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Mainstreaming Genomics: Training Experience of Hospital Medical Officers at The Royal Melbourne Hospital

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This project was initiated and overseen by IW. AH was responsible for formatting the survey and writing the manuscript. LH electronically distributed the survey questions and collected the responses. AG oversaw the statistical analysis for the study. LF provided oversight of quantitative analysis. All authors have reviewed and approve of the manuscript.

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Abstract:
The rapid evolution and wide applicability of genomic testing means that medical practitioners outside the field are not appropriately skilled to understand the utility of genomics for their patients. Rotating junior doctors through genomic medicine provides them with the hands-on experience necessary to understand the complexities in this field. In this study, we analysed the training experience of 12 hospital medical officers who rotated through genomic medicine at the Royal Melbourne Hospital. Here we demonstrate that immersion in clinical genomics aids in mainstreaming genomics knowledge.

Key Words: Mainstreaming Genomic Medicine, HMO education, Genomic Medicine, Clinical Genetics, Genomics immersion

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Abstract:

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Introduction:

Genomic medicine is a highly specialized area of medicine. In the years since the Human Genome Project, multiple genes have been identified and linked to numerous monogenic conditions which span almost every subspecialty in medicine [1]. Genomic testing technology has rapidly evolved from single gene testing to multigene panels [2]. These developments, coupled with the knowledge base required to order and interpret genomic results, has meant that many medical specialists outside of the field of clinical genomics have not had an opportunity to understand the complexities and the practical utility of clinical genomics for their patients.

Background:

During their training years, hospital medical officers (HMO) gain exposure to various subspecialties. The skills learnt during these early periods of their training are

integral to their future medical practice. The quality and scope of training plays a major role in inculcating the required knowledge and interest in these young doctors highlighting the importance of an optimal training environment during this period [3]. Traditionally the only doctors-in-training with exposure to Genomic Medicine were those who chose to specialise in this area, post RACP examinations. Genomic medicine has expanded enormously in the last decade and now has significant clinical application to all medical sub-specialities. It is, therefore, important to integrate practical genomics knowledge into the wider medical community which may be accomplished in part by giving junior doctors some practical experience in this expanding field.

At the Royal Melbourne Hospital (RMH), we introduced HMOs under the physician training stream to a three-month rotation through Genomic Medicine, shared part-time with Clinical Immunology. Here, we present the results of a survey conducted to assess the perceived utility of practical Genomic Medicine training to HMOs.

Methods:

This study was approved through the Melbourne Health Human Research and Ethics Committee (reference number: QA2016099). A survey was developed consisting of 18 purpose-designed questions, 14 of which were open-text responses, to examine the experience of HMOs' rotation in the RMH Genomic Medicine department (Appendix 1). The survey questions also explored the impact of this rotation on their practice and within their overall training pathway.

An online link was sent to the HMOs using the survey software SurveyMonkey. Responses were received anonymously. Descriptive statistics were used to summarise the responses, with results reported as n (%). Inductive content analysis was used to identify ideas, categories, and themes within the open-text responses for each question.[4] A triangulated approach was undertaken for this analysis where three authors independently coded the data and consensus was then reached based on common themes for each question.

Results:

Of the 26 HMOs who rotated through the Genomic Medicine department at RMH between the years 2013 and 2019, invitations to participate were emailed to 24 HMOs as current contact details were unavailable for two participants. Twelve out of the 24 (50%) responded. Half the respondents (50%) were in the third year of their basic physician training or further, and another 41.6% were in the 2nd year of their physician training. Of the 4 rotations in a year, 5 respondents (41.6%) experienced Genomic Medicine as their second rotation, four (33.3%) as their first rotation and three (24.9%) as first or second rotation.

Ten of the twelve respondents indicated that learning basic clinical genetics was the goal they set for themselves prior to commencing the rotation and 11 of them felt they had achieved that goal at the end of the rotation (1 participant skipped this question). Whilst 7 (58%) felt that there was a structured learning pathway during their rotation, the other 5 (41.6%) did not feel there was a structured pathway. All the participants felt that they had experienced adequate supervision during their rotation. With regards to relevance and usefulness to their physician training, 10 of the 12 participants (83.3%) rated this rotation at 7 or above out of 10 (3 participants 10/10; 1 participant 9/10; 3 participants 8/10; three 7/10; one 6/10 and one 4/10). Amongst these, the participants who ranked it highest (10/10) felt that the rotation was particularly useful in the context of the physician training examinations; whereas the lowest ranking participant felt the rotation was too sub-specialised. Ten of the 12 participants (83.3%) expressed that there was enough balance between observation, clinical work and letter writing.

Of the 12 participants, 10 were able to apply the knowledge learnt in their time with Genomic Medicine in their subsequent rotations. All participants found that their approach to documenting family history improved after the rotation. Approximately 83% of the participants had never or only infrequently incorporated clinical genomics in their day-to-day medical practice prior to their rotation. After the rotation, 58.3% were able to incorporate genomics knowledge sometimes, and 33.3% most of the time in their clinical practice (see fig 1).

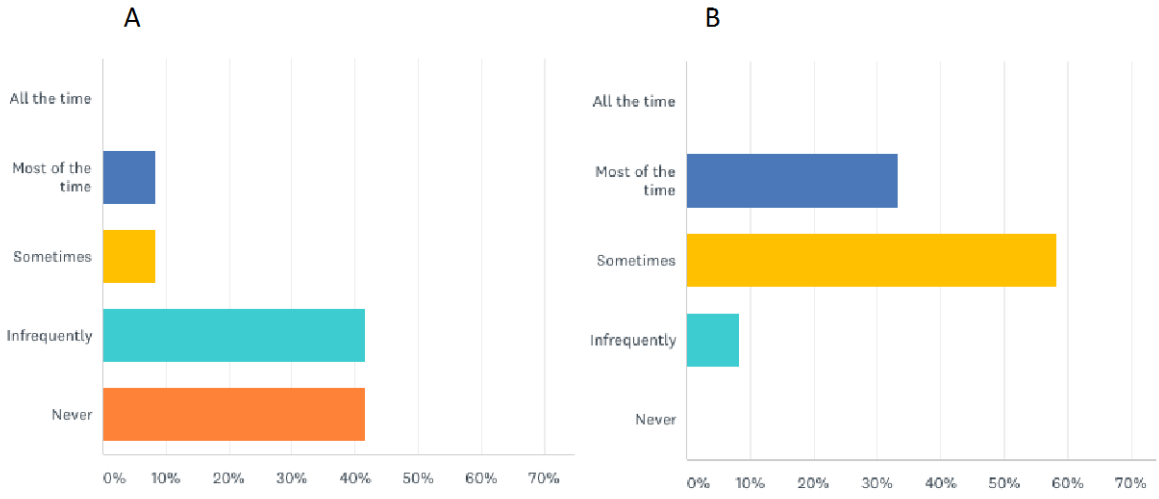

Fig 1: Incorporation of genomic knowledge prior to (A) and after (B) rotation. Wilcoxon paired sample signed rank test Z=2.803, p=0.005

All the participants were able to consider a genetic diagnosis in the differentials for their patients, since the rotation. Since the rotation, 50% of the participants said they would refer patients to Genomic Medicine somewhat more often and 41.6% said they would refer a lot more often, with 8.3% saying their referral pattern has not changed (see fig 2).

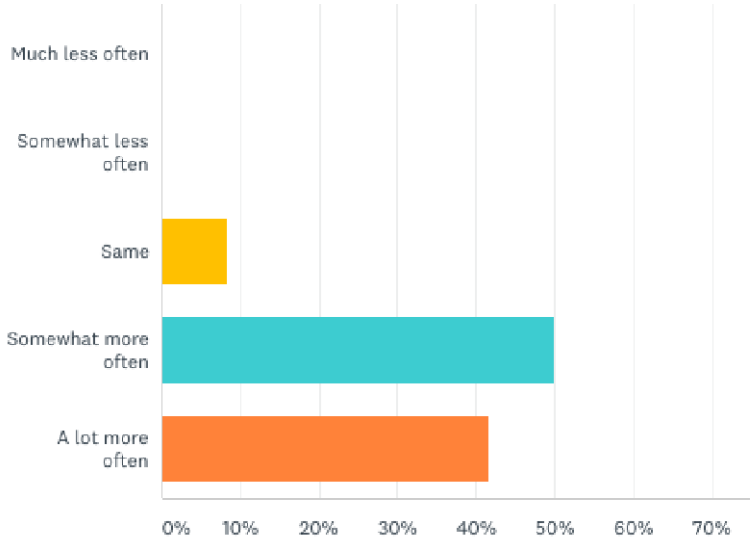

Fig 2. Considering a referral to Genomic Medicine since rotation. Wilcoxon paired sample signed rank test z=2.934, p=0.003

All of them were also able to share their genetics knowledge with others, predominantly other clinical staff, after their rotation. Most responders (8/12 i.e. 66.6% with 4 not answering this question) liked the supportive learning environment and the variety of learning experiences offered during the rotation. Some of the comments at the end of the survey indicated that residents would like their genomics rotation to be a full term (as opposed to sharing the rotation with another specialty as per current arrangement) to provide more exposure, although a few others were happy with the current part-time arrangement. There was also a suggestion to provide reading material prior to commencing the rotation. Many commented on how their communication skills improved subsequent to the rotation. Some residents also found writing letters to patients as being time-consuming, but accepted it as part of the model-of-care in Genomic Medicine.

Discussion and conclusions:

With the availability of direct-to-consumer testing as well as extensive media coverage about genomics, many members of the public have some awareness of genomic testing [5]. Many approach their doctors to gain further knowledge, especially if there is some relevance to their personal or family history [6]. However, the majority

of physicians are not exposed to clinical genomics training and feel unprepared to answer these questions [7, 8]. Without knowledge of when to consider requesting and how to interpret a genetic test, such investigations can create a risk of misdiagnosis. Furthermore, there is a risk of unnecessary medical procedures as well as reduced confidence for the patient in the medical system [9 10].

Once established in their medical practice, physicians may have competing interests with insufficient time to obtain hands-on experience in clinical genomics [10]. In conjunction with inclusion of genomics in the medical curriculum, the availability of genomics as a medical rotation for junior doctors aids in mainstreaming genomic knowledge in the medical community.

When providing a training program, it is important to ensure that a high quality, engaging and stimulating learning environment is provided [11]. Medical educational departments have used different tools to assess the quality of the “work/learning” environment provided by their departments. A German study of 225 HMOs assessed the satisfaction of the HMOs in their learning environment with a questionnaire that assessed their feedback under 10 different categories [11]. The methodology of learning, availability of adequate supervision, and the learning structure were identified as the most important factors contributing to effective learning.

Feedback helps in identifying parameters for improvement. Instruments such as the Postgraduate Hospital Educational Environment Measure (PHEEM) have been used previously to assess the learning environment [12,13-16]. Given the novelty of this training program, responses from these HMOs will be utilized in designing ongoing Genomic Medicine training programs at RMH.

In our study, we have been able to demonstrate that the respondents found their genomics rotation useful and relevant to their physician training; gaining genomics knowledge that they could apply and incorporate into their subsequent clinical practice. By way of practical immersion in the subject, we hope that these HMOs have been able to learn how to deliver complex genomic results to their patients in an easily understandable fashion. As a result of this survey, we intend to provide a structured learning pathway including pre-reading materials in order to have a standard set of parameters against which the HMOs can compare their learning and

improvement.

As a pilot cross-sectional study with non-identifiable data collection there are some inevitable limitations to this study, which prevent us from making generalisable conclusions. The survey was collected in an anonymised fashion to protect the privacy of the participants, who may have concerns about future employment opportunities. Anonymisation in this scenario prevented response bias.

However, this approach has potentially introduced other biases. For instance, we were not able to differentiate between the experiences of the earlier HMOs and more recent HMOs. Therefore, we were not able to assess the changes to the quality of the training program over the years. Moreover, those trainees who were closer to their physician exams would have experienced the rotation differently to those who were further away from the exams. In addition, selection biases such as gender and sampling could also not be accounted for.

Based on our questionnaire, we could infer that 50% (6/12) of third year BPTs, 45% (5/9) of second year BPTs and 20% (1/5) of first year BPTs had responded. There is no statistical difference between the BPT year level of responders and non-responders ($p=0.459$ Fisher's Exact test) indicating that there is roughly equal representation between the responders and non-responders without a systematic bias based on their BPT levels. However, we cannot be confident that the responders and non-responders were similar in other aspects such as age, gender or other demographics. Whilst it may not be possible to draw unequivocal conclusions from a single survey, as 100% of the responders (i.e. ~50% of the study population) had a positive experience, there is reasonable evidence to support the continued inclusion of this rotation for physician trainees. This pilot study provides valuable information which will further be evaluated in a longitudinal study.

Overall, the genomics rotation has been a positive experience for both the junior doctors as well as the genomics department thus far and this survey has given us the ability to understand what has worked and where further improvement can occur in our effort to mainstream clinical genomics knowledge. Following our initial experience, we encourage other hospitals and clinical genomics departments to also consider including HMO rotations into their training programs.

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Appendix 1 (Supplementary)

Questionnaire for HMO Genomics Experience Survey

1. Which year of Physician training are you in?

□ First □ Second □ Third □ Fourth and higher □ Other _____

2. What number rotation in the year were you allocated in genetic medicine?

□ 1st □2nd □ 3rd □ 4th

3. What were your learning goals prior to commencing your rotation?

Comments: _____

4. Was there a structured learning pathway during your rotation?

Comments: _____

5. Did you have adequate supervision during your rotation?

Comments: _____

6. How useful was the genetics rotation for your physician training?

On a scale of 1-10 (1 being not useful and 10 being extremely useful)

Comments: _____

7. Do you feel there was a balance in your workload between observation, clinical work and letter writing?

Comment_____

8. Did you achieve your learning goals set prior to rotation?

Comments: _____

9. Were you able to use the knowledge gained during this rotation in subsequent rotations?

Comments: _____

10. How frequently have you been able to incorporate your genetics knowledge in your day to day practice of medicine before your Genetics rotation?

□ All the time □ Most of the time □ Sometimes □ Infrequently □ Never

11. How frequently have you been able to incorporate your genetics knowledge in your day to day practice of medicine after your Genetics rotation?

□ All the time □ Most of the time □ Sometimes □ Infrequently □ Never

12. Has your approach to taking a family history changed, if at all? Y/N

Please comment _____

13. Since your rotation, have you considered a genetic diagnosis in your differential diagnosis? Y/N

Please comment_____

14. How much more or less often would you refer to Genetics following your genetics rotation, compared to before, if you see a patient with a genetic diagnosis?

□Much less often □ Somewhat less often □ Same □ Somewhat more often □ A lot more often

15. Have you been able to share your knowledge of genetics with other staff (medical, allied health or nursing)?

If yes, who ? _____

How frequently?_____

16. Do you see yourself using genetic knowledge in your future medical practice?

□All the time □Most of the time □Sometimes □Infrequently □Never

17. What did you like/dislike about your rotation?_____

18. Any other comments/ suggestions for improvement:

_____

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