additional analysis has highlighted this effect is evident for doctors as young as 26 on registration, who make up over 20% of the doctor population in this sample.

As these results are unlikely to be due to chance, one must consider other possible explanations. Bias in either measurement of exposure or outcome is very unlikely as age at graduation is taken from year of registration and year of birth so should be well recorded and any coding errors are likely to be random in nature. Similarly any coding errors in the ARCP/RITA outcomes are unlikely to be differential according to age at graduation. A very small proportion of outcome data were missing and ~~again~~ this is unlikely to have been systematically biased. Though we attempted to control for a variety of covariates that could influence the outcome, we did not have reliable data on whether trainees were in full or part time training. The latter may be more common in mature graduates and may influence progression in training. Similarly we could not explore if there was an interaction between mature graduate status and full or part time training. In addition, ARCP is not intended to capture excellence in training but merely adequate progression. It is possible that the performance of mature graduates is bimodal so that some mature doctors actually have better outcomes but this would not be evident in our analysis.

One must consider several possible explanations as to why older graduates have more problems progressing through higher training if we assume our observed associations are truly causal. (a) They may have more commitments outside of work (caring commitments for either children or parents or other personal relationship issues) that may make it harder to successfully complete all the assessments required for ARCP [11]. (b) They may find themselves committing to a specialty that may not have been their first choice in order to stay in a certain part of the country for their children or spouse. This could result in them doing less well in ARCP due a degree of ambivalence to this specialty. (c) They may have more problems passing post-graduate specialist exams or completing more technical skills competencies which result in either additional training time or in the worst case leaving the specialty. This may be one explanation why we observed the same ~~pattern of results~~difficulty with progression for doctors of ethnic minority background who are known to have a higher failure rate with the MRCGP exam [13,~~14~~14]. ~~(d~~(d) Being older, these doctors may find it harder to engage with the informal social support groups among junior doctors (either due to personal commitments or the age gap) and thus have fewer resources to call upon during challenging rotations or clinical situations. (e) The higher rate of leaving the programme in the oldest age group may reflect an inappropriate choice of specialty or that older graduates, having had a past career and already made one major change, have more confidence to switch specialties than younger graduates.

These results should not be interpreted as older graduates are therefore less competent doctors. The ARCP/RITA assessments are there to monitor training progression against specific competencies and milestones and are not a direct measure of the quality of doctors. Some excellent doctors simply take longer to complete their training and may have gained additional skills and life experiences on this journey, learning more from their mistakes than their successes.

These results, however, should not be a cause for complacency. Longer training programmes exert additional financial pressures on training budgets and any doctor who leaves medicine altogether at this stage has had a lot of time and money invested into their training. The problem is not unique to older graduates as we observed that men, ethnic minorities and some specialties showed the same pattern of results.

In conclusion, mature doctors are part of the makeup of the NHS workforce and they widen the variety of doctors as well as bringing insights from past careers that is to be welcomed. While they appear to do better than their younger counterparts at university, they are more likely to have problems with specialty training in the UK. We believe that the causes for this are multi-factorial and probably not unique to the United Kingdom but generalisable to other high income countries like the USA and Canada, though this requires empirical confirmation. These results should be an impetus for further qualitative research to provide greater insights into why older graduates are more like to have difficulties in progression and direct action from training programmes so that they can identify problems at an earlier stage and provide greater support for such trainees as appropriate.

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Table 1: Association between 'Mature status' and failure to progress at ARCP adjusted for a range of potential confounders.

	Model 1* OR (95% CI)	p Value	Model 2* OR (95% CI)	p Value
Older (≥~~28~~29 years) (2,610)	1.34 (1.22 to 1.49)	<0.001	1.57 (1.41 to 1.74)	<0.001
~~Normal age~~Younger group (≤28 years) (35,698)	1.00		1.00	
Older group (29 to 31 years) (1,414)	1.27 (1.11 to 1.46)	0.001	1.43 (1.24 to 1.65)	<0.001
Oldest group (≥32 years) (1,196)	1.43 (1.24 to 1.65)	<0.001	1.74 (1.50 to 2.02)	<0.001
p-value for trend		<0.001		<0.001
Female gender (21,470)			0.82 (0.77 to 0.87)	<0.001
Ethnic minority (11,338)			1.59 (1.49 to 1.68)	<0.001
Mature Friendly University (35,745)			1.18 (1.06 to 1.32)	0.003
First Specialty				
Medicine (10,135)			1.00	
ACCS & related (5,827)			1.00 (0.92 to 1.08)	0.93
Surgery (6,077)			0.84 (0.77 to 0.91)	<0.001
GP & Public Health (9,094)			0.26 (0.24 to 0.29)	<0.001
O&G (1,528)			2.16 (1.91 to 2.43)	<0.001
Paediatrics (2,791)			0.81 (0.72 to 0.90)	<0.001
Pathology (564)			0.84 (0.67 to 1.06)	0.14
Psychiatry (966)			0.51 (0.42 to 0.63)	<0.001
Radiology (1,326)			0.88 (0.76 to 1.02)	0.10

*Model 1, simple odds ratio; Model 2 for binary age-group after adjustment for all covariates as shown in table except for the three level age group variable. This model was then rerun with the three level age-group and other covariates to examine for a dose-response effect

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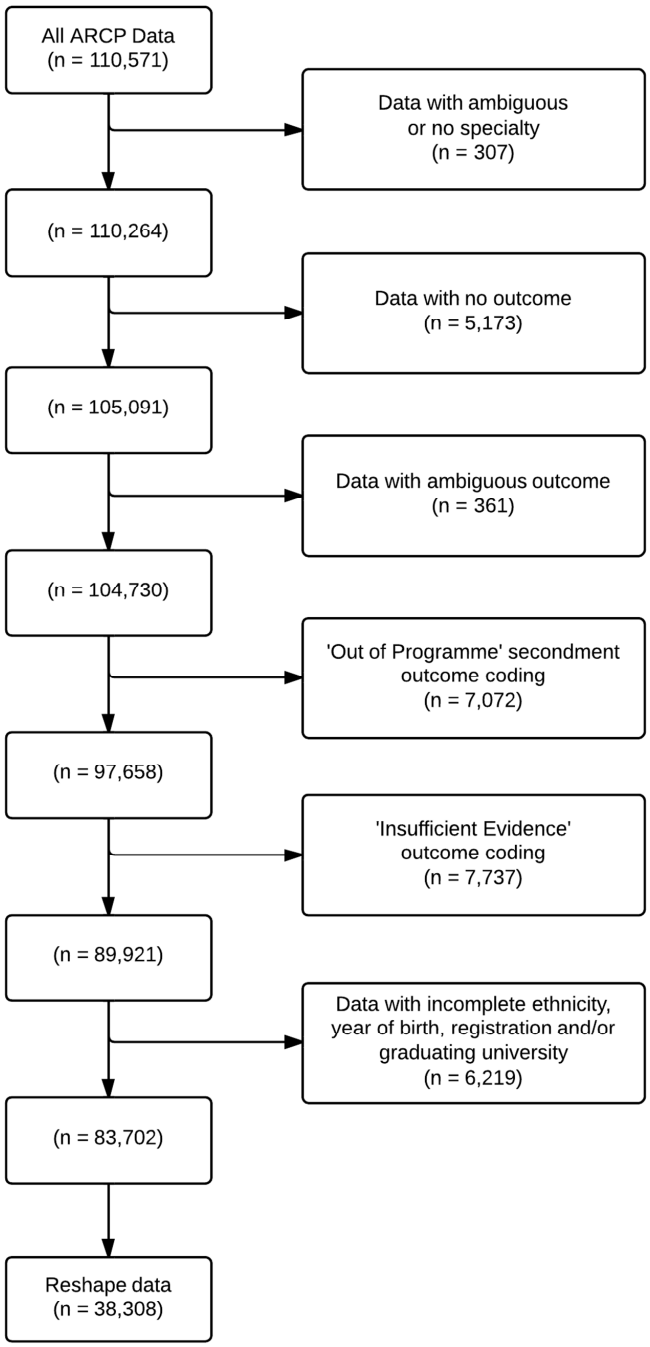
Figure 1: A flow chart showing losses of data due to incomplete or inadequate data to reach the final study sample.



Appendix 1: ACRP/RITA Outcome categories

ARCP	
Outcome 1	Satisfactory Progress
Outcome 2	Unsatisfactory Progress - Development of specific competences required, additional training time not required
Outcome 3	Unsatisfactory Progress - Inadequate progress by the trainee, additional training time required
Outcome 4	Unsatisfactory Progress - Released from the training programme with or without specified competences; trainee will be required to give up their National Training Number.
Outcome 5	Incomplete evidence presented.
Outcome 6	Recommendation for completion of training.
Outcome 7	Fixed-term specialty outcome:
Outcome 7.1	- Satisfactory progress in or completion of the LAT / FTSTA placement.
Outcome 7.2	- Development of Specific Competences Required – additional training time not required
Outcome 7.3	- Inadequate progress by trainee
Outcome 7.4	- Incomplete evidence presented
Outcome 8	Out of programme for research, approved clinical training or a career break (OOPR/OOPT/OOPC).
Outcome 9	For doctors undertaking top-up training in a training post.
RITA	
C	Satisfactory progress
D	Recommendation for targeted training
E	Records a recommendation for intensified supervision/repeated experience.
F	Records out-of-programme experience (including maternity leave)
G	Provides a final record of satisfactory progress on completion of training.

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Web Table 1: Association between mature status and other covariates*

	Normal age (≤28 years)	Older group (29 to 31 years)	Oldest group (≥32 years)
Gender			
Male	43.4% (15,484)	50.7 % (717)	53.3% (637)
Female	56.6% (20,214)	49.3% (697)	46.7% (559)
Ethnic Minority			
Non-Ethnic Minority	69.7% (24,883)	77.8% (1,100)	82.5% (987)
Ethnic Minority	30.3% (10,815)	22.2% (314)	17.5% (209)
Graduating University			
Mature Friendly University	94.1% (33,580)	84.8% (1,199)	80.8% (966)
Non-Mature Friendly University	5.9% (2,118)	15.2% (215)	19.2% (230)
First Specialty			
Medicine	94.8% (9,604)	2.9 (296)	2.6% (235)
ACCS & related	94.2% (5,487)	3.3% (191)	2.6% (149)
Surgery	93.0% (5,648)	4.2% (252)	2.9% (177)
GP & Public Health	90.1% (8,190)	4.9% (446)	5% (458)
O&G	93.6% (1,430)	3.3% (50)	3.1% (48)
Paediatrics	95.9% (2,674)	2.6% (73)	1.6% (44)
Pathology	89.5% (505)	5.1% (29)	5.3% (30)
Psychiatry	93.5% (903)	3.9% (38)	2.6% (25)
Radiology	94.8% (1,257)	2.9% (39)	2.3% (30)
TOTAL			100% (35,698)

*All associations were unlikely to have occurred by chance ($p<0.001$)

Web Table 2: Multivariable association of age at graduation and failure to progress at ARCP using more detailed age-bands and adjusted for a range of potential confounders.

	OR (95% CI)	p Value
≤ 23 years old (8,453)	1.05 (0.97 to 1.14)	0.23
24 years old (13,997)	1.0	
25 years old (7,951)	1.12 (1.04 to 1.21)	<0.001
26 years old (2,738)	1.50 (1.35 to 1.67)	<0.001
27 years old (1,614)	1.50 (1.31 to 1.72)	<0.001
28 years old (945)	1.55 (1.30 to 1.84)	<0.001
29 to 31 years old (Older group) (1,414)	1.6 (1.38 to 1.85)	<0.001
≥ 32 years old (Oldest group) (1,196)	1.95 (1.67 to 2.28)	<0.001
p-value for trend	<0.001	
Female gender	0.83 (0.78 to 0.88)	<0.001
Ethnic Minority	1.59 (1.50 to 1.69)	<0.001
Mature Friendly University	1.12 (1.00 to 1.26)	0.04
First Specialty		
ACCS & related	1.00 (0.92 to 1.08)	0.91
Medicine	1.0	
Surgery	0.84 (0.77 to 0.91)	<0.001
GP & Public Health	0.26 (0.23 to 0.29)	<0.001
O&G	2.13 (1.89 to 2.40)	<0.001
Paediatrics	0.81 (0.72 to 0.91)	<0.001
Pathology	0.83 (0.66 to 1.05)	0.12
Psychiatry	0.50 (0.41 to 0.62)	<0.001
Radiology	0.89 (0.77 to 1.03)	0.13

Web Table 3: Multivariable association of 'Mature status' and being asked to leave specialty at ARCP (code 4) adjusted for a range of covariates*.

	OR (95% CI)	p Value
Older (≥29 years)	1.81 (1.34 to 2.44)	<0.001
Younger group (≤28 years)		
Older group (29 to 31 years)	1.29 (0.82 to 2.03)	0.28
Oldest group (≥32 years)	2.48 (1.69 to 3.62)	<0.001
p-value for trend	<0.001	
Female gender	0.78 (0.65 to 0.94)	0.01
Ethnic Minority	1.52 (1.26 to 1.83)	<0.001
Mature Friendly University	1.24 (0.89 to 1.73)	0.21
First Specialty		
ACCS & related	0.99 (0.78 to 1.25)	0.95
Medicine	1.0	
Surgery	0.51 (0.39 to 0.68)	<0.001
GP & Public Health	0.22 (0.16 to 0.31)	<0.001
O&G	0.49 (0.25 to 0.79)	0.005
Paediatrics	0.74 (0.62 to 1.25)	0.48
Pathology	-	-
Psychiatry	0.47 (0.24 to 0.91)	0.03
Radiology	0.18 (0.07 to 0.43)	<0.0001

* Model run with binary age-group after adjustment for all covariates as shown in table except for the three level age group variable. This model was then rerun with the three level age-group and other covariates to examine for a dose-response effect

Reviewer(s)' Comments to Author:
Reviewer: 1
Reviewer Name Kevin Hayes
Institution and Country St George's University London, UK
Please state any competing interests or state 'None declared': I am a first author on one of the cited references in this paper but None declared

There is a clear, important research question and testing of a Null hypothesis with an appropriate study design. The conclusions are clear and not overstated. Strengths and weaknesses are clearly stated.
I would take issue with strength 3 at the beginning as written:

"Results are counter to prevailing beliefs and research regarding mature medical students showing that despite doing better at university, they appear to 'do worse' once they have become doctors"
The results do not necessarily mean these doctors "do worse" it is simply a measure of specific outcomes - this is actually acknowledged in the discussion section, so this assertion needs to be clarified in line with the discussion section.

We thank Mr. Hayes for this comment and agree with his suggestion. We have amended this accordingly.

The study does offer potential reasons for the findings but clearly and correctly states that the study does not prove them just raises more potential qualitative research questions about this important cohort of doctors. There are several mentions of other "minority groups" having similar outcomes. They may have similar outcomes but they are different cohorts and cannot necessarily be compared to this cohort - it needs to be clearer in the discussion what "association" if any these findings have

We are sorry if this was not clear. We were referring to the similarly increased risk of problems with progression as assessed by the ARCP process. We have clarified this.

Overall a very good study - a few minor revisions as above only

We thank Mr. Hayes for his positive comments and suggestions.

Reviewer: 2
Reviewer Name John C. Mclachlan
Institution and Country Durham University
Please state any competing interests or state 'None declared': None Declared

This is an important topic which is likely to court controversy. I believe it deserves publication in principal but some important issues should be addressed prior to this.
1) The manuscript should also be reviewed by someone with very high level understanding of previous work in this area. I suggest Professor Chris McManus, UCL and/or Dr Paul Tiffin, Durham. I believe more sophisticated analyses could be done, and would prove informative.

2) The authors are correct that large numbers give small p values. What matters is the effect size, and the authors should calculate a value for this. An Odds Ratio, of course, is not an effect size.

We generally prefer to use the simplest statistical methods if we can as this is easier to interpret for the average reader. In our experience, more sophisticated analyses can occasionally be more informative but in general support the conclusions from simpler analyses. We agree about the issue of effect estimates rather than p-values however we are confused by the statement that an odds ratio is not an effect estimate. We note that this is the same effect estimate used by Tiffin et al (BMJ 2014).

3) The authors should comment that the data is right-censored – there is no 'excellent' category above mere progression. If therefore older graduates showed greater variance than school leaver graduates, then this would be undetectable in the current study. It could be that mature students do generally make better doctors overall, as a variety of soft measures seem to suggest, but a small proportion of them struggle for the career reasons mentioned. These results therefore do not necessarily contradict previous understandings.

This is a very cogent point and we agree with Dr. Mclachlan that because of a potential ceiling effect, we could be missing a bimodal distribution so that mature doctors could be both having problems and doing excellently. We have added this to the limitations and discussion.

4) The authors should refer more widely to previous work on age effects in doctors – for instance Norcini et al (2013) Medical Care 51;1034-1039.

We thank Prof. Mclachlan for highlighting this reference and note that this paper relates to a doctor's years since graduation as opposed to their age.

This is well worth pursuing!

We thank Prof. Mclachlan for his positive comments and suggestions.

Reviewer: 3
Reviewer Name Chris McManus
Institution and Country UCL, UK
Please state any competing interests or state 'None declared': None declared

This is an interesting paper, which looks at career progression of UK trained doctors through ARCP in relation to age at graduation. It makes the strong claim that doctors who are older at qualification perform less well. That however does seem to contradict other evidence (and, for instance, older graduates on accelerated undergraduate courses seem to perform substantially better in examinations in medical school, and therefore presumably are likely to do better on postgraduate training; see BMC Med Ed, Mahesan et al, 2011, 11:76). That raises a number of questions about the present study which need resolving. In view of the recent paper by Tiffin et al in the BMJ on ARCP I have used that in comparison with the present study, not least as the datasets seem to overlap substantially but the conclusions potentially seem incompatible.

We thank Prof. McManus for his positive comments and agree that there is overlap between the datasets we have used and that by Tiffin et al. (we were unaware of this work at the time we were conducting our analyses) however we do not believe that the findings are contradictory (see comments below).

1. ARCP/RITA classifications are complex, and Tiffin et al chose as 'satisfactory codes 1, 6, C and G, whereas the present chooses as unsatisfactory 3,4,7.3, D and E, which is not the complement of the Tiffin classification. Tiffin et al also use ordinal regression, since the classifications can be classified in some form of hierarchy. There is an argument for also carrying out the current study using the Tiffin approach.

We have compared our codes with Tiffin et al and for RITA they are complementary as the missing code F reflects out of programme experience. There are discrepancies for the ARCP codes. We specifically chose to not include code 2 and we justified our reasons for this in the paper. In the experience of one of the authors as an ARCP assessor, code 2 is most often used for trainees with inadequate documentation not

poor progression. The panel will give an outcome 2 with the proviso that this is converted to a 1 if the trainee provides this within a reasonable time frame.

2. Tiffin et al also excluded "ARCP outcomes related to examination failure". That raises important questions about whether age is related to academic or non-academic problems, and it would be useful to have similar analyses for the present data.

Tiffin et. al. included international graduates which we specifically excluded and hence looks at PLAB examination results. Our hypothesis was to test whether more mature doctors have greater difficulty in progressing through postgraduate training and clearly examination failure is one potential reason. We would not wish to exclude this reason for failure to progress and specifically mention this potential explanation in the discussion. Furthermore, the ARCP dataset does not include the reason for failure (whether academic or non-academic).

3. Age at qualification is not an easy variable. The current authors use a cut point of 29+ at graduation. However they then divide older graduates into 29 to 31 and 32+ and find a dose-response effect. However the classification of those of 28 or less is far from obvious, and it is not clear that they are homogenous (i.e. without a dose-response effect). 32+ are different from 29-31 and <29, and it therefore seems possible that the so-called "Normal age" group [surely an unfortunate bit of phrasing?] is also heterogenous. If 23-24 is a typical post-school leaving age, and 26-27 is a typical age for graduates to qualify, then there could well be variation here. Given the large Ns then surely the data needed dividing up into something like <-23, 24,25,26,27,28, 29-31, 32+ in order to see what is going on. At present the classification is too simplistic.

Our hypothesis was for "mature students" for which there is no standard definition so we chose one that we feel has strong face validity. We agree with Prof. McManus that there may be heterogeneity in the baseline group. We have therefore repeated the analyses with this group sub-divided as he has suggested. These additional analyses have been informative and we have now added a new supplemental table. The data show that, as before, the oldest group (>=32 years) are markedly worse than the younger groups but in fact there is little difference in the 26-31 year group in the unadjusted analysis though adjustment slightly increase the odds ratio for the 29-31 year group. If anything the threshold for increased problems with progression appears to be at 26 years and above; lower than we have previously shown. We do not feel this in anyway invalidates our a priori definition of "mature" student but this post-hoc analysis is of interest and also demonstrates the non-linearity of the relationship with age. We have added some discussion of this finding into the paper.

We have also changed the name of the 'Normal Age' group to 'Younger group'.

4. Age and age at qualification are separate, and confounded with cohort. Tiffin et al found no effect of age at all which seems difficult to reconcile with the current data. Some exploration/explanation is required.

There are two issues that need to be considered here. One is the differences in the datasets and analysis strategy and the other is the interpretation of our results with respect to Tiffin et al.

Though the two datasets are from the same primary source and do indeed overlap temporally, they are different as Tiffin et al includes all non-UK graduates whilst these were explicitly excluded from our analyses. The Tiffin paper uses age at ARCP (parameterised as a continuous variable) whilst we have used age at provisional registration in much larger categorical groupings. As our hypothesis relates to age

at registration and not age at ARCP, the Tiffin results are less relevant to this, though clearly they will be correlated to some degree.

In the univariable analysis section of the paper by Tiffin et al they state that "Increasing age (odds ratio 1.04, 1.03 to 1.04)… with increased odds of obtaining a less satisfactory outcome at ARCP." The smaller effect estimate reflects the way that age was parameterised but is consistent with our results (though as we have now shown the assumption of linearity may or may not be valid). The "Age" coefficient in table 4 (Odds ratio 1.00, 95% CI 0.98 to 1.01) which appears null is harder to interpret as this from a multivariable model which also includes two interaction terms with age (age and UK experience, age and non-white ethnicity).

5. I like the idea of 'graduate-friendly' medical schools, but a single cut-off seems too easy. Could we please see a plot of ARCP problem rates by percentage of 'older' graduates from each medical school. Medical schools are known to differ strongly in their success rates at MRCP/MRCGP (see the McManus paper in the same BMJ as the Tiffin paper), and in a proper analysis there would be dummy variables for medical schools in the analysis.

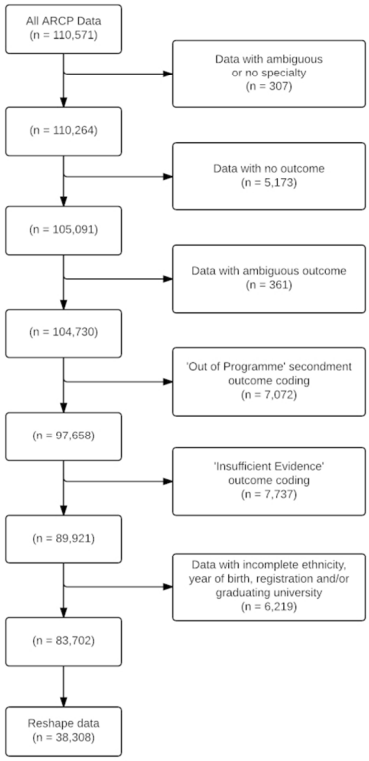
Unfortunately the GMC aggregated some of the London medical schools into one group before releasing the data but we have now rerun the analysis as suggested with a dummy variable for each school and this makes almost no difference to the results. We have added a sentence to the results section to inform the readers of this analysis.

6. The tables would benefit from including Ns on a systematic basis.

We agree with this suggestion and have made this amendment.

We thank Prof. McManus for his positive comments and suggestions.

Finally, the authors would like to highlight an additional point added to the discussion after this review. This was suggested following a presentation to the Severn Deanery Foundation Programme Away Day (Sept. 2014).



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BMJ Open

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Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2014-005658.R2
Article Type:	Research
Date Submitted by the Author:	13-Oct-2014
Complete List of Authors:	Pyne, Vicky; University of Bristol, ; Ben-Schlomo, Yoav; Dept of Social Medicine
Primary Subject Heading:	Medical education and training
Secondary Subject Heading:	Medical management
Keywords:	MEDICAL EDUCATION & TRAINING, Human resource management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisational development < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

Older doctors and progression through specialty training in the United Kingdom: a cohort analysis of General Medical Council data.

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Word count 2979

Abstract

Objective: To determine whether older age at graduation is associated with any difference in outcomes from the annual specialty training progression assessment.

Design: An open cohort of 38,308 doctors who graduated from a United Kingdom medical school with annual assessments of progression in their specialty training program with data centrally collected by the General Medical Council between 05/08/2009 to 31/07/2012.

Results: Mature junior doctors (≥ 29 years at graduation) were more likely to have problems with progression on their ARCP/RITA than their younger colleagues (Odds ratio 1.34, 95% CI 1.22, 1.49, p<0.001). This association was, if anything, even stronger (Odds ratio 1.57, 95% CI 1.41, 1.74, p<0.001) after adjustment for gender, ethnicity, type of University and specialty. The same was true when only looking at the most extreme ARCP outcome (4) which is being asked to leave their specialist programme (Odds ratio 1.81, 95% CI 1.34, 2.44, p<0.001).

Conclusions: Mature doctors are a growing part of the medical workforce and they are likely to broaden the spectrum of doctors by bring different life experience to the profession. These results suggest that they are more likely to have problems with progressing through their specialist training programme. More research is required to determine the reasons behind these associations and how mature doctors can be supported both in choosing the best training programme and in coping with the complex demands of higher training at a later stage in their lives.

Strengths of this Study

1. First study to look at how age at graduation affects a doctor's chance of succeeding in their annual revalidation.
2. Large sample size with little missing data and minimal sources of bias for exposure and outcome variables.
3. Results are counter to prevailing beliefs that mature medical students cope better with medical training as demonstrates greater problems with progression through the ARCP process.
4. Highlights the importance of other demographic and clinical factors that determine progression in training.

Limitations of this Study

5. No quantitative or qualitative data to try to understand the reasons for worse progression and to what degree these are or are not academic related.
6. ARCP data is a simple measure of adequate progression and does not capture excellence so could hide a bimodal distribution whereby mature junior doctors are also more likely to excel as well as have problems of progression.

Introduction

Over the last decade, more mature students have been welcomed onto the medical training programme. Whilst they only make up around 4% of medical students in the UK[1], they are a more substantial proportion of graduates from the USA and Canada (16.7% and 14.2% were 30 or older at graduation respectively [2] [3]). These students are often different in their outlook and abilities to a typical school leaver and may be better suited as both a student and future doctor. For example, the former director of the graduate entry programme at St George's Hospital Medical School has stated that "mature students… are sooner and better able to handle the responsibilities of being a doctor" and are "much more self-directed, challenging, demanding, questioning, and mature" than their younger counterparts [4]. These subjective views have some limited support from both qualitative and quantitative research during the medical school years, for example, older students appear to do better at year 3 OSCE exams [5]. Two studies have suggested that mature students cope better with the transition to clinical responsibilities feeling less confused, daunted, anxious or intimidated and more likely to describe a positive transition [6] [7]. This may not merely reflect greater academic experience; greater age at program entry, as opposed to the presence of a previous degree, was a better predictor for positive attributes and attitudes related to being a doctor [8]. This may reflect stronger motivational factors that lead them to positively choose medicine as a subsequent career.

Remarkably little is known about what happens to these mature graduates after they qualify. These positive attitudes could result in very focussed and determined graduates who try to reach their choice of specialist career as quickly and efficiently as possible thereby progressing through their training rapidly. On the other hand, mature graduates are more likely to have established geographical roots and family commitments that may make handling the double burdens of career and family problematic even earlier in their training as compared to younger graduates. Anecdotal evidence from the Severn Deanery has suggested that some mature students required greater

support with getting through their annual assessment (previously known as RITA - Record of In Training Assessment) and now referred to as ARCP (Annual Review of Competence Progression). We objectively test the null hypothesis that the proportion of doctors who either require additional training time or who are asked to leave the programme is the same for both older and younger graduate doctors.

Methods

Datasource and variable definitions

The General Medical Council, who collate the national data on ARCP/RITA, kindly provided us with an anonymised extract of data for all UK medical graduates who had a review between 05/08/2009 to 31/07/2012. In the United Kingdom, prior to 2013, the ARCP/RITA process begins at the start of speciality training (such as surgery or primary care) and continues until completion of training (obtaining a certificate of completion of training – CCT) that enables doctors to apply for a consultant post.

Because the coding of the outcomes for ARCP and RITA do not map directly onto each other, we had to use slightly different definitions for our outcome measure of poor progression. For ARCP we used codes 3 (requires additional training time), 4 (released from the programme) and 7.3 (inadequate progress) as a composite measure of poor progression. For the RITA we used codes D (targeted training) and E (intensified or repeat training) as our poor outcome measure (see appendix 1 for the full coding scheme)[9] [10]. We choose to exclude subjects with a code for insufficient evidence (as this often reflects inadequate documentation rather than poor progress per se) and those trainees on an out-of-program secondment.

Our exposure measure was based on an arbitrary age cut-off (coded as an integer value). There is no accepted standard definition of a “mature” student so we chose to define this as a graduate who was 29 years or over at the year of first registration (i.e. year of graduation). By choosing this cut-point

we hoped to not include graduates who had simply taken a gap year, intercalated BSc or a prior degree before going straight into medicine (as this should mean they are not older than 27 years) but those who would have had some years of "work" experience outside of medicine. This is similar to a previous study that defined the "older mature" as "students who have worked in other occupations for a number of years prior to making a decision to apply to medical school" [11]. We further sub-divided this 'mature' group into those aged between 29 years and 31 years and those who were 32 years or older on date of first registration to examine for any dose-response effects with older age at registration. Finally for a sensitivity analysis we examined a more detailed classification of the younger baseline group into the following categories (≤ 23, 24, 25, 26, 27, 28 years). We defined, a priori, a number of potential confounders or intermediaries that could be associated with being an older graduate and a greater probability of poor progression. These were gender, specialty, ethnicity, and whether the graduate had qualified from a "mature friendly" medical school that may be better able to help the older graduate cope with the future stresses of being a doctor. This last variable was operationalized as follows: We calculated the percentage of mature students graduating from the medical school and then created a binary variable if the percentage was greater than 10% - approximately the top quartile and these were mainly the new medical schools (e.g. Exeter, Brighton & Sussex etc.). We could not disaggregate all the London-based medical schools as they were all coded as University of London.

Statistical methods

The original dataset had multiple records for a doctor for each assessment (long format) but this could be linked by an anonymous unique identifier. We reshaped the data into wide format (one row per doctor) so each doctor is only represented once in the dataset. If the doctor had poor progression more than once, we only coded the first event. We compared simple proportions using Chi-squared tests and linear regression for continuous variables. We then calculated the crude odds ratio (95% confidence intervals, p-values) for older age at graduation and poor progression and

multivariable odds ratio adjusting for gender, ethnicity (binary variable defined as non-ethnic if ticked any of the White ethnicity codes from census or ethnic minority, which included any other code), specialty (dummy variable) and mature friendly medical school (binary variable). For specialty we used hospital medicine as the baseline group as it had the largest number of doctors. We undertook a sensitivity analysis using the most extreme outcome – leaving the training programme. As this is only explicitly coded in the ARCP outcomes, we could not use subjects with RITA assessments for this secondary analysis. We examined for potential interactions between age at registration with gender and ethnicity and either failure to progress or being asked to leave the specialty.

Results

We received a total of 110,571 records (multiple assessments per doctor). We dropped 307 records (0.3%) without a specialty code and there were 5,173 records with a missing outcome (4.7%) and 361 records (0.3%) with an ambiguous code that we could not use (99% of the missing outcome data came from 2012, when the GMC asked Deaneries to return forms even for doctors who were not having ARCPs as they were out of programme, on maternity leave or long term sick so these are not really missing outcomes - Andy Knapton, GMC personal communication). In addition, there were 7,072 records (6.4%) for out-of-program secondments and 7,737 records (7.0%) coded as insufficient evidence leaving us with 89,921 records. After removing incomplete data for ethnicity, year of birth, year of registration, and graduating university, we were left with 83,702 records from 38,308 doctors (see figure 1) similar to the stated number of registered doctors (in Approved Practice Settings) as listed by the GMC [12]. There were 2,610 (6.8%) mature graduates (1,414 between 29 and 31 years, and 1,196 ≥ 32 years). 83.7% of assessments were ARCP and 16.3% were from the RITA. In total, 6,045 doctors (15.8%) failed at least one ARCP or RITA during the three years of recorded data and of those, 491 (1.3%) were asked to leave the specialty programme (ARCP Outcome 4).

Older doctors were more likely to be male, non-ethnic minority, and train in Primary Care or Public Health (p<0.001) compared to younger doctors (see web table 1). Older doctors were more likely to have problems with progression (odds ratio 1.34, 95% CI 1.22, 1.49, p-value <0.001) (table 1). After adjusting for gender, ethnicity, type of medical school, and choice of specialty, the odds ratio was further increased (OR 1.57, 95% CI 1.41, 1.74, p<0.001). When we broke down the older age group into three categories (non-mature, 29 to 31 years, ≥ 32 years), the trend was even more marked both with and without adjustment for other covariates (OR 1.0, 1.43, 1.74 respectively, p-value for trend <0.001 after multivariable adjustment). Our more detailed breakdown of the younger age group suggested that increased problems with progression are evident at a younger age, 26 years and above, though the oldest group (≥ 32 years) appear to have additional problems (see web table 2).

Our secondary analysis using just the extreme outcome of leaving the training programme (ARCP-4) found an even greater odds ratio of failing to progress for mature students compared to non-matures (OR 1.81, 95% CI 1.34, 2.44, p<0.001). When we examined this by our three level age group, we observed a non-linear trend (OR for non-mature, 29 to 31 years, ≥ 32 years: 1.0, 1.29, 2.48 respectively, p-value for trend <0.001) whereby the excess risk seemed mainly limited to the oldest group (≥ 32 years) (web table 3). There was no evidence of any interactions between maturity and either gender or ethnicity on failure to progress or being asked to leave the specialty. The results were essentially unchanged when we replaced the type of university with a dummy variable for all universities.

Discussion

This study provides strong evidence that doctors who are older at graduation were more likely to have problems with progression at their annual assessment and were more likely to leave their

initial specialist training programme. These findings appeared to be independent of other factors, such as gender, ethnicity, type of medical school and speciality. The last showed wide variability with some specialties having higher (Obstetrics and Gynaecology) and others lower (General Practice and Public Health) rates of problems with progression. This finding is consistent with the results of a recent analysis comparing doctors who obtained their medical degree either in or outside of the UK and testing whether the Performance and Linguistics Assessments Board examination system explained performance at ARCP [13]. It is also consistent with the recent GMC Report on the state of medical education and practice in the UK [14] which found (in Figure 46) that doctors who were over 30 when joining the register were more likely than their younger counterparts to receive a sanction or a warning. While the null hypothesis defined 'mature' graduates as those over 28 years at first registration, additional analysis has highlighted this effect is evident for doctors as young as 26 on registration, who make up over 20% of the doctor population in this sample.

As these results are unlikely to be due to chance, one must consider other possible explanations. Bias in either measurement of exposure or outcome is very unlikely as age at graduation is taken from year of registration and year of birth so should be well recorded and any coding errors are likely to be random in nature. Similarly any coding errors in the ARCP/RITA outcomes are unlikely to be differential according to age at graduation. A very small proportion of outcome data were missing and this is unlikely to have been systematically biased. Though we attempted to control for a variety of covariates that could influence the outcome, we did not have reliable data on whether trainees were in full or part time training. The latter may be more common in mature graduates and may influence progression in training. Similarly we could not explore if there was an interaction between mature graduate status and full or part time training. In addition, ARCP is not intended to capture excellence in training but merely adequate progression. It is possible that the performance of mature graduates is bimodal so that some mature doctors actually have better outcomes but this would not be evident in our analysis.

One must consider several possible explanations as to why older graduates have more problems progressing through higher training if we assume our observed associations are truly causal. (a) They may have more commitments outside of work (caring commitments for either children or parents or other personal relationship issues) that may make it harder to successfully complete all the assessments required for ARCP [11]. (b) They may find themselves committing to a specialty that may not have been their first choice in order to stay in a certain part of the country for their children or spouse. This could result in them doing less well in ARCP due a degree of ambivalence to this specialty. (c) They may have more problems passing post-graduate specialist exams or completing more technical skills competencies which result in either additional training time or in the worst case leaving the specialty. This may be one explanation why we observed the same difficulty with progression for doctors of ethnic minority background who are known to have a higher failure rate with the MRCGP exam [13];[15]. (d) Being older, these doctors may find it harder to engage with the informal social support groups among junior doctors (either due to personal commitments or the age gap) and thus have fewer resources to call upon during challenging rotations or clinical situations. (e) The higher rate of leaving the programme in the oldest age group may reflect an inappropriate choice of specialty or that older graduates, having had a past career and already made one major change, have more confidence to switch specialties than younger graduates.

These results should not be interpreted as older graduates are therefore less competent doctors. The ARCP/RITA assessments are there to monitor training progression against specific competencies and milestones and are not a direct measure of the quality of doctors. Some excellent doctors simply take longer to complete their training and may have gained additional skills and life experiences on this journey, learning more from their mistakes than their successes.

These results, however, should not be a cause for complacency. Longer training programmes exert additional financial pressures on training budgets and any doctor who leaves medicine altogether at this stage has had a lot of time and money invested into their training. The problem is not unique to older graduates as we observed that men, ethnic minorities and some specialties showed the same pattern of results.

In conclusion, mature doctors are part of the makeup of the NHS workforce and they widen the variety of doctors as well as bringing insights from past careers that is to be welcomed. While they appear to do better than their younger counterparts at university, they are more likely to have problems with specialty training in the UK. We believe that the causes for this are multi-factorial and probably not unique to the United Kingdom but generalisable to other high income countries like the USA and Canada, though this requires empirical confirmation. These results should be an impetus for further qualitative research to provide greater insights into why older graduates are more like to have difficulties in progression and direct action from training programmes so that they can identify problems at an earlier stage and provide greater support for such trainees as appropriate.

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Data Sharing Statement: No additional data available.

Figure 1: A flow chart showing losses of data due to incomplete or inadequate data to reach the final study sample.

Table 1: Association between 'Mature status' and failure to progress at ARCP adjusted for a range of potential confounders.

	Model 1* OR (95% CI)	p Value	Model 2* OR (95% CI)	p Value
Older (≥29 years) (2,610)	1.34 (1.22 to 1.49)	<0.001	1.57 (1.41 to 1.74)	<0.001
Younger group (≤28 years) (35,698)	1.00		1.00	
Older group (29 to 31 years) (1,414)	1.27 (1.11 to 1.46)	0.001	1.43 (1.24 to 1.65)	<0.001
Oldest group (≥32 years) (1,196)	1.43 (1.24 to 1.65)	<0.001	1.74 (1.50 to 2.02)	<0.001
p-value for trend		<0.001		<0.001
Female gender (21,470)			0.82 (0.77 to 0.87)	<0.001
Ethnic minority (11,338)			1.59 (1.49 to 1.68)	<0.001
Mature Friendly University (35,745)			1.18 (1.06 to 1.32)	0.003
First Specialty				
Medicine (10,135)			1.00	
ACCS & related (5,827)			1.00 (0.92 to 1.08)	0.93
Surgery (6,077)			0.84 (0.77 to 0.91)	<0.001
GP & Public Health (9,094)			0.26 (0.24 to 0.29)	<0.001
O&G (1,528)			2.16 (1.91 to 2.43)	<0.001
Paediatrics (2,791)			0.81 (0.72 to 0.90)	<0.001
Pathology (564)			0.84 (0.67 to 1.06)	0.14
Psychiatry (966)			0.51 (0.42 to 0.63)	<0.001
Radiology (1,326)			0.88 (0.76 to 1.02)	0.10

*Model 1, simple odds ratio; Model 2 for binary age-group after adjustment for all covariates as shown in table except for the three level age group variable. This model was then rerun with the three level age-group and other covariates to examine for a dose-response effect

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Because the coding of the outcomes for ARCP and RITA do not map directly onto each other, we had to use slightly different definitions for our outcome measure of poor progression. For ARCP we used codes 3 (requires additional training time), 4 (released from the programme) and 7.3 (inadequate progress) as a composite measure of poor progression. For the RITA we used codes D (targeted training) and E (intensified or repeat training) as our poor outcome measure (see appendix 1 for the full coding scheme)[9] [10]. We choose to exclude subjects with a code for insufficient evidence (as this often reflects inadequate documentation rather than poor progress per se) and those trainees on an out-of-program secondment.

Our exposure measure was based on an arbitrary age cut-off (coded as an integer value). There is no accepted standard definition of a “mature” student so we chose to define this as a graduate who was 29 years or over at the year of first registration (i.e. year of graduation). By choosing this cut-point

we hoped to not include graduates who had simply taken a gap year, intercalated BSc or a prior degree before going straight into medicine (as this should mean they are not older than 27 years) but those who would have had some years of "work" experience outside of medicine. This is similar to a previous study that defined the "older mature" as "students who have worked in other occupations for a number of years prior to making a decision to apply to medical school" [11]. We further sub-divided this 'mature' group into those aged between 29 years and 31 years and those who were 32 years or older on date of first registration to examine for any dose-response effects with older age at registration. Finally for a sensitivity analysis we examined a more detailed classification of the younger baseline group into the following categories (≤ 23, 24, 25, 26, 27, 28 years). We defined, a priori, a number of potential confounders or intermediaries that could be associated with being an older graduate and a greater probability of poor progression. These were gender, specialty, ethnicity, and whether the graduate had qualified from a "mature friendly" medical school that may be better able to help the older graduate cope with the future stresses of being a doctor. This last variable was operationalized as follows: We calculated the percentage of mature students graduating from the medical school and then created a binary variable if the percentage was greater than 10% - approximately the top quartile and these were mainly the new medical schools (e.g. Exeter, Brighton & Sussex etc.). We could not disaggregate all the London-based medical schools as they were all coded as University of London.

Statistical methods

The original dataset had multiple records for a doctor for each assessment (long format) but this could be linked by an anonymous unique identifier. We reshaped the data into wide format (one row per doctor) so each doctor is only represented once in the dataset. If the doctor had poor progression more than once, we only coded the first event. We compared simple proportions using Chi-squared tests and linear regression for continuous variables. We then calculated the crude odds ratio (95% confidence intervals, p-values) for older age at graduation and poor progression and

multivariable odds ratio adjusting for gender, ethnicity (binary variable defined as non-ethnic if ticked any of the White ethnicity codes from census or ethnic minority, which included any other code), specialty (dummy variable) and mature friendly medical school (binary variable). For specialty we used hospital medicine as the baseline group as it had the largest number of doctors. We undertook a sensitivity analysis using the most extreme outcome – leaving the training programme. As this is only explicitly coded in the ARCP outcomes, we could not use subjects with RITA assessments for this secondary analysis. We examined for potential interactions between age at registration with gender and ethnicity and either failure to progress or being asked to leave the specialty.

Results

We received a total of 110,571 records (multiple assessments per doctor). We dropped 307 records (0.3%) without a specialty code and there were 5,173 records with a missing outcome (4.7%) and 361 records (0.3%) with an ambiguous code that we could not use (99% of the missing outcome data came from 2012, when the GMC asked Deaneries to return forms even for doctors who were not having ARCPs as they were out of programme, on maternity leave or long term sick so these are not really missing outcomes - Andy Knapton, GMC personal communication). In addition, there were 7,072 records (6.4%) for out-of-program secondments and 7,737 records (7.0%) coded as insufficient evidence leaving us with 89,921 records. After removing incomplete data for ethnicity, year of birth, year of registration, and graduating university, we were left with 83,702 records from 38,308 doctors (see figure 1) similar to the stated number of registered doctors (in Approved Practice Settings) as listed by the GMC [12]. There were 2,610 (6.8%) mature graduates (1,414 between 29 and 31 years, and 1,196 ≥ 32 years). 83.7% of assessments were ARCP and 16.3% were from the RITA. In total, 6,045 doctors (15.8%) failed at least one ARCP or RITA during the three years of recorded data and of those, 491 (1.3%) were asked to leave the specialty programme (ARCP Outcome 4).

Older doctors were more likely to be male, non-ethnic minority, and train in Primary Care or Public Health (p<0.001) compared to younger doctors (see web table 1). Older doctors were more likely to have problems with progression (odds ratio 1.34, 95% CI 1.22, 1.49, p-value <0.001) (table 1). After adjusting for gender, ethnicity, type of medical school, and choice of specialty, the odds ratio was further increased (OR 1.57, 95% CI 1.41, 1.74, p<0.001). When we broke down the older age group into three categories (non-mature, 29 to 31 years, ≥ 32 years), the trend was even more marked both with and without adjustment for other covariates (OR 1.0, 1.43, 1.74 respectively, p-value for trend <0.001 after multivariable adjustment). Our more detailed breakdown of the younger age group suggested that increased problems with progression are evident at a younger age, 26 years and above, though the oldest group (≥ 32 years) appear to have additional problems (see web table 2).

Our secondary analysis using just the extreme outcome of leaving the training programme (ARCP-4) found an even greater odds ratio of failing to progress for mature students compared to non-matures (OR 1.81, 95% CI 1.34, 2.44, p<0.001). When we examined this by our three level age group, we observed a non-linear trend (OR for non-mature, 29 to 31 years, ≥ 32 years: 1.0, 1.29, 2.48 respectively, p-value for trend <0.001) whereby the excess risk seemed mainly limited to the oldest group (≥ 32 years) (web table 3). There was no evidence of any interactions between maturity and either gender or ethnicity on failure to progress or being asked to leave the specialty. The results were essentially unchanged when we replaced the type of university with a dummy variable for all universities.

Discussion

This study provides strong evidence that doctors who are older at graduation were more likely to have problems with progression at their annual assessment and were more likely to leave their

initial specialist training programme. These findings appeared to be independent of other factors, such as gender, ethnicity, type of medical school and speciality. The last showed wide variability with some specialties having higher (Obstetrics and Gynaecology) and others lower (General Practice and Public Health) rates of problems with progression. This finding is consistent with the results of a recent analysis comparing doctors who obtained their medical degree either in or outside of the UK and testing whether the Performance and Linguistics Assessments Board examination system explained performance at ARCP [13]. It is also consistent with the recent GMC Report on the state of medical education and practice in the UK [14] which found (in Figure 46) that doctors who were over 30 when joining the register were more likely than their younger counterparts to receive a sanction or a warning. While the null hypothesis defined 'mature' graduates as those over 28 years at first registration, additional analysis has highlighted this effect is evident for doctors as young as 26 on registration, who make up over 20% of the doctor population in this sample.

As these results are unlikely to be due to chance, one must consider other possible explanations. Bias in either measurement of exposure or outcome is very unlikely as age at graduation is taken from year of registration and year of birth so should be well recorded and any coding errors are likely to be random in nature. Similarly any coding errors in the ARCP/RITA outcomes are unlikely to be differential according to age at graduation. A very small proportion of outcome data were missing and this is unlikely to have been systematically biased. Though we attempted to control for a variety of covariates that could influence the outcome, we did not have reliable data on whether trainees were in full or part time training. The latter may be more common in mature graduates and may influence progression in training. Similarly we could not explore if there was an interaction between mature graduate status and full or part time training. In addition, ARCP is not intended to capture excellence in training but merely adequate progression. It is possible that the performance of mature graduates is bimodal so that some mature doctors actually have better outcomes but this would not be evident in our analysis.

One must consider several possible explanations as to why older graduates have more problems progressing through higher training if we assume our observed associations are truly causal. (a) They may have more commitments outside of work (caring commitments for either children or parents or other personal relationship issues) that may make it harder to successfully complete all the assessments required for ARCP [11]. (b) They may find themselves committing to a specialty that may not have been their first choice in order to stay in a certain part of the country for their children or spouse. This could result in them doing less well in ARCP due a degree of ambivalence to this specialty. (c) They may have more problems passing post-graduate specialist exams or completing more technical skills competencies which result in either additional training time or in the worst case leaving the specialty. This may be one explanation why we observed the same difficulty with progression for doctors of ethnic minority background who are known to have a higher failure rate with the MRCGP exam [13][15][14]. (d) Being older, these doctors may find it harder to engage with the informal social support groups among junior doctors (either due to personal commitments or the age gap) and thus have fewer resources to call upon during challenging rotations or clinical situations. (e) The higher rate of leaving the programme in the oldest age group may reflect an inappropriate choice of specialty or that older graduates, having had a past career and already made one major change, have more confidence to switch specialties than younger graduates.

These results should not be interpreted as older graduates are therefore less competent doctors. The ARCP/RITA assessments are there to monitor training progression against specific competencies and milestones and are not a direct measure of the quality of doctors. Some excellent doctors simply take longer to complete their training and may have gained additional skills and life experiences on this journey, learning more from their mistakes than their successes.

These results, however, should not be a cause for complacency. Longer training programmes exert additional financial pressures on training budgets and any doctor who leaves medicine altogether at this stage has had a lot of time and money invested into their training. The problem is not unique to older graduates as we observed that men, ethnic minorities and some specialties showed the same pattern of results.

In conclusion, mature doctors are part of the makeup of the NHS workforce and they widen the variety of doctors as well as bringing insights from past careers that is to be welcomed. While they appear to do better than their younger counterparts at university, they are more likely to have problems with specialty training in the UK. We believe that the causes for this are multi-factorial and probably not unique to the United Kingdom but generalisable to other high income countries like the USA and Canada, though this requires empirical confirmation. These results should be an impetus for further qualitative research to provide greater insights into why older graduates are more like to have difficulties in progression and direct action from training programmes so that they can identify problems at an earlier stage and provide greater support for such trainees as appropriate.

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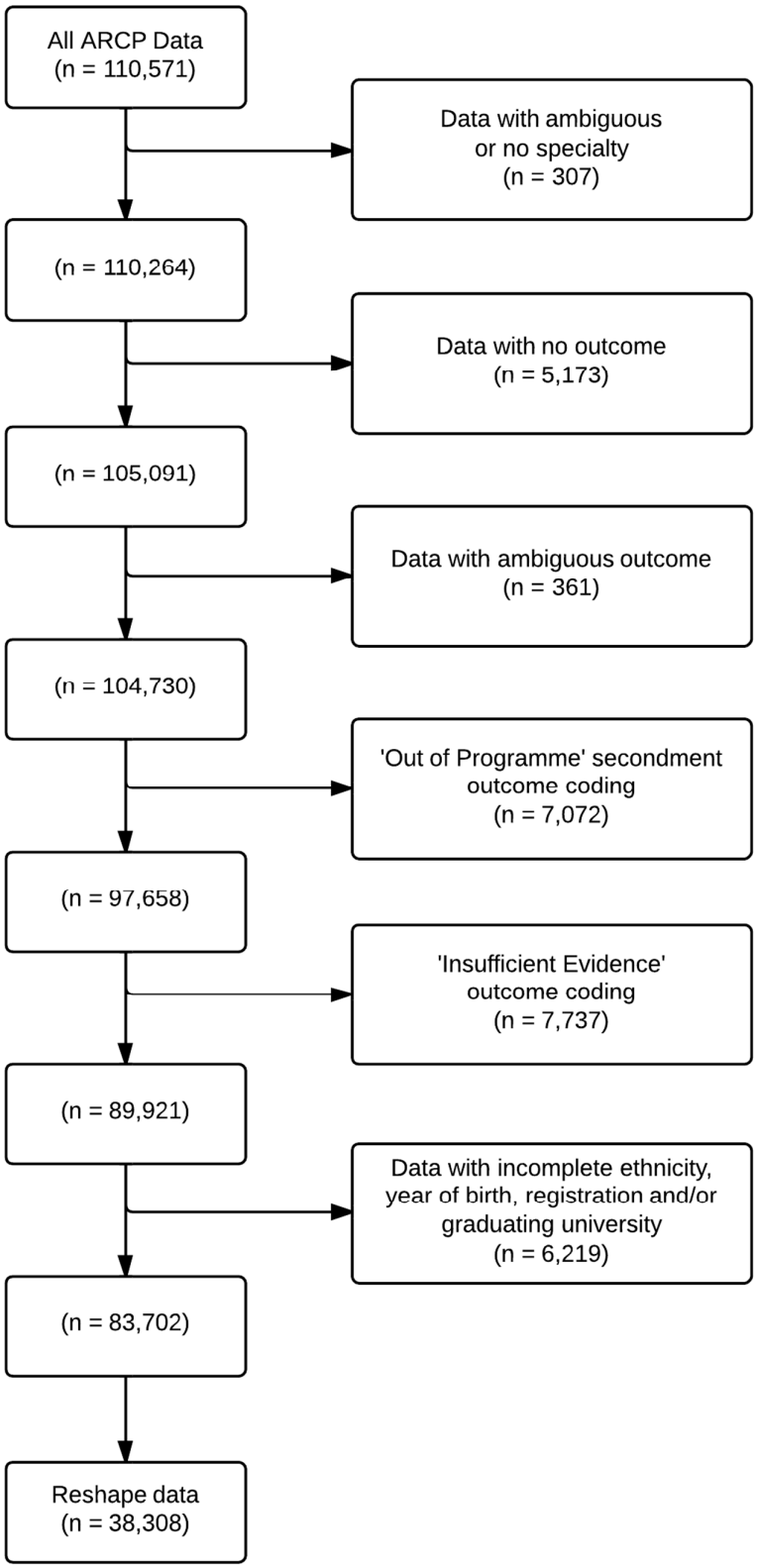
Table 1: Association between 'Mature status' and failure to progress at ARCP adjusted for a range of potential confounders.

	Model 1* OR (95% CI)	p Value	Model 2* OR (95% CI)	p Value
Older (≥29 years) (2,610)	1.34 (1.22 to 1.49)	<0.001	1.57 (1.41 to 1.74)	<0.001
Younger group (≤28 years) (35,698)	1.00		1.00	
Older group (29 to 31 years) (1,414)	1.27 (1.11 to 1.46)	0.001	1.43 (1.24 to 1.65)	<0.001
Oldest group (≥32 years) (1,196)	1.43 (1.24 to 1.65)	<0.001	1.74 (1.50 to 2.02)	<0.001
p-value for trend		<0.001		<0.001
Female gender (21,470)			0.82 (0.77 to 0.87)	<0.001
Ethnic minority (11,338)			1.59 (1.49 to 1.68)	<0.001
Mature Friendly University (35,745)			1.18 (1.06 to 1.32)	0.003
First Specialty				
Medicine (10,135)			1.00	
ACCS & related (5,827)			1.00 (0.92 to 1.08)	0.93
Surgery (6,077)			0.84 (0.77 to 0.91)	<0.001
GP & Public Health (9,094)			0.26 (0.24 to 0.29)	<0.001
O&G (1,528)			2.16 (1.91 to 2.43)	<0.001
Paediatrics (2,791)			0.81 (0.72 to 0.90)	<0.001
Pathology (564)			0.84 (0.67 to 1.06)	0.14
Psychiatry (966)			0.51 (0.42 to 0.63)	<0.001
Radiology (1,326)			0.88 (0.76 to 1.02)	0.10

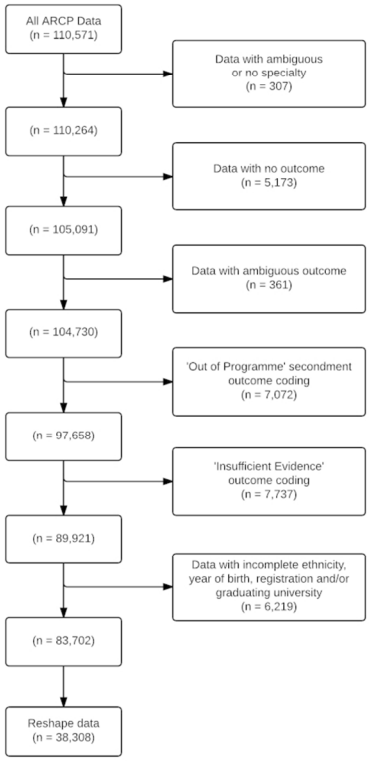
*Model 1, simple odds ratio; Model 2 for binary age-group after adjustment for all covariates as shown in table except for the three level age group variable. This model was then rerun with the three level age-group and other covariates to examine for a dose-response effect

Figure 1: A flow chart showing losses of data due to incomplete or inadequate data to reach the final study sample.



Appendix 1: ACRP/RITA Outcome categories

ARCP	
Outcome 1	Satisfactory Progress
Outcome 2	Unsatisfactory Progress - Development of specific competences required, additional training time not required
Outcome 3	Unsatisfactory Progress - Inadequate progress by the trainee, additional training time required
Outcome 4	Unsatisfactory Progress - Released from the training programme with or without specified competences; trainee will be required to give up their National Training Number.
Outcome 5	Incomplete evidence presented.
Outcome 6	Recommendation for completion of training.
Outcome 7	Fixed-term specialty outcome:
Outcome 7.1	- Satisfactory progress in or completion of the LAT / FTSTA placement.
Outcome 7.2	- Development of Specific Competences Required – additional training time not required
Outcome 7.3	- Inadequate progress by trainee
Outcome 7.4	- Incomplete evidence presented
Outcome 8	Out of programme for research, approved clinical training or a career break (OOPR/OOPT/OOPC).
Outcome 9	For doctors undertaking top-up training in a training post.
RITA	
C	Satisfactory progress
D	Recommendation for targeted training
E	Records a recommendation for intensified supervision/repeated experience.
F	Records out-of-programme experience (including maternity leave)
G	Provides a final record of satisfactory progress on completion of training.



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Web Table 1: Association between mature status and other covariates*

	Normal age (≤28 years)	Older group (29 to 31 years)	Oldest group (≥32 years)
Gender			
Male	43.4% (15,484)	50.7 % (717)	53.3% (637)
Female	56.6% (20,214)	49.3% (697)	46.7% (559)
Ethnic Minority			
Non-Ethnic Minority	69.7% (24,883)	77.8% (1,100)	82.5% (987)
Ethnic Minority	30.3% (10,815)	22.2% (314)	17.5% (209)
Graduating University			
Mature Friendly University	94.1% (33,580)	84.8% (1,199)	80.8% (966)
Non-Mature Friendly University	5.9% (2,118)	15.2% (215)	19.2% (230)
First Specialty			
Medicine	94.8% (9,604)	2.9 (296)	2.6% (235)
ACCS & related	94.2% (5,487)	3.3% (191)	2.6% (149)
Surgery	93.0% (5,648)	4.2% (252)	2.9% (177)
GP & Public Health	90.1% (8,190)	4.9% (446)	5% (458)
O&G	93.6% (1,430)	3.3% (50)	3.1% (48)
Paediatrics	95.9% (2,674)	2.6% (73)	1.6% (44)
Pathology	89.5% (505)	5.1% (29)	5.3% (30)
Psychiatry	93.5% (903)	3.9% (38)	2.6% (25)
Radiology	94.8% (1,257)	2.9% (39)	2.3% (30)
TOTAL			100% (35,698)

*All associations were unlikely to have occurred by chance ($p<0.001$)

Web Table 2: Multivariable association of age at graduation and failure to progress at ARCP using more detailed age-bands and adjusted for a range of potential confounders.

	OR (95% CI)	**p Value**
≤ 23 years old (8,453)	1.05 (0.97 to 1.14)	0.23
24 years old (13,997)	1.0	
25 years old (7,951)	1.12 (1.04 to 1.21)	<0.001
26 years old (2,738)	1.50 (1.35 to 1.67)	<0.001
27 years old (1,614)	1.50 (1.31 to 1.72)	<0.001
28 years old (945)	1.55 (1.30 to 1.84)	<0.001
29 to 31 years old (Older group) (1,414)	1.6 (1.38 to 1.85)	<0.001
≥ 32 years old (Oldest group) (1,196)	1.95 (1.67 to 2.28)	<0.001
p-value for trend	<0.001	
Female gender	0.83 (0.78 to 0.88)	<0.001
Ethnic Minority	1.59 (1.50 to 1.69)	<0.001
Mature Friendly University	1.12 (1.00 to 1.26)	0.04
First Specialty		
ACCS & related	1.00 (0.92 to 1.08)	0.91
Medicine	1.0	
Surgery	0.84 (0.77 to 0.91)	<0.001
GP & Public Health	0.26 (0.23 to 0.29)	<0.001
O&G	2.13 (1.89 to 2.40)	<0.001
Paediatrics	0.81 (0.72 to 0.91)	<0.001
Pathology	0.83 (0.66 to 1.05)	0.12
Psychiatry	0.50 (0.41 to 0.62)	<0.001
Radiology	0.89 (0.77 to 1.03)	0.13

Web Table 3: Multivariable association of 'Mature status' and being asked to leave specialty at ARCP (code 4) adjusted for a range of covariates*.

	OR (95% CI)	p Value
Older (≥29 years)	1.81 (1.34 to 2.44)	<0.001
Younger group (≤28 years)		
Older group (29 to 31 years)	1.29 (0.82 to 2.03)	0.28
Oldest group (≥32 years)	2.48 (1.69 to 3.62)	<0.001
p-value for trend	<0.001	
Female gender	0.78 (0.65 to 0.94)	0.01
Ethnic Minority	1.52 (1.26 to 1.83)	<0.001
Mature Friendly University	1.24 (0.89 to 1.73)	0.21
First Specialty		
ACCS & related	0.99 (0.78 to 1.25)	0.95
Medicine	1.0	
Surgery	0.51 (0.39 to 0.68)	<0.001
GP & Public Health	0.22 (0.16 to 0.31)	<0.001
O&G	0.49 (0.25 to 0.79)	0.005
Paediatrics	0.74 (0.62 to 1.25)	0.48
Pathology	-	-
Psychiatry	0.47 (0.24 to 0.91)	0.03
Radiology	0.18 (0.07 to 0.43)	<0.0001

* Model run with binary age-group after adjustment for all covariates as shown in table except for the three level age group variable. This model was then rerun with the three level age-group and other covariates to examine for a dose-response effect

Appendix 1: ACRP/RITA Outcome categories

ARCP	
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Outcome 5	Incomplete evidence presented.
Outcome 6	Recommendation for completion of training.
Outcome 7	Fixed-term specialty outcome:
Outcome 7.1	- Satisfactory progress in or completion of the LAT / FTSTA placement.
Outcome 7.2	- Development of Specific Competences Required – additional training time not required
Outcome 7.3	- Inadequate progress by trainee
Outcome 7.4	- Incomplete evidence presented
Outcome 8	Out of programme for research, approved clinical training or a career break (OOPR/OOPT/OOPC).
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