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Early career clinical-academic training can produce substantial outputs and encourage retention of junior doctors

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Early career clinical-academic training can produce substantial outputs and encourage retention of junior doctors

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Abstract

Background

Clinical academics, who combine clinical and academic practice, form an essential part of any healthcare system, however, this workforce is shrinking and there have been international calls to sustain it.

We describe the successful implementation and outputs of a combined clinical academic training programme for doctors in their first postgraduate year in Ireland, the Academic Internship Track (AIT).

Objectives

To evaluate the implementation of a combined clinical and academic training programme for doctors in the earliest career stages.

Design

The AIT was evaluated using the CIPP model (Context, Input, Process and Product). Literature reviews, meetings with key stakeholders, reviews of similar established programmes overseas, a survey of undergraduate medical students, exit survey, scientific outputs and career trajectory monitoring were all implemented in the programme evaluation.

Setting

The AIT represents collaboration amongst all six intern training networks in Ireland.

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Results

Key stakeholders indicated support and significant interest in establishing the AIT. The input evaluation informed programme design which incorporates protected time to carry out a research project, a named supervisor, a bursary, and access to dedicated study days. Since the programme's launch in 2017, there has been 100% uptake of posts and 0% attrition. Exiting participants indicate high levels of satisfaction with the programme, and the majority intend remaining in Ireland in both the immediate and longer terms. Participants have already produced substantial scientific outputs and made significant contributions to their respective fields.

Conclusions

Now in its fourth year, AIT remains a highly sought-after programme and is perceived to be beneficial to one's career. Participants in the programme have contributed significantly to their field of interest despite being in the earliest career stages. The programme has the potential to help retain medical talent in Ireland.

Article Summary

Strengths and Limitations of the study

- This is the first study to describe the successful implementation of a combined clinical-academic training programme for junior doctors in Ireland in their first postgraduate year

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- Participants in the programme indicate high levels of satisfaction with the programme, produce substantial research outputs and are more likely to remain in Ireland for further training compared to their peers
- It is too early to monitor career trajectory of participants in the programme
- A limitation of the search for research outputs was that it was conducted by one researcher using one database (PubMed)

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Keywords

Graduate medical education, academic training, training programmes, junior physicians, internship and residency, programme evaluation

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Background

Clinical academics (or clinician scientists) occupy a crucial role in healthcare systems, bridging a gap between research and patient care. Through their combined clinical and academic practice, they have the potential to identify research questions relevant to patient care and to translate research from bench to bedside (1-4). A strong research culture is associated with improved patient outcomes (5). Despite the importance of the role, there are concerns that it is under threat: in the US, the clinical academic workforce is ageing, with the average age at which a first independent NIH grant is awarded approaching 43. A leaky pipeline compounds the problem: a third of young investigators with mentored NIH grants never apply for independent R01 grants, and many more are lost at later career stages (6). Similar problems exist in Australia and New Zealand, where the ability to recruit and retain clinical academics is potentially outstripped by an increase in demand for undergraduate medical education (7). Action is required to continue to attract talented graduates to careers in clinical academic practice (8).

International literature suggests that those who engage with research early in their clinical careers will continue to do so. Graduates of the UK's Academic Foundation Programme (UKAFP) are over forty times more likely to progress to specialty academic training compared to graduates of the standard foundation programme (9.5% vs 0.2%)(9). A U.S review of 25 years of NIH-sponsored Medical Student Research Fellowship programmes (MSRFs) found that up to half of former participants (n=1,000) considered themselves to be working in academic medicine, and the vast majority had conducted additional research after their medical student experience (10). Publication during residency is recognised as a determinant of the capacity to publish in a future career (11, 12). In Psychiatry for example, the decision to pursue a research career is already well established by residency and very few who have less than the highest

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level of interest in research by that time eventually enrol in research career tracks. Together these indicate the crucial importance of early influences. (13).

Ireland's Context

Opportunities for clinical research in Ireland are increasing. There has been considerable investment in clinical research infrastructure over the last decade. There now exists seven Clinical Research Facilities nationwide, multiple Clinical Trial Networks and Science Foundation Ireland (SFI)-funded research institutes across the University and healthcare sector. Ireland has retained its reputation and position in the top 10 most innovative countries in Europe (14) . The Irish government has pledged to build a strong research and innovation base in Ireland with the aim of becoming a Global Innovation Leader (15). This has prompted expansion of the number of Health Research Board (HRB) funded clinician scientist awards, as a result academic capacity has increased in cancer, immunology, personalised medicine, neuroscience, ageing, bioinformatics and medical devices (16).

If opportunities for clinical research are increasing, clinical training and education must provide a workforce that is able to avail of these opportunities. Prior to 2017, there was no combined clinical and academic training programme in Ireland for junior doctors at any level. In July 2017, the academic internship track was launched, it provides a one- year combined clinical and academic training programme to junior doctors in their first postgraduate year (interns). Currently in its fourth year, we offer an evaluation of the programme's development and success.

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Programme Evaluation

CIPP Model of Evaluation

The CIPP model includes formative and summative assessments with an emphasis on not only proving that a programme works, but also seeking areas for improvement. Key to the process is equity, and engagement is sought with all stakeholders in a fair and balanced manner. CIPP stands for **C**ontext, **I**nput, **P**rocess and **P**roduct evaluation (17), (18) (Table 1).

CIPP Model of Evaluation		
Type of Evaluation	**Questions asked**	**Methods**
Context	What educational need is being met? What goals should be pursued to meet the needs?	Literature review Meetings with key stakeholders Online survey of undergraduate medical students
Input	What are the most promising approaches to meeting the educational need? What might some of the barriers to successful implementation of the programme be?	Literature review Curriculum review of similar programmes Meeting with Director of UKAFP, an established programme Online survey of undergraduate medical students
Process	To what extent was the programme carried out as planned?	Review of recruitment to process: post uptake and attrition Survey of exiting academic interns seeking feedback on programme
Product	To what extent did the programme effectively address the original objectives?	Review of scientific outputs of previous participants in the programme Feedback from exiting interns on career intentions Monitoring of career trajectory and retention in Ireland

Table 1: Academic Internship Track Evaluation Model (adapted from Stufflebeam et al, (17))

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Context Evaluation

A context evaluation is similar but more comprehensive than a needs assessment as it also incorporates an assessment of problems, assets and opportunities (17). A literature review identified a need to provide training pathways for clinical academics to build and sustain the workforce. During the early stages of programme development, meetings were held with three groups who were key stakeholders: the Intern Network Executive (INE), the body responsible for delivering intern training and assessment; the Irish Medical Council's Education Committee who oversee intern education and training, and the Health Service Executive's National Doctors Training and Planning (NDTP), the body responsible for ensuring the Irish Health Service is provided with the appropriate number of medical specialists. All stakeholders were in support of the development of an academic track for internship whose aims are to:

- provide opportunities for doctors at the beginning of their careers to continue or develop research, education and healthcare leadership and management skills
- promote scientific discovery and sustained academic development within the context of contemporary clinical practice
- and retain medical talent in Ireland

Funding was subsequently provided for 24 posts nationally, representing ~3% of all intern posts.

Medical students may also be considered key stakeholders, so an anonymous online survey was distributed to medical students in their fourth (penultimate) year of training; respondents indicated a high level of interest in a potential academic internship (19).

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Input Evaluation

A literature review was undertaken to investigate approaches to combined clinical academic training programmes for junior doctors at the earliest career stages. The most similar programme to the Academic Intern Track in Ireland is the UKAFP (UK Academic Foundation Programme). The programme design and curriculum were examined, and a meeting was held with the Programme Director who provided further information and advice on programme design and implementation.

The literature review also revealed barriers to junior doctors' participation in clinical research which include time constraints owing to clinical/workplace duties, lack of statistical knowledge and research training, and lack of supervisors (20-22).

The survey of 4th year medical students asked what elements of a clinical academic training programme would be of greatest importance: they agreed that protected time within the working week, a named supervisor and access to training on basic and advanced research skills would be important or very important (19).

Collating the advice, evidence from the literature and feedback from students, the Academic Internship Track programme was designed to incorporate: protected time within the working week, usually occurring during one three-month rotation during which time is divided equally between clinical and academic work; a named academic supervisor; funding in the form of a €2,000 bursary to cover research and travel costs for the year; and study days and seminars to provide training in research, education and leadership skills.

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Process Evaluation

Uptake of AIT posts

Now in its fourth year, the AIT has seen 72 academic interns complete the programme with a current cohort of 24 due to complete training in July 2021. Similar numbers of candidates apply to the academic track annually, with initial applications outnumbering posts by about 16 to 1. There has been 100% uptake of posts each year, and 0% attrition from the programme.

Feedback from exiting academic interns

An anonymous online survey was distributed to the exiting interns of the 2017/18 and 2018/19 cohort (n=48). Eleven interns out of 24 responded in 2018 and 22/24 in 2019 giving an overall response rate of 69% (n=33).

In the first year of the programme 92% indicated that their experience of the clinical component of the year was good or excellent, and 83% indicated that the quality of experience of the academic part of the year was good or excellent. Of that first cohort, 42% had also applied for or considered applying for the UKAFP prior to accepting the post on the AIT. Fifty-three per cent held another third level qualification.

Ninety-two per cent of respondents perceived a benefit from participating in the AIT. As well as learning new skills, producing papers for publication and learning good time-management skills, participants appreciated the opportunity to work closely with mentors and get a sense of life as a clinical academic. Several participants mentioned that they found the overall experience to be very fulfilling. Eighty-three per cent would recommend the academic track to a friend. The 2018/19 survey showed very similar results.

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Product Evaluation

Early scientific outputs

An individual search on PubMed for each of the 72 AIT participants was conducted between 10th and 20th June 2020. Only original, peer-reviewed research papers, essays or review articles published </=5 years prior to graduation and any time post-graduation were included, with letters, commentary, abstracts, conference proceedings and editorials excluded.

One hundred and thirty-five articles which named participants in the AIT from 2017-2019 (n=72) as authors were identified. Of these, 50 were published in the five years prior to graduation and 85 either during or at 1-2 years post completion of the AIT (Fig 1).

Forty-one of the 72 former academic interns (56.94%) have achieved publication of a research paper/review article in a peer reviewed journal to date; a substantial number of publications were open access.

The quality of publications based on journal impact factor is also an indicator for success of the programme (Table 2).

Journal	Number of Publications	Impact Factor
British Journal of Anaesthesia	2	6.199
Free Radical Biology & Medicine	1	6.17
The American Journal of Sports Medicine	6	6.057
JCI Insight	1	6.014
Annals of Medicine	1	5.435

Table 2: Top five publications by journal impact factor (published after start of AIT)

Academic interns develop their own project proposal and identify an area of research that is of interest to them. On reviewing the project titles and primary supervisors' occupation, we found a total of 28 specialties represented, with oncology, anaesthetics, obstetrics and gynaecology, orthopaedic surgery and paediatrics being the most represented specialties (Fig 2). Analysis suggest interns publish predominantly in the specialty represented by their

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academic track projects: 64 of the 85 publications attributed to academic interns during and after the AIT are within the same field as their academic track project.

Feedback from exiting interns indicated outputs other than publication or presentation, these included outreach activities, gaining additional qualifications, achieving awards and accolades for their academic work, gaining teaching experience and learning new research skills.

Career Trajectory and Retention in Ireland

In 2017/18 on formal reporting, 10/12 participants confirmed they were remaining in Ireland for their first SHO year, with two planning to travel abroad. However, informally 22/24 or (92%) planned to stay in Ireland and subsequently did. In 2018 /19 none of the respondents reported an intention to apply for a training scheme abroad and just 10% planned to take up non-training scheme work abroad. Of the remainder, most (42.6%) planned to take up a training post in Ireland; others planned to join a GP scheme, take a stand-alone post, or undertake further study.

The first AIT cohort provided open-ended responses regarding 5-year career intentions, most reported that they were aiming for higher specialist training schemes without indicating a specific location; only 1 indicated a preference to train abroad. By the second cohort, 66.7% indicated an aspiration for HST in Ireland and the ICAT programme. Other preferences such as non-integrated research/academia are shown (Fig 3).

With the programme just in its fourth year, it is too early to determine its effects on career trajectory, however this will be monitored as a key outcome going forward.

Discussion

Evaluation of the first four years of the Academic Internship Track in Ireland has shown three key findings: a demand to develop key research skills by early career junior doctors, the

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capacity to translate these skills and contribute to a chosen field of study and that satisfying these needs may contribute to the retention of this valuable expertise.

The survey of undergraduate students indicated a significant interest in the programme, and this has been borne out in the recruitment process. Similar numbers apply for academic internship annually, with applications received far exceeding the places available. In four years, we have never had a post unfilled, and no-one has left the programme early. The level of interest in the programme has been sustained, even during the uncertainties of the COVID pandemic, indicating the perceived quality of the programme and its benefit to one's career. It is likely that there is great scope for expansion of the programme.

Even at the earliest career stage, participants in a combined clinical academic training programme have the potential to contribute substantially to their field of interest. The majority of participants in the first three years of the academic track have already contributed to publications as named authors and it is anticipated that this number will rise significantly given the lengthy process of manuscript preparation and publication. Publications either during or after the academic track outnumber publications in the five years before the academic track (when participants would have been undergraduate medical students). A substantial number of publications (38.8%) were open access, and many were published in high calibre journals.

Data from a similar programme run in the UK, the UK Academic Foundation Programme indicates that on exiting the two-year programme, 33% of participants have submitted or prepared papers for publication (23). While it is not a direct comparison, 57% of AIT participants having achieved publication at 0,1 and 2 years post-academic track would suggest that they are prolific compared to their peers.

Medical doctors at all levels, clinical academics or not, are thought to publish at a rate of 0.47 papers per year. Publication rate is much lower at the earliest career stages (24). Taking one

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year of the academic track, 2018/19 as an example, the 24 participants succeeded in publishing at an average rate of 1.27 papers each per year in the two years since their academic internship start date, indicating a rate of publication over twice that of the average doctor, despite being at the earliest career stage.

There are some limitations of the database review: it was conducted by one researcher only, and only one database (PubMed) was searched. Therefore, it is possible that papers which should have been attributed to participants in the programme were missed, whereas others may have been misattributed.

It is possible that creating such opportunities at an early career stage can help retain doctors in Ireland in both the immediate and longer term. Participants in the AIT tend to remain in Ireland after completion of the programme; in contrast, almost two thirds of interns who have completed the standard intern-training programme plan to emigrate abroad at least for a year (25). Ireland has ongoing problems recruiting and retaining health personnel, and despite producing the most doctors among Organisation for Economic Co-operation and Development (OECD) countries, it remains below average for practicing doctors per 1,000 population. A national doctor retention strategy has been in place since 2015 but has enjoyed limited success (26). Factors influencing the higher retention rate may include intrinsic factors such as a focussed career plan. Alternatively, academic interns having fostered relationships with other researchers may wish to continue to build their networks, emphasising the importance of mentors to early career clinical academics.

A different perspective might suggest that the academic track creates greater job satisfaction and hence greater retention. Burnout is high among Irish junior doctors, and that this contributes to the decision to emigrate (27). A highly demanding job combined with low or scarce resources can negatively impact on employee wellbeing, whereas a highly demanding job with high levels of support and resources can have a positive impact (28). Exiting academic

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interns express high levels of satisfaction with the programme. It's possible provision of additional resources to achieve their academic goals (in the form of time, funding and mentorship) enhance the academic interns' experiences of intern year, mitigate against burnout, and encourage their retention within the Irish healthcare system, however further research would be required to investigate this hypothesis. It is likely multiple factors are at play.

The AIT is not without its challenges: a small number of posts nationally means many excellent candidates miss out on posts each year, limited funding for study days and other events can impact on their delivery, and the arrival of COVID-19 has necessitated a move to online educational sessions as well as a potential increase in conflict between clinical responsibilities and academic goals. Despite these challenges, it remains a training programme that is highly regarded among students and interns and is perceived to be of value to one's career. While it is early days yet in terms of career trajectory, it is hoped that this positive early experience will provide these talented graduates with a stepping-stone towards further clinical academic training, launching their careers as clinical academics and helping to build and sustain this workforce for the future.

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Abbreviations

AIT	Academic Internship Track
HSE	Health Service Executive
HST	Higher Specialist Training
HRB	Health Research Board
ICAT	Irish Clinical Academic Training
INE	Intern Network Executive
IMC	Irish Medical Council
IMSC	Irish Medical Schools Council
NDTP	National Doctors Training and Planning
NIH	National Institute for Health
SFI	Science Foundation Ireland
UKAFP	UK Academic Foundation Programme

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Footnotes

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Competing interests statement

EB is employed by Trinity College and oversees the implementation of the Academic Internship Track in the Dublin South-East Intern Network.

MH is employed by Trinity College Dublin and is the Director for Internship for the Dublin South East Intern Network.

Statement on ethical approval

Ethics approval was obtained for any part of the review requiring ethics. Ethics approval was not required for the overall programme evaluation.

Note on authorship

The first author (EB) made substantial contributions to the conception and design of the study, data acquisition, interpretation and analysis. She developed the exit survey and searched the literature for papers attributable to former participants in the AIT. She drafted and revised the manuscript and approved it for final submission. The second author (MH) made substantial contributions to the conception and design of the study, data interpretation and analysis. She

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reviewed the initial drafts of the manuscript and approved the final draft for submission. Both authors have full access to all the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Data sharing statement

No additional data are available

Patient and Public Involvement statement

It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research.

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Figure 1: Peer-reviewed publications of the first three cohorts of academic interns (n=72)

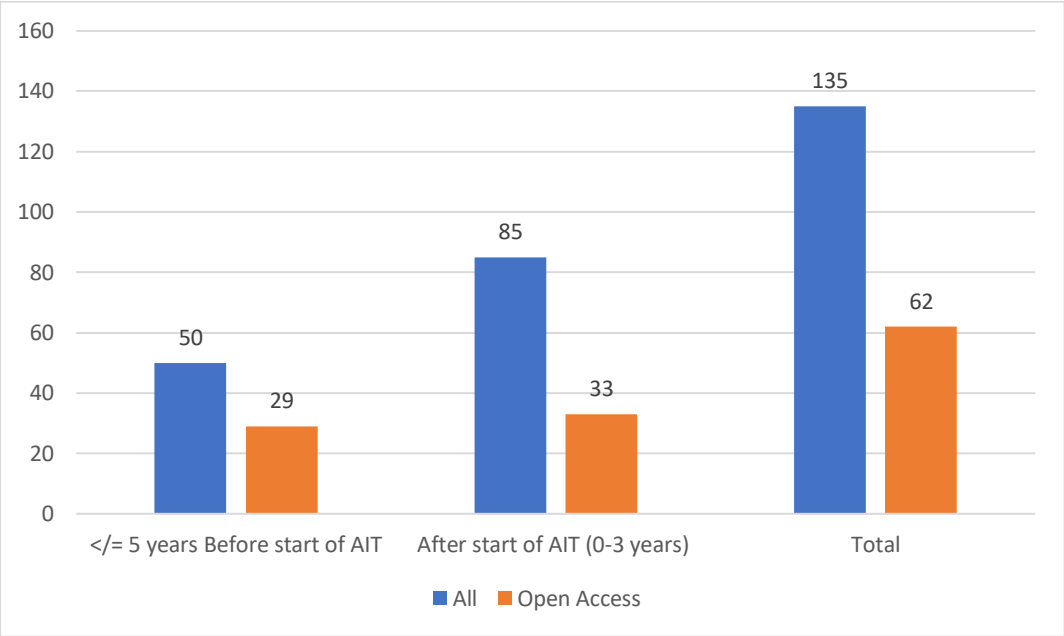

Fig 1: Peer-reviewed publications of first three cohorts of academic interns (n=72)

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Figure 2: Specialties represented by academic track interns (n=72)

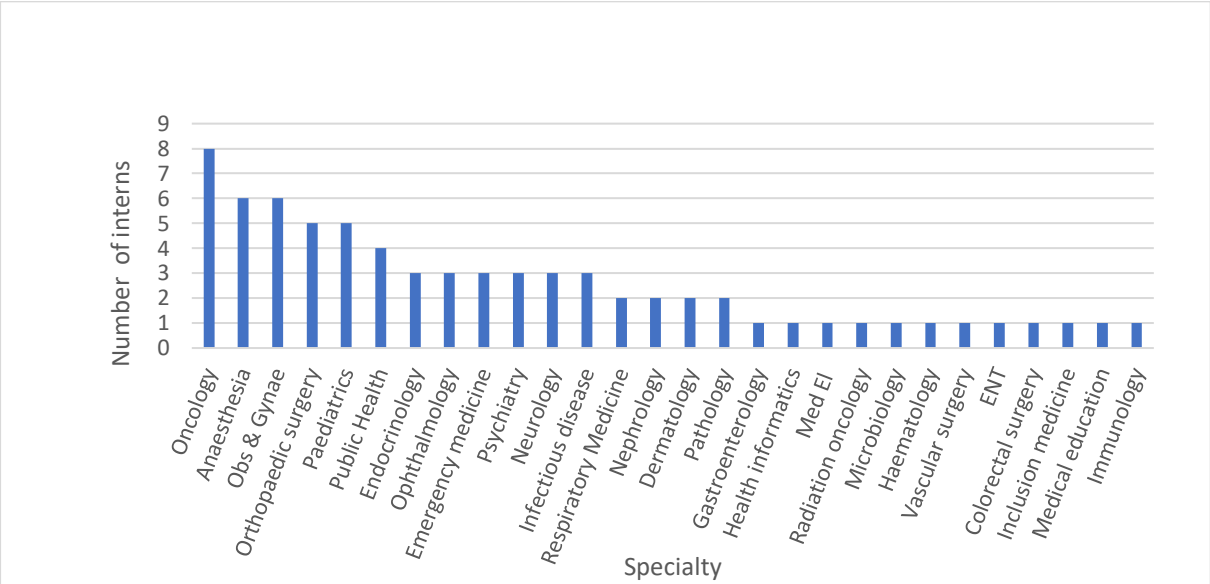

Fig 2: Specialties represented by academic interns (n=72)

*There is some overlap between clinical specialty and medical education or healthcare leadership and management projects. Where >1 field was involved, the project was attributed to the specialty of the principle supervisor.

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Figure 3: Longer-term career plans

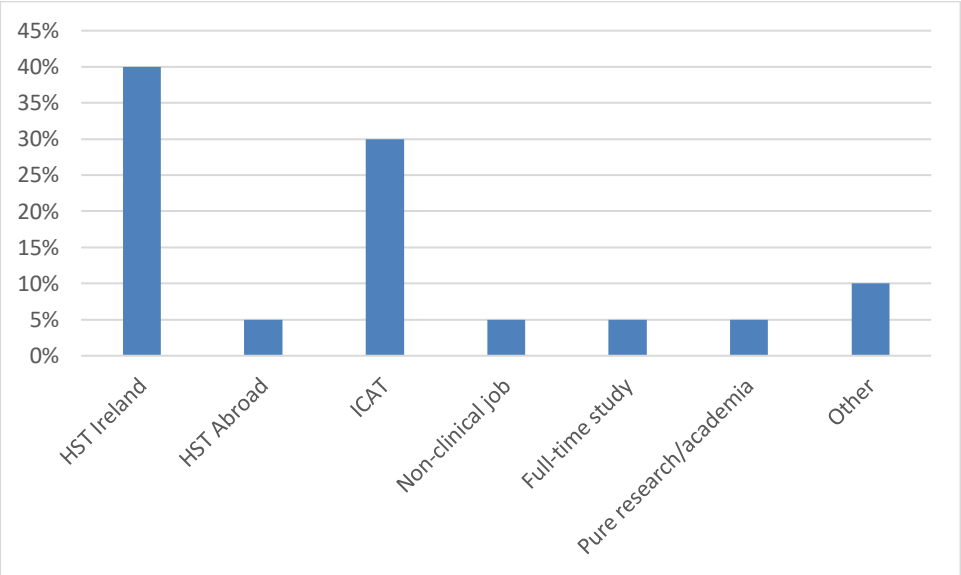

Fig 3: Longer term career plans (HST= Higher Specialist Training, ICAT = Irish Clinical Academic Training Programme)

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Evaluation of an early career clinical academic training programme using the CIPP model

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Abstract

Objectives

This study describes the successful implementation and outputs of a combined clinical academic training programme for doctors in their first postgraduate year in Ireland, the Academic Internship Track (AIT).

Design

The AIT was evaluated using the CIPP model (Context, Input, Process and Product). Literature reviews, meetings with key stakeholders, reviews of similar established programmes overseas, a survey of undergraduate medical students, exit survey, scientific outputs and career trajectory monitoring were all implemented in the programme evaluation.

Setting

The AIT represents collaboration amongst all six intern training networks in Ireland.

Results

Key stakeholders indicated support and significant interest in establishing the AIT. The input evaluation informed programme design which incorporates protected time to carry out a research project, a named supervisor, a bursary, and access to dedicated study days. Since the programme's launch in 2017, there has been 100% uptake of posts and 0% attrition. Exiting participants indicate high levels of satisfaction with the programme, with 92% reported having benefitted from participation. Over 90% intend remaining in Ireland in both the immediate and longer terms. Fifty-seven per cent of participants in the first three years of the

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programme had succeeded in publishing a research article or review paper in a peer-reviewed journal.

Conclusions

Now in its fourth year, AIT remains a highly sought-after programme and is perceived to be beneficial to one's career. Participants in the programme have contributed significantly to their field of interest despite being in the earliest career stages. The programme has the potential to help retain medical talent in Ireland.

Article Summary

Strengths and Limitations of the study

- This is the first study to describe the successful implementation of a combined clinical-academic training programme for junior doctors in Ireland in their first postgraduate year
- The CIPP evaluation model was a useful and appropriate method to evaluate the training programme
- Equitable stakeholder input was key to the programme's successful evaluation and implementation
- The search for research outputs was conducted by one researcher using one database (PubMed)
- It was not possible to compare the scientific outputs of participants in the programme with a control group

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Keywords

Graduate medical education, academic training, training programmes, junior physicians, internship and residency, programme evaluation

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Background

Clinical academics (or clinician scientists) occupy a crucial role in healthcare systems, bridging a gap between research and patient care. Through their combined clinical and academic practice, they have the potential to identify research questions relevant to patient care and to translate research from bench to bedside (1-4). A strong research culture is associated with improved patient outcomes (5). Despite the importance of the role, there are concerns that it is under threat: in the US, the clinical academic workforce is ageing, with the average age at which a first independent NIH grant is awarded approaching 43. A leaky pipeline compounds the problem: a third of young investigators with mentored NIH grants never apply for independent R01 grants, and many more are lost at later career stages (6). Similar problems exist in Australia and New Zealand, where the ability to recruit and retain clinical academics is potentially outstripped by an increase in demand for undergraduate medical education (7). Action is required to continue to attract talented graduates to careers in clinical academic practice (8).

International literature suggests that those who engage with research early in their clinical careers will continue to do so. Graduates of the UK's Academic Foundation Programme (UKAFP) are over forty times more likely to progress to specialty academic training compared to graduates of the standard foundation programme (9.5% vs 0.2%)(9). A U.S review of 25 years of NIH-sponsored Medical Student Research Fellowship programmes (MSRFs) found that up to half of former participants (n=1,000) considered themselves to be working in academic medicine, and the vast majority had conducted additional research after their medical student experience (10). Publication during residency is recognised as a determinant of the capacity to publish in a future career (11, 12). In Psychiatry for example, the decision to pursue a research career is already well established by residency and very few who have less than the highest

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level of interest in research by that time eventually enrol in research career tracks. Together these indicate the crucial importance of early influences. (13).

Ireland's Context

Opportunities for clinical research in Ireland are increasing. There has been considerable investment in clinical research infrastructure over the last decade. There now exists seven Clinical Research Facilities nationwide, multiple Clinical Trial Networks and Science Foundation Ireland (SFI)-funded research institutes across the University and healthcare sector. Ireland has retained its reputation and position in the top 10 most innovative countries in Europe (14) . The Irish government has pledged to build a strong research and innovation base in Ireland with the aim of becoming a Global Innovation Leader (15). This has prompted expansion of the number of Health Research Board (HRB) funded clinician scientist awards, as a result academic capacity has increased in cancer, immunology, personalised medicine, neuroscience, ageing, bioinformatics and medical devices (16).

If opportunities for clinical research are increasing, clinical training and education must provide a workforce that is able to avail of these opportunities. Prior to 2017, there was no combined clinical and academic training programme in Ireland for junior doctors at any level. In July 2017, the academic internship track was launched, it provides a one- year combined clinical and academic training programme to junior doctors in their first postgraduate year (interns). Currently in its fourth year, we offer an evaluation of the programme's development and success.

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Programme Evaluation

CIPP Model of Evaluation

The CIPP model includes formative and summative assessments with an emphasis on not only proving that a programme works, but also seeking areas for improvement. Key to the process is equity, and engagement is sought with all stakeholders in a fair and balanced manner. CIPP stands for **C**ontext, **I**nput, **P**rocess and **P**roduct evaluation (17), (18) (Table 1).

CIPP Model of Evaluation		
Type of Evaluation	**Questions asked**	**Methods**
Context	What educational need is being met? What goals should be pursued to meet the needs?	Literature review Meetings with key stakeholders Online survey of undergraduate medical students
Input	What are the most promising approaches to meeting the educational need? What might some of the barriers to successful implementation of the programme be?	Literature review Curriculum review of similar programmes Meeting with Director of UKAFP, an established programme Online survey of undergraduate medical students
Process	To what extent was the programme carried out as planned?	Review of recruitment to process: post uptake and attrition Survey of exiting academic interns seeking feedback on programme
Product	To what extent did the programme effectively address the original objectives?	Review of scientific outputs of previous participants in the programme Feedback from exiting interns on career intentions Monitoring of career trajectory and retention in Ireland

Table 1: Academic Internship Track Evaluation Model (adapted from Stufflebeam et al, (17))

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Context Evaluation

A context evaluation is similar but more comprehensive than a needs assessment as it also incorporates an assessment of problems, assets and opportunities (17). A literature review identified a need to provide training pathways for clinical academics to build and sustain the workforce. During the early stages of programme development, meetings were held with three groups who were key stakeholders: the Intern Network Executive (INE), the body responsible for delivering intern training and assessment; the Irish Medical Council's Education Committee who oversee intern education and training, and the Health Service Executive's National Doctors Training and Planning (NDTP), the body responsible for ensuring the Irish Health Service is provided with the appropriate number of medical specialists. All stakeholders were in support of the development of an academic track for internship whose aims are to:

- provide opportunities for doctors at the beginning of their careers to continue or develop research, education and healthcare leadership and management skills
- promote scientific discovery and sustained academic development within the context of contemporary clinical practice
- and retain medical talent in Ireland

Funding was subsequently provided for 24 posts nationally, representing ~3% of all intern posts.

Medical students may also be considered key stakeholders, so an anonymous online survey was distributed to medical students in their fourth (penultimate) year of training; respondents indicated a high level of interest in a potential academic internship (19).

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Input Evaluation

A literature review was undertaken to investigate approaches to combined clinical academic training programmes for junior doctors at the earliest career stages. The most similar programme to the Academic Intern Track in Ireland is the UKAFP (UK Academic Foundation Programme). The programme design and curriculum were examined, and a meeting was held with the Programme Director who provided further information and advice on programme design and implementation.

The literature review also revealed barriers to junior doctors' participation in clinical research which include time constraints owing to clinical/workplace duties, lack of statistical knowledge and research training, and lack of supervisors (20-22).

The survey of 4th year medical students asked what elements of a clinical academic training programme would be of greatest importance: they agreed that protected time within the working week, a named supervisor and access to training on basic and advanced research skills would be important or very important (19).

Collating the advice, evidence from the literature and feedback from students, the Academic Internship Track programme was designed to incorporate: protected time within the working week, usually occurring during one three-month rotation during which time is divided equally between clinical and academic work; a named academic supervisor; funding in the form of a €2,000 bursary to cover research and travel costs for the year; and study days and seminars to provide training in research, education and leadership skills.

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Process Evaluation

Uptake of AIT posts

Now in its fourth year, the AIT has seen 72 academic interns complete the programme with a current cohort of 24 due to complete training in July 2021. Similar numbers of candidates apply to the academic track annually, with initial applications outnumbering posts by about 16 to 1. There has been 100% uptake of posts each year, and 0% attrition from the programme.

Feedback from exiting academic interns

An anonymous online survey was distributed to the exiting interns of the 2017/18 and 2018/19 cohort (n=48). Twelve interns out of 24 responded in 2018 and 21/24 in 2019 giving an overall response rate of 69% (n=33).

In the first year of the programme 92% indicated that their experience of the clinical component of the year was good or excellent, and 83% indicated that the quality of experience of the academic part of the year was good or excellent. Of that first cohort, 42% had also applied for or considered applying for the UKAFP prior to accepting the post on the AIT. Fifty-three per cent held another third level qualification.

Ninety-two per cent of respondents perceived a benefit from participating in the AIT. As well as learning new skills, producing papers for publication and learning good time-management skills, participants appreciated the opportunity to work closely with mentors and get a sense of life as a clinical academic. Several participants mentioned that they found the overall experience to be very fulfilling. Eighty-three per cent would recommend the academic track to a friend. The 2018/19 survey showed very similar results.

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Product Evaluation

Early scientific outputs

An individual search on PubMed for each of the 72 AIT participants was conducted between 10th and 20th June 2020. Only original, peer-reviewed research papers, essays or review articles published </=5 years prior to graduation and any time post-graduation were included, with letters, commentary, abstracts, conference proceedings and editorials excluded.

One hundred and thirty-five articles which named participants in the AIT from 2017-2019 (n=72) as authors were identified. Of these, 50 were published in the five years prior to graduation and 85 either during or at 1-2 years post completion of the AIT (Fig 1).

Forty-one of the 72 former academic interns (56.94%) have achieved publication of a research paper/review article in a peer reviewed journal to date; a substantial number of publications were open access. Removing one very prolific individual from the cohort still indicates a high level of publication, with 94 total publications, 33 prior to the academic track and 61 during or after, with a range of 0-8 publications. In this group, there was an average of 0.46 publications per intern prior to the academic track and 0.86 publications during or after the academic track, however it must be noted that the duration of time since commencement of the academic track and hence the amount of data available varied for each cohort.

The quality of publications based on journal impact factor is also an indicator for success of the programme (Table 2).

Journal	Number of Publications	Impact Factor
British Journal of Anaesthesia	2	6.199
Free Radical Biology & Medicine	1	6.17
The American Journal of Sports Medicine	6	6.057
JCI Insight	1	6.014
Annals of Medicine	1	5.435

Table 2: Top five publications by journal impact factor (published after start of AIT)

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Academic interns develop their own project proposal and identify an area of research that is of interest to them. On reviewing the project titles and primary supervisors' occupation, we found a total of 28 specialties represented, with oncology, anaesthetics, obstetrics and gynaecology, orthopaedic surgery and paediatrics being the most represented specialties (Fig 2). Analysis suggests interns publish predominantly in the specialty represented by their academic track projects: 64 of the 85 publications attributed to academic interns during and after the AIT are within the same field as their academic track project.

Feedback from exiting interns indicated outputs other than publication or presentation, these included outreach activities, gaining additional qualifications, achieving awards and accolades for their academic work, gaining teaching experience and learning new research skills.

Career Trajectory and Retention in Ireland

In 2017/18 on formal reporting, 10/12 participants confirmed they were remaining in Ireland for their first SHO year, with two planning to travel abroad. However, informally 22/24 or (92%) planned to stay in Ireland and subsequently did. In 2018 /19 none of the respondents reported an intention to apply for a training scheme abroad and just 10% planned to take up non-training scheme work abroad. Of the remainder, most (42.6%) planned to take up a training post in Ireland; others planned to join a GP scheme, take a stand-alone post, or undertake further study.

The first AIT cohort provided open-ended responses regarding 5-year career intentions, most reported that they were aiming for higher specialist training schemes without indicating a specific location; only 1 indicated a preference to train abroad. By the second cohort, 66.7% indicated an aspiration for HST in Ireland and the ICAT programme. Other preferences such as non-integrated research/academia are shown (Fig 3).

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With the programme just in its fourth year, it is too early to determine its effects on career trajectory, however this will be monitored as a key outcome going forward.

Discussion

Evaluation of the first four years of the Academic Internship Track in Ireland has shown three key findings: a demand to develop key research skills by early career junior doctors, the capacity to translate these skills and contribute to a chosen field of study, and that satisfying these needs may contribute to the retention of this valuable expertise.

The survey of undergraduate students indicated a significant interest in the programme, and this has been borne out in the recruitment process. Similar numbers apply for academic internship annually, with applications received far exceeding the places available. In four years, we have never had a post unfilled, and no-one has left the programme early. The level of interest in the programme has been sustained, even during the uncertainties of the COVID pandemic, indicating the perceived quality of the programme and its benefit to one's career. It is likely that there is great scope for expansion of the programme.

Even at the earliest career stage, participants in a combined clinical academic training programme have the potential to contribute substantially to their field of interest. The majority of participants in the first three years of the academic track have already contributed to publications as named authors and it is anticipated that this number will rise significantly given the lengthy process of manuscript preparation and publication. Publications either during or after the academic track outnumber publications in the five years before the academic track (when participants would have been undergraduate medical students). A substantial number of publications (38.8%) were open access, and many were published in high calibre journals.

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Data from a similar programme run in the UK, the UK Academic Foundation Programme indicates that on exiting the two-year programme, 33% of participants have submitted or prepared papers for publication (23). While it is not a direct comparison, 57% of AIT participants having achieved publication at 0,1 and 2 years post-academic track would suggest that they are prolific compared to their peers.

Medical doctors at all levels, clinical academics or not, are thought to publish at a rate of 0.47 papers per year. Publication rate is much lower at the earliest career stages (24). Taking one year of the academic track, 2018/19 as an example, the 24 participants succeeded in publishing at an average rate of 1.27 papers each per year in the two years since their academic internship start date, indicating a rate of publication over twice that of the average doctor, despite being at the earliest career stage.

There are some limitations of the database review: it was conducted by one researcher only, and only one database (PubMed) was searched. Therefore, it is possible that papers which should have been attributed to participants in the programme were missed, whereas others may have been misattributed. Further, it was not possible to compare the research outputs of participants with a control group, e.g. a group of interns who did not participate in the academic track, due to a lack of other identifying factors such as field of interest or supervisor.

It is possible that creating such opportunities at an early career stage can help retain doctors in Ireland in both the immediate and longer term. Participants in the AIT tend to remain in Ireland after completion of the programme; in contrast, almost two thirds of interns who have completed the standard intern-training programme plan to emigrate abroad at least for a year (25). Ireland has ongoing problems recruiting and retaining health personnel, and despite producing the most doctors among Organisation for Economic Co-operation and Development (OECD) countries, it remains below average for practicing doctors per 1,000 population. A national doctor retention strategy has been in place since 2015 but has enjoyed limited

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success (26). Factors influencing the higher retention rate may include intrinsic factors such as a focussed career plan. Alternatively, academic interns having fostered relationships with other researchers may wish to continue to build their networks, emphasising the importance of mentors to early career clinical academics.

A different perspective might suggest that the academic track creates greater job satisfaction and hence greater retention. Burnout is high among Irish junior doctors, and that this contributes to the decision to emigrate (27). A highly demanding job combined with low or scarce resources can negatively impact on employee wellbeing, whereas a highly demanding job with high levels of support and resources can have a positive impact (28). Exiting academic interns express high levels of satisfaction with the programme. It's possible provision of additional resources to achieve their academic goals (in the form of time, funding and mentorship) enhance the academic interns' experiences of intern year, mitigate against burnout, and encourage their retention within the Irish healthcare system, however further research would be required to investigate this hypothesis. It is likely multiple factors are at play.

The AIT is not without its challenges: a small number of posts nationally means many excellent candidates miss out on posts each year, limited funding for study days and other events can impact on their delivery, and the arrival of COVID-19 has necessitated a move to online educational sessions as well as a potential increase in conflict between clinical responsibilities and academic goals. Despite these challenges, it remains a training programme that is highly regarded among students and interns and is perceived to be of value to one's career. While it is early days yet in terms of career trajectory, it is hoped that this positive early experience will provide these talented graduates with a stepping-stone towards further clinical academic training, launching their careers as clinical academics and helping to build and sustain this workforce for the future.

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Abbreviations

AIT	Academic Internship Track
HSE	Health Service Executive
HST	Higher Specialist Training
HRB	Health Research Board
ICAT	Irish Clinical Academic Training
INE	Intern Network Executive
IMC	Irish Medical Council
IMSC	Irish Medical Schools Council
NDTP	National Doctors Training and Planning
NIH	National Institute for Health
SFI	Science Foundation Ireland
UKAFP	UK Academic Foundation Programme

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Competing interests statement

EB is employed by Trinity College and oversees the implementation of the Academic Internship Track in the Dublin South-East Intern Network.

MH is employed by Trinity College Dublin and is the Director for Internship for the Dublin South East Intern Network.

Statement on ethical approval

Ethics approval was obtained for any part of the review requiring ethics. Ethics approval was not required for the overall programme evaluation.

Note on authorship

The first author (EB) made substantial contributions to the conception and design of the study, data acquisition, interpretation and analysis. She developed the exit survey and searched the literature for papers attributable to former participants in the AIT. She drafted and revised the manuscript and approved it for final submission. The second author (MH) made substantial contributions to the conception and design of the study, data interpretation and analysis. She

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reviewed the initial drafts of the manuscript and approved the final draft for submission. Both authors have full access to all the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Data sharing statement

No additional data are available

Patient and Public Involvement statement

It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research.

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Figure 1: Peer-reviewed publications of the first three cohorts of academic interns (n=72)

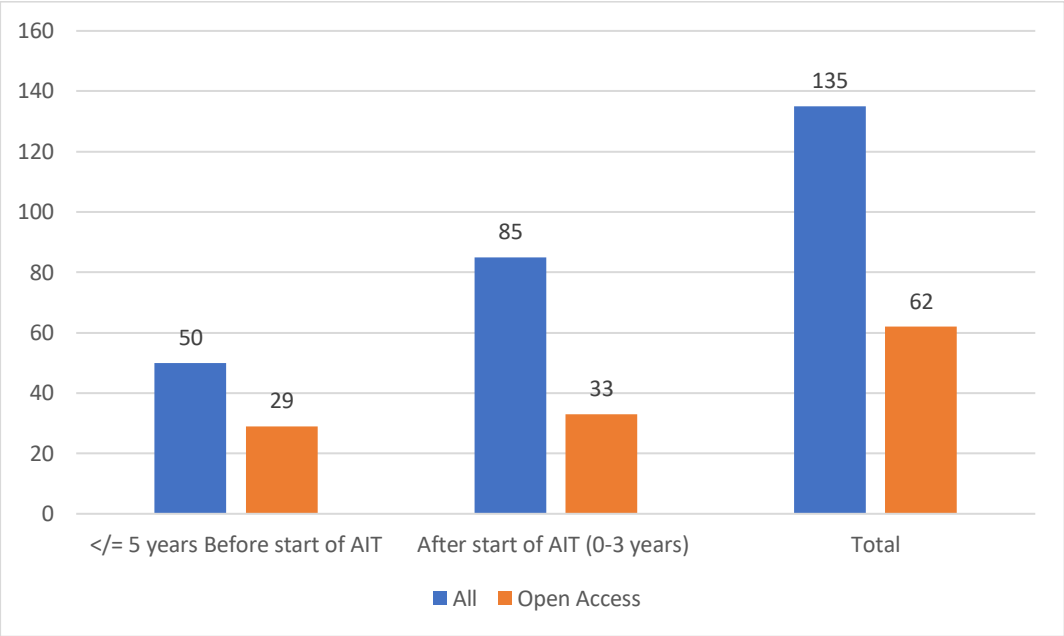

Fig 1: Peer-reviewed publications of first three cohorts of academic interns (n=72)

review only

Figure 2: Specialties represented by academic track interns (n=72)

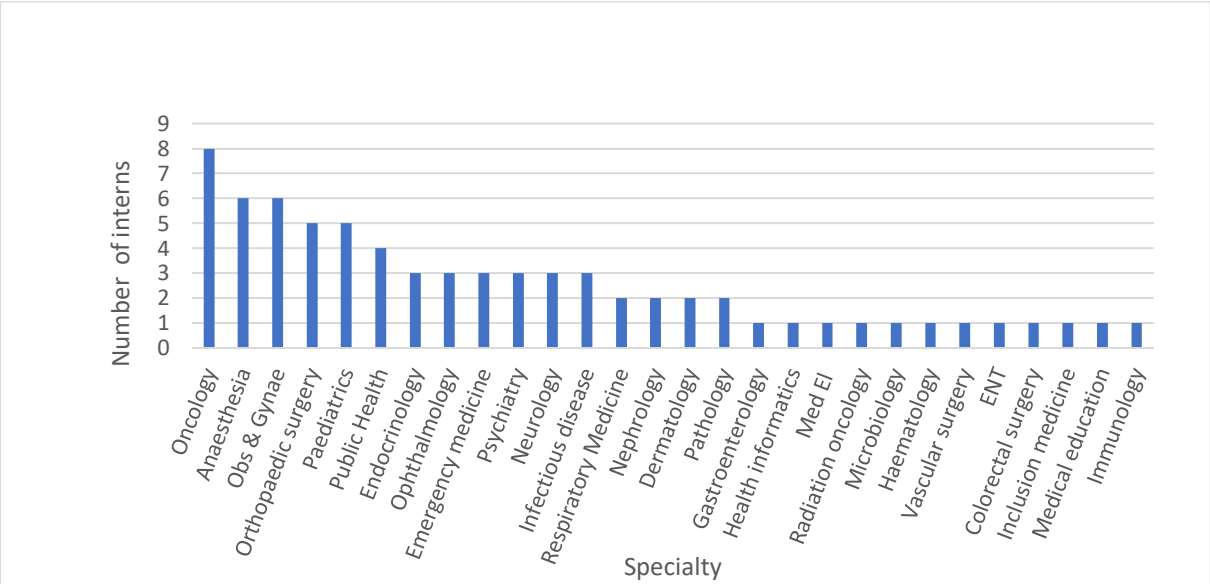

Fig 2: Specialties represented by academic interns (n=72)

*There is some overlap between clinical specialty and medical education or healthcare leadership and management projects. Where >1 field was involved, the project was attributed to the specialty of the principle supervisor.

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Figure 3: Longer-term career plans

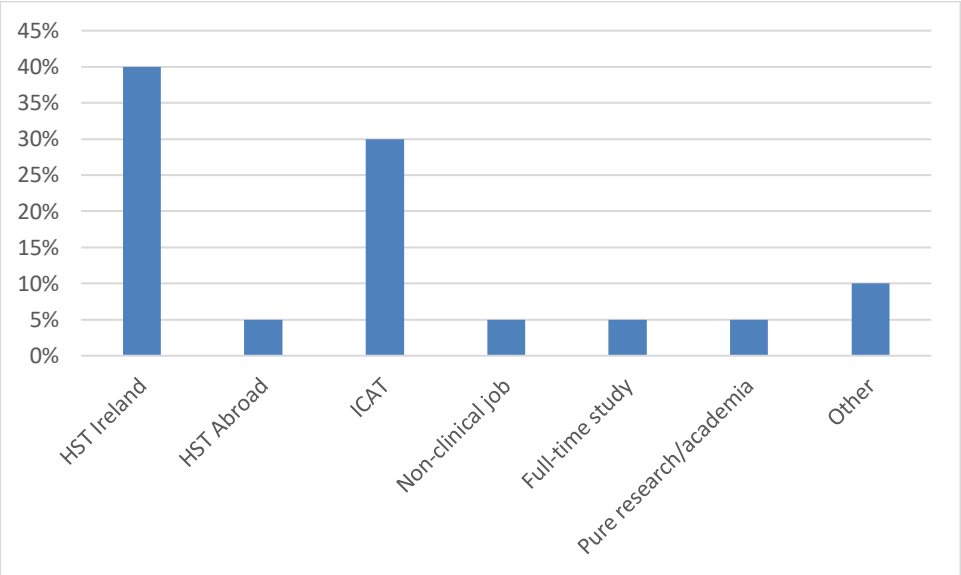

Fig 3: Longer term career plans (HST= Higher Specialist Training, ICAT = Irish Clinical Academic Training Programme)

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Exit survey questions 2018

1. Do you identify as:

Male

Female

Prefer not to say

2. Had you any third level qualifications in addition to your medical degree prior to commencing the academic track for internship?

No

Yes, another undergraduate degree

Yes, a Master's degree

Yes, a PhD

Yes, other

Other (please specify)

3. Thinking back to your final year, did you apply for another intern training programme overseas (e.g. UKFP, UKAFP), or were you seriously considering applying for an overseas training programme?

Yes

No

Prefer not to say

Comments?

4. When did you do your academic rotation?

First rotation

Second rotation

Third rotation

Fourth rotation

5. How would you rate the quality of experience for the CLINICAL part of your year?

Excellent

Good

Neutral

Fair

Poor

Any comments?

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6. How would you rate the quality of experience for the ACADEMIC part of your year?

Excellent

Good

Neutral

Fair

Poor

Any comments?

7. Do you feel you personally benefitted from participating in the academic track? Please outline below.

8. Please indicate your key achievements during academic internship e.g. publication, presentation, teaching, skills gained.

9. Is there anything else you would like to have achieved during your academic internship? Please outline below.

10. Is there anything you would like to see change for future academic interns?

11. Would you recommend the academic track for internship to a friend?

Yes, definitely

Yes, probably

Maybe

Probably not

Definitely not

Any comments?

12. How useful do you think the academic track will be for your future career?

Extremely useful

Very useful

Somewhat useful

Less useful

Not useful

Any comments?

13. What are your career plans for July?

14. Where do you see yourself in five years?

15. Any final comments or suggestions?

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Exit survey questions 2019

1. Please indicate when you did your academic rotation.

1st rotation

2nd rotation

3rd rotation

4th rotation

2. Please indicate any outputs you have achieved to date:

Oral presentation

Oral presentation pending

Poster presentation

Poster presentation pending

Research or other skills (please describe below)

Manuscript prepared for publication

Manuscript submitted for publication

Paper published

Award/accolade for academic achievement

Other (please specify)

3. What are your career plans for July?

BST Ireland

BST abroad

Non-scheme or locum SHO job in Ireland

Non-scheme or locum SHO job abroad

Further study

Non-clinical work

Other (please specify below)

4. Where do you see yourself in 5 years (ideal job)?

HST in Ireland

HST abroad

ICAT Scheme

Non-clinical job

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Full-time PhD/MD/further study

Pure clinical research/academia

Other (please specify below)

5. Do you feel you benefitted from participating in the academic track? Please outline below

6. Would you recommend the academic track to a friend?

Yes

No

Maybe

7. Is there anything you would like to change about the academic track for future years?

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