



Short report

Stay at home: implementation and impact of virtualising cancer genetic services during COVID-19

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ABSTRACT

The COVID-19 pandemic has led to the rapid adoption of virtual clinic processes and healthcare delivery. Herein, we examine the impact of virtualising genetics services at Canada's largest cancer centre. A retrospective review was conducted to evaluate relevant metrics during the 12 weeks prior to and during virtual care, including referral and clinic volumes, patient wait times and genetic testing uptake. The number of appointments and new patients seen were maintained during virtual care. Likewise, there was a significant increase in the number of patients offered testing during virtual care who did not provide a blood sample (176/180 (97.7%) vs 180/243 (74.1%); $p < 0.001$), and a longer median time from the date of pretest genetic counselling to the date a sample was given (0 vs 11 days; $p < 0.001$). Referral volumes significantly decreased during virtual care (35 vs 22; $p < 0.001$), which was accompanied by a decreased median wait time for first appointment (55 days vs 30 days; $p < 0.001$). The rapid virtualisation of cancer genetic services allowed the genetics clinic to navigate the COVID-19 pandemic without compromising clinical volumes or access to genetic testing. There was a decrease in referral volumes and uptake of genetic testing, which may be attributable to pandemic-related clinical restrictions.

INTRODUCTION

The novel coronavirus, COVID-19, has greatly impacted many healthcare systems worldwide, in particular patients with cancer. Numerous collaboratives have developed practical guidelines for the provision of clinical services for oncology patients in an ethical and resource-sensitive manner.^{1–3} It was suggested that cancer genetics services could be deferred during a pandemic; however, the genetic counselling field has historically been innovative in employing alternative models of care, allowing for rapid implementation of novel service delivery.^{4–5}

Well-established models of genetic service delivery include group counselling, telegenetics and telephone counselling.^{6–7} These alternatives show high rates of patient satisfaction and similar outcomes in measures of knowledge, psychological functioning and uptake of genetic testing compared with in-person appointments.^{8–10} Thus, the provision of high-quality genetics services through alternate models of care and the virtualisation of clinical systems was seen as an opportunity to maintain

genetic counselling services during the COVID-19 pandemic. While some genetic clinics have shown positive adaptations to the pandemic through rapid implementation of well-established alternative service delivery models, there is a paucity of literature describing virtualisation of genetic teams to physically distance within the Canadian context.^{11–12}

The Familial Cancer Clinic (FCC) at the Princess Margaret Cancer Centre (PM) in Toronto is Canada's largest cancer genetics centre.^{4–13} Herein, we describe the virtualisation of FCC staff and implementation of virtual cancer genetics services. We report on clinical metrics with respect to referral and clinic volumes, wait times and uptake of genetic testing.

MATERIALS AND METHODS

Clinic baseline characteristics

Patients seen at the FCC include those with a personal and/or family history of cancer suggestive of a hereditary cancer syndrome. Referrals are accepted from PM oncologists (internal) and outside physicians (external), with the option to refer urgently when genetic testing results may impact treatment. The FCC team comprised seven genetic counsellors, one medical geneticist, two administrators and one genetic counsellor assistant.

Prior to the pandemic, all staff worked on-site full time using a combination of traditional in-person, telephone and telegenetics (ie, videoconference) service delivery models. Patients meeting Ontario Ministry of Health criteria for genetic testing were booked in-person to facilitate having their blood drawn at PM on the day of their appointment whereas those not immediately identifiable as being eligible for genetic testing were scheduled a telephone consult to obtain a family history. For patients proceeding with urgent or routine genetic testing, a telephone appointment for results disclosure was scheduled 3 or 10 weeks following blood draw, respectively. A fax machine and paper charts were used to receive and store patient records and genetic testing results. Referral data, pedigrees and genetic testing details were recorded in the FCC's electronic database. Weekly FCC team meetings were held in-person to discuss procedural issues, complex cases and administrative concerns.

Interventions

At the emergence of the COVID-19 pandemic in Canada, all FCC appointments were transitioned to



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a virtual method of delivery (telephone or telegenetics). Patients scheduled with the medical geneticist were seen via telehealth, while patients seen by genetic counsellors were scheduled as telephone appointments due to the lack of availability of video accounts. Patients were emailed testing requisitions following their appointment, enabling them to provide a blood sample at a community phlebotomy laboratory, with whom a partnership was established. Follow-up appointments for results disclosure were extended from 10 to 12–16 weeks, allowing patients to give their sample at a convenient time, while accounting for potential laboratory delays. FCC staff transitioned to working from home using institution-provided laptops and a virtual private network. Processes including e-faxing, electronic patient charts on a secure SharePoint and daily team videoconference meetings were adopted.

Study design

To evaluate the impact of COVID-19 on genetics service delivery and the effectiveness of patient and staff virtualisation, a retrospective review of referral and clinic volumes, patient wait times and genetic testing uptake was conducted. Testing uptake was defined as the proportion of patients who consented to genetic testing and went on to provide a blood sample. Clinic volumes and method of service delivery were extracted from clinic statistics. Weekly referral volumes, referral source (internal or external), type of referral (urgent or routine), patient demographics, and genetic testing uptake were obtained from the FCC database. Appointment wait times were calculated as the number of days between receipt of referral and date of first appointment offered. Overall, results wait times were calculated as the number of days from the date testing was offered to the date results were disclosed.

Clinical data were collected for the 12 weeks prior (previrtual care) and the 12 weeks following (virtual care) implementation of patient and staff virtualisation. Previrtual care and virtual care periods were defined as 2 December 2019 to 6 March 2020 and 16 March 2020 to 5 June 2020, respectively. The week of 9 March 2020 to 13 March 2020 was excluded as a transition week, with 16 March 2020 defining the start date for all appointments

being conducted virtually. The weeks of 23 December 2019 to 3 January 2020 were excluded due to holiday observances. 17 July 2020 was selected as the study end date and thus any patient who had not provided a sample by this date was excluded from genetic testing wait time calculations. Patients who had genetic testing initiated by their oncologist were included in referral and clinic volumes and appointment wait time statistics, but were not included in the analysis of genetic testing metrics, as they did not participate in pretest genetic counselling with an FCC genetic counsellor.

Statistical analysis

Descriptive statistics were used to summarise demographic information. Significant differences between previrtual care and during virtual care cohorts were evaluated using Mann-Whitney U tests for continuous variables and Pearson's χ^2 or Fisher's exact tests for categorical variables, as appropriate. Statistical analyses were completed using IBM SPSS Statistics for Windows, V.24 (IBM, Armonk, New York, USA), and statistical significance was reported using a two-tailed $\alpha=0.05$.

RESULTS

Virtualisation

As of 17 March 2020, non-administrative staff were working from home, and by 27 March, the e-fax system was implemented, allowing all FCC staff to work remotely (figure 1). Four weeks after the virtualisation effort began, electronic chart implementation allowed for a completely virtual genetics clinic from an administrative perspective (figure 1).

Demographics

During the study period, the FCC saw a total of 874 patients, 441 of whom were offered testing. There were no statistically significant differences between patients seen or offered genetic testing prior to and during virtual care with respect to age, ethnicity and sex. Overall, 81.8% of patients seen were women, 52.6% were Caucasian and the median age at first visit was 53 years (online supplemental table S1).

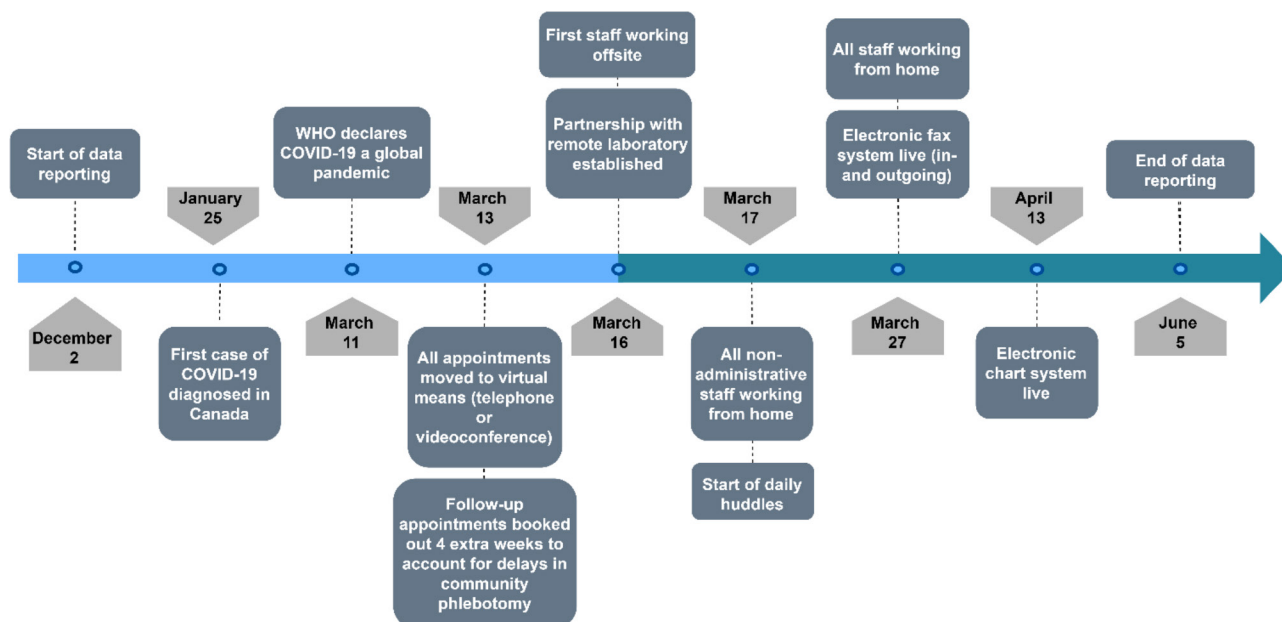


Figure 1 Timeline of virtualisation events from the beginning of the study period (2 December 2019) to the end (5 June 2020).

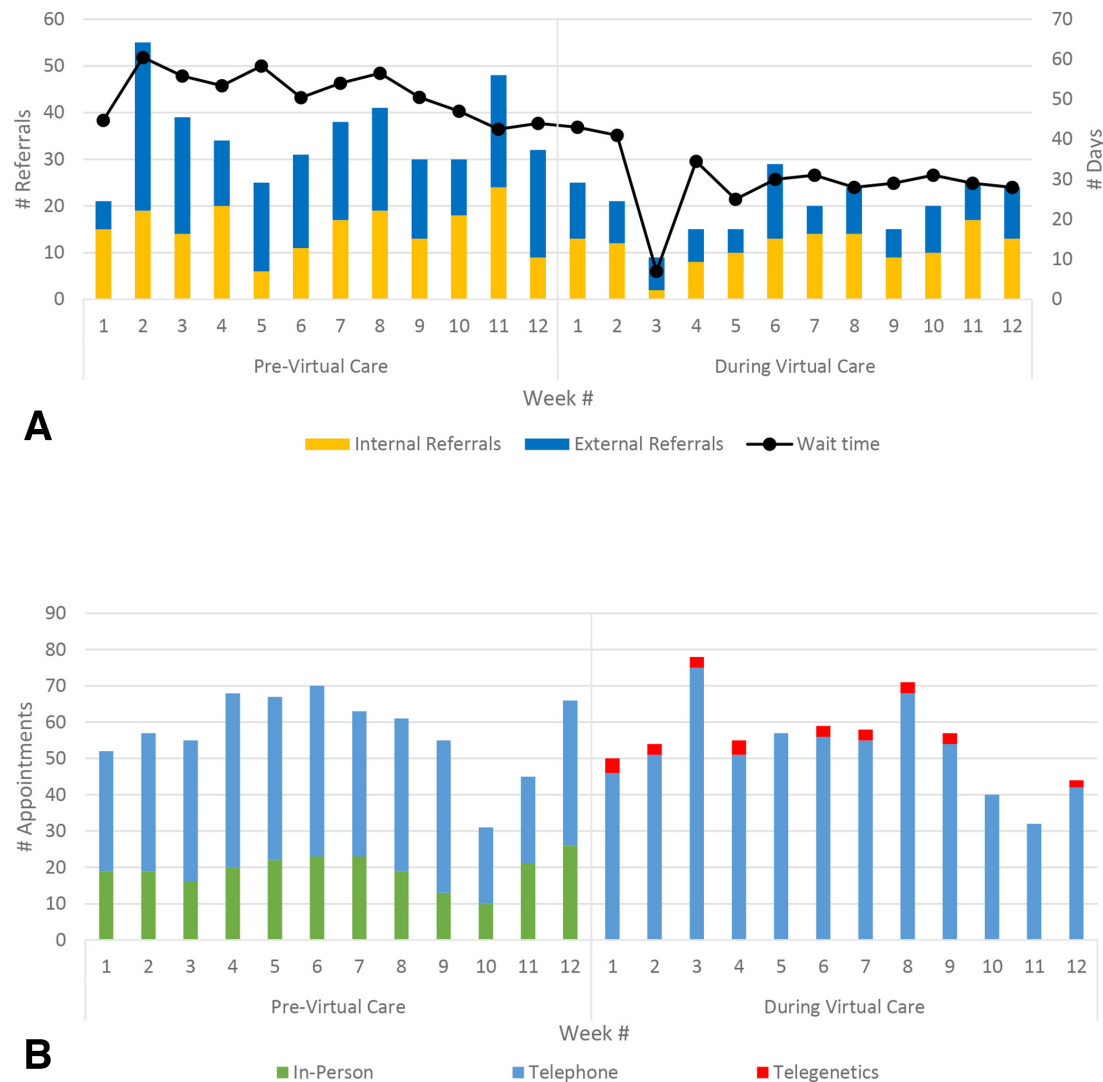


Figure 2 (A) Referral volume and wait time. Weekly referral volumes, as well as median wait time from referral to first appointment offered for patients referred during that week, both previrtual care and during virtual care. (B) Clinic volume by service delivery method. Weekly clinic volumes classified by service delivery method, both previrtual care and during virtual care.

Referrals

Overall, 685 referrals were received, 439 previrtual care (64.1%) and 246 during virtual care (35.9%). There was a significantly higher median number of referrals between previrtual care and during virtual care (35 vs 22; $p < 0.001$), as well as a significantly lower proportion of urgent referrals (7.5% vs 13%; $p = 0.019$), and a significantly longer median appointment wait time (55 days vs 30 days; $p < 0.001$) (figure 2A).

Clinical volumes

There was no significant difference in the median number of weekly genetics appointments (59 previrtual care vs 56 during virtual care; $p = 0.478$). The median number of new patients seen each week was lower previrtual care than during virtual care (31 vs 38); however, this difference was not significant ($p = 0.101$). Lastly, a significantly lower proportion of telephone appointments was noted previrtual care (459/690, 66.5%) compared with during virtual care (627/655, 95.7%; $p < 0.001$) (figure 2B).

Uptake of genetic testing

A summary of genetic testing metrics is provided in online supplemental table 2. Overall, there was no significant difference in the

proportion of patients offered testing previrtual care (186/368, 50.5%) compared with postvirtual care (255/506, 50.4%; $p = 0.965$). Previrtual care, 3.2% (6/186) of patients who were offered genetic testing declined, compared with 4.7% (12/255) during virtual care ($p = 0.438$). Interestingly, a smaller proportion of individuals offered predictive genetic testing declined testing previrtual care (1/37; 2.7% vs during virtual care: 6/49; 12.2%); however, this difference was not significant ($p = 0.231$). Previrtual care, the uptake of testing was significantly higher (176/180, 97.7%) than during virtual care (180/243, 74.1%; $p < 0.001$).

Phases of genetic testing

Details of wait times for various phases of genetic testing are summarised in online supplemental table 3. The median time from test offered to blood draw was significantly shorter previrtual care (0 days) than postvirtual care (11 days; $p < 0.001$) and a significantly longer period between date of blood draw to results was noted previrtual care to during virtual care (36 vs 29 days; $p = 0.001$). The median length of time from receipt of results to disclosure was significantly shorter previrtual care (21 days vs 29 days during virtual care; $p = 0.034$), as was the overall median wait time for genetic testing results (64 days vs 78 days;

$p < 0.001$). Importantly, with median wait times of 21.5 and 23 days, respectively, there was no difference between overall result wait times for urgent patients among previrtual care and during virtual care groups ($p = 0.625$).

DISCUSSION

The results of this study demonstrate that clinical genetics operations can continue under pandemic restrictions by modifying service delivery. The FCC at PM was able to successfully transition to a virtual clinic during the COVID-19 pandemic without a significant impact to clinical volumes or number of patients offered testing. Although the number of referrals was significantly lower during virtual care (35 vs 22), this is likely attributable to fewer patients being seen by referring physicians due to a decreased demand for tertiary care services, resulting from general recommendations to stay at home. While the volume of new patients seen was maintained from previrtual care to virtual care (59 vs 56), there was a significant decrease in the wait time for an initial genetics consultation (55 vs 30 days). This suggests that without an influx of referrals, clinical volumes will decrease. Interestingly, the proportion of urgent referrals was higher during virtual care than previrtual care (7.5% vs 13%), illustrating that genetic services remain critical to patient care and should continue to be available during a pandemic. As many genetic service providers likely ceased activities completely during the COVID-19 pandemic, the rapid shift of FCC to work remotely and provide virtual services contributed to FCC's ability to continue to deliver high-quality care. Some key features allowing for the clinic's successful provision of virtual genetics care included institutional support, robust technological solutions, frequent communication among clinic team members and the team's willingness to implement and continually improve virtual processes.

Barriers to accessing genetic testing blood draws were encountered alongside a significant decrease in uptake of genetic testing (97.7% vs 74.1%) during the virtual care period. There was also a significantly longer time for patients to give their blood sample (0 vs 11 days), which resulted in an increased wait time to results disclosure (64 vs 78 days). Decreased testing rates may be a result of the pandemic itself, rather than the service delivery model, as some patients expressed concern with leaving their homes to provide a blood sample. Some patients who went to a community laboratory for the collection of a blood sample reported that laboratory staff were unfamiliar with the process of genetic testing, and that they were unable to have their blood drawn. Once this barrier was identified, patients were provided with a letter from the FCC to alleviate confusion. Finally, a subset of patients did not have a printer or email address and were unable to print the requisition to have their blood drawn. A potential solution to this technological barrier could include electronic ordering of genetic testing by the practitioner, or validation of genetic testing at provincially funded laboratories using saliva instead of blood. Overall, these barriers provide a likely explanation for the decreased uptake of genetic testing during virtual care.

Despite the benefit to patients and increased safety for staff, the transition to a virtual genetics clinic was not without challenge. During COVID-19, clinicians took on select administrative duties, resulting in increased workload, while administrative staff continued to go on-site periodically to send and receive mail. Technological difficulties were common; yet continual education from team members most familiar with each workflow ameliorated challenges in real time. Logistical aspects

of working from home such as the strength of home internet connections, the availability of a quiet place to work and reliable phone reception to conduct appointments were all communal concerns. Similar concerns have been expressed in other medical fields, including the difficulty of work-life balance while at home and being productive alongside children.^{14–16} Importantly, psychosocial services at PM were introduced during COVID-19 for staff seeking additional support.

Limitations

The results of this study should be considered in the context of several limitations. The study took place at a single, tertiary-care, Canadian cancer genetics clinic and thus the results may not be applicable to other genetics centres. Community-based clinics might have fewer resources to facilitate virtualisation of patient care, require in-person visits or may need to prioritise non-cancer genetics patients. Further, the FCC provides genetic testing within the confines of a universal healthcare system. As such, access to virtual genetic services may be different elsewhere. Additionally, the immediate impact of virtual care efforts provided by our analysis of 12 weeks prior to and during virtual care may not be reflective of longer term trends. Finally, the perspectives of clinicians providing genetic counselling and the patient experience were not explored.

Future directions

Future research is necessary to evaluate the lasting effects of COVID-19, including whether models of genetics services have changed permanently and if other clinics have successfully implemented meaningful methods of virtualisation. Additionally, patient perspectives regarding barriers to accessing appropriate and timely genetic testing should be explored to guide long-term changes to the virtualisation of patient care. Future exploration is also needed to assess the impact of virtual care on cascade testing, the uptake of preventive surgery/screening recommendations, as well as patient perspectives and understanding. Cancer genetics services may also consider continuing to offer a blended model of virtual and in-person care in pandemic-free times in an effort to improve patient access and lower the burden of hospital visits, while offering the benefits of face-to-face appointments. This blended model will then provide the safety net of quickly pivoting to an entirely virtual service delivery in the face of future pandemics.

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Contributors MLN: conceptualisation; data curation; formal analysis; investigation; methodology; project administration; visualisation; writing (original draft, review, editing). JM: conceptualisation; data curation; formal analysis; investigation; methodology; project administration; visualisation; writing (review, editing). SRA: conceptualisation; supervision; writing (review, editing). BG: conceptualisation; methodology; writing (review, editing). BO: investigation; writing (review, editing). ET: conceptualisation; writing (review, editing). JM: conceptualisation; data curation; formal analysis; methodology; writing (review, editing). RHK: conceptualisation; funding acquisition; methodology; supervision; writing (review, editing).

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SUPPLEMENTARY FIGURES

Table S1. Patient Demographics Pre- and During Virtual Care

	Patients Seen		Patients Offered Testing	
	Pre-Virtual Care N=368 (%)	During Virtual Care N=506 (%)	Pre-Virtual Care N=186 (%)	During Virtual Care N=255 (%)
Ethnicity				
African	6 (1.6)	14 (2.8)	1 (0.5)	26 (10.2)
Ashkenazi Jewish	37 (10.1)	42 (8.3)	26 (14.0)	6 (2.3)
Asian	24 (6.5)	40 (7.9)	13 (7.0)	18 (7.1)
Caucasian	190 (51.6)	270 (53.4)	104 (55.9)	146 (57.3)
East Indian	9 (2.5)	23 (4.5)	7 (3.8)	11 (4.3)
Hispanic	8 (2.2)	9 (1.8)	3 (1.6)	5 (1.9)
Middle Eastern	24 (6.5)	28 (5.5)	8 (4.3)	13 (5.1)
Mixed	27 (7.3)	44 (8.7)	14 (7.5)	20 (7.8)
Indigenous	1 (0.3)	1 (0.2)	1 (0.5)	0 (0)
West Indies	13 (3.5)	13 (2.6)	7 (3.8)	4 (1.6)
Unknown	29 (7.9)	22 (4.3)	2 (1.1)	6 (2.3)
Sex				
Female	302 (82.1)	413 (81.6)	141 (75.8)	195 (76.5)
Male	66 (17.9)	93 (18.4)	45 (24.2)	60 (23.5)
Median Age (range)	52.0 (17-90)	54.0 (17-89)	52.4 (17-87)	53.6 (17-88)

Table S2. Genetic Testing Metrics Pre- and During Virtualization

	Pre-Virtual Care X/N (%)	During Virtual Care X/N (%)	p-value
Overall patients offered testing	186/368 (50.5)	255/506 (50.4)	0.965
Predictive	37/37 (100.0)	49/49 (100.0)	N/A
Non-predictive	149/331 (45.0)	206/457 (45.1)	0.986
Overall patients declined testing	6/186 (3.2)	12/255 (4.7)	0.438
Predictive	1/37 (2.7)	6/49 (12.2)	0.231
Non-predictive	5/149 (3.4)	6/206 (2.9)	1
Overall uptake of testing	176/180 (97.7)	180/243 (74.1)	<0.001
Predictive	36/36 (100.0)	31/43 (72.1)	<0.001
Non-predictive	140/144 (97.2)	149/200 (74.5)	<0.001

Table S3. Phases of Genetic Testing Pre- and During Virtual Care

	Pre-Virtual Care			During Virtual Care			p-value
	N	Median # days	Range of days	N	Median # days	Range of days	
Testing offered to sample given	176	0	0-65	180	11	0-102	<0.001
Sample given to result receipt	176	36	10-131	145	29	7-66	0.001
Result receipt to disclosure	176	21	0-66	145	29	0-178	0.034
Overall result wait time	182	64	16-152	147	78	15-264	<0.001
Urgent	10	21.5	16-33	14	23	16-53	0.625
Non-Urgent	172	64	16-152	133	80	15-264	<0.001

(S1) Summary of demographics of all patients seen, and patients offered testing by an FCC genetic counselor (non-mainstreamed), including median age, and proportions of ethnicity and sex, stratified by pre- and during virtual care.

(S2) Summary of genetic testing metrics from pre-virtual care to during virtual care, including the proportions of patients who were offered testing (overall and predictive versus non-predictive), declined testing (overall and predictive versus non-predictive), and uptake of genetic testing (defined as the proportion of patients who consented to genetic testing and went on to provide a blood sample). (S3) Summary of the number of days during each phase of the genetic testing process and the overall wait time for genetic test results (overall cohort, and urgent versus non-urgent patients)