# The Gene Messenger Impact Project:

## An innovative genetics knowledge translation strategy for primary care providers

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Conflict of Interest:

In license agreements for the Information Assessment Method, McGill receives unrestricted funds from the Canadian Medical Association, the Canadian Pharmacists Association and John Wiley & Sons. The authors have no other conflicts of interest to declare.

Acknowledgements:

Funding for this study was provided by the Canadian Institutes of Health Research (Grant # KTB 106227). We would like to thank the many family physicians who participated in this continuing education research project.

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**Abstract:**

**Introduction:** Primary care providers (PCP) will need to be integrally involved in the delivery of genomic medicine. The GenetiKit trial demonstrated effectiveness of a knowledge translation (KT) intervention on family physicians' (FP) genetics referral decision-making. Most wanted to continue receiving *Gene Messengers (GM),* evidence-based summaries of new genetic tests with primary care recommendations. Our objective was to determine the value of *GMs* as a KT/continuing education (CE) strategy in genomic medicine for FPs.

**Methods:** Using a "push" model, we invited 19,060 members of the College of Family Physicians of Canada to participate. Participants read *GMs* online, receiving 12 emailed topics over 6 months. Participants completed an online Information Assessment Method questionnaire evaluating *GMs* on 4 constructs: cognitive impact, relevance, intended use of information for a patient, expected health benefits.

**Results:** 1402 FPs participated, 55% rated at least 1 *GM*. Most (73%) indicated their practice would be improved after reading *GMs*, with referral to genetics ranked highly. Of those who rated a *GM* relevant, 94% would apply it to at least 1 patient and 79% would expect health benefits. This method of CE was found useful for genetics by 88% and 94% wanted to continue receiving *GMs*.

**Discussion:** FPs found this novel CE strategy, brief individual reflective e-learning, to be valuable for learning about genetics. This method of information delivery may be an especially effective method for CE in genomic medicine where discoveries occur at a rapid pace and lack of knowledge is a barrier to integration of genetic services.

**Introduction:**

Genomic medicine has the potential to increase understanding of disease, and lead to more individualized risk assessment, diagnosis, screening and management. For benefits to accrue from a genomics approach, primary care providers will need to be integrally involved in the delivery of genomic medicine. However, primary care providers face many challenges in integrating genomic medicine into practice. Internationally there are numerous studies documenting primary care providers' lack of education and knowledge of genetics,[1-6] and their lack of preparedness to handle genetic problems in practice.[2] While it is true that primary care providers are challenged by the rapid advances in genomic medicine, this cognitive deficit model is likely insufficient to explain the slow uptake of genomics into primary care practice.[7-9] Studies have shown that primary care providers are more willing to integrate genomic medicine into their practices if it changes management or when there is evidence of benefit to patients.[3,7,10] There has been a call for clinical decision support and point of care tools in genetic medicine[3,11,12] including tools that provide indicators of a hereditary component to disease, indications for genetics referral and benefits and limitations of genetic testing.[3,13]

Our previous study, the GenetiKit trial, demonstrated the effectiveness of a knowledge translation complex intervention on family physicians' (FP) genetics referral decisions and self-reported confidence in core genetics competencies.[14] Over 90% of the participating FPs wanted to continue receiving one component of the intervention, a knowledge support service called *Gene Messenger*. *Gene Messengers* are 2-page evidence-based structured summaries of new gene-disease associations or genetic tests reported in popular print media, with "bottom line" recommendations for primary care practice.

The objective of this project was to determine the value of *Gene Messengers* as a knowledge translation/continuing education strategy in genomic medicine for family physicians.

**Methods:**

We chose a "push" model of knowledge translation. "Push technologies allow information to be delivered to the user rather than requiring the user to actively search for the desired information; they require minimal effort on the part of the recipient, which greatly supports their adoption."[15] We also included a "brief individual reflective e-learning activity"[16,17] based on the theory that continuing education which is interactive, "engages learners, helps them reflect on current practices",[18] and identifies gaps, is more likely to change performance.[18]

An email invitation to participate in this study was sent three times at 2-week intervals to all 19,060 English-speaking members of the College of Family Physicians of Canada (CFPC). After completing a demographic questionnaire and providing informed consent, participants were invited to read the first *Gene Messenger*. Participants received a total of 12 *Gene Messengers* on different topics by email approximately every 2 weeks for 6 months (July 2011 to Jan 2012). Each *Gene Messenger* followed the same design template (Figure 1) starting at the top with a very brief summary and a one or two sentence "bottom line" recommendation for primary care. This was followed by information on the consequences of having a gene mutation, who should be offered genetic counseling and testing, and the benefits and harms/limitations of genetic testing. One or two references were also included. A list of *Gene Messenger* topics is provided in Table 1.

Participants were invited to complete one Information Assessment Method (IAM) questionnaire after reading each *Gene Messenger*. A hyperlink connected participants to the IAM, a valid and useable evaluation tool for linking the delivery of emailed information with continuing professional development.[19,20] Based on a "Push-Pull-Acquisition-Cognition-Application" conceptual framework,[18,20,21] the IAM comprises a brief questionnaire linked to the source of clinical information, in this case the *Gene Messenger* delivered by email. A completed IAM questionnaire documents participants' perceptions of the value of this clinical information according to 4 constructs: cognitive impact (e.g. learning something new), relevance of the information for at least one patient, intended use of information for a specific patient (e.g. modify treatment or referral), and expected health benefits (e.g. avoiding unnecessary treatment).[19] Since 2006, the IAM has been used to document reflective learning in various e-learning programs.[21,22] We modified the IAM by adding several questions of particular relevance to genetics in primary care practice (Appendix A). A selected bibliography of articles on the IAM is found at mcgill.ca/iam.[23]

Participants received continuing education credit for each submitted *Gene Messenger* IAM questionnaire. In order to obtain summative feedback on *Gene Messengers* as well as this knowledge translation method for genetics continuing education, participants were also asked to complete one overall evaluation questionnaire regarding the project.

Analysis

Anonymous data were exported from the CFPC server in Excel format and then analyzed using IBM SPSS Statistics (Version 20). Descriptive statistics were used for demographic data and IAM responses. The data from the rating forms were first subjected to an overall analysis then divided by topic and analysed using frequency distributions. The Clinical Relevance of Information Index (CRII)[24] was used to measure clinical relevance of each Gene Messenger for at least one patient of each participant using the following formula:

$$\text{CRII} = \begin{cases} \dfrac{2T\,(T+P)}{(T+P+N)\,(2T+P)}, & \text{when } T+P > 0 \\ 0, & \text{otherwise} \end{cases}$$

*T = Totally relevant*
*P = Partially relevant*
*N = Not relevant*

Each CRII value falls in a range between 0 (no relevance) and 1 (maximum relevance).

Two researchers (JC, JA) met to discuss the short answer responses to the question: "Do you have any final comments on *Gene Messengers* or on this method of delivering information about genetics in primary care?" Themes were generated together for the first 50 responses, and the remaining responses were then coded independently by both researchers. Any differences in coding were resolved by discussion.

Ethics approval was obtained from the Mount Sinai Hospital Research Ethics Board.

**Results:**

Recruitment and Participation

A total of 19,060 FPs were invited to participate in the study. We obtained responses from 1402 to the demographics questionnaire and 713 (55%) rated at least one of the 12 *Gene Messengers*.

The mean number of ratings per participant was 5 (range 1-12). The end-of-project feedback questionnaire was completed by 381 (27%); of those, 118 (31%) gave written comments.

Demographics of participants are shown in Table 2. The mean participant age was 46 years (range 25-85) and 842 (60%) were female.

Cognitive Impact of GMs on practice (Table 3)

Overall, 2417/3291 (73%) of the ratings of participating FPs indicated that their practices would be changed and improved (yes or possibly). This ranged from a low of 128/274 (47%) for type 2 diabetes to a high of 85% for each of Factor V Leiden (208/245), familial melanoma (207/244), hereditary breast/ovarian cancer (289/342) and hereditary colorectal cancer (211/249).

Table 4 indicates the top 3 responses for each *Gene Messenger* when FPs were asked what aspect will be changed and improved. For example, "referral to genetics" was ranked in the top 3 ways that practice would be improved for Alzheimer disease, hereditary hemochromatosis, hereditary colorectal cancer, cardiomyopathy, schizophrenia and sickle cell anemia.

Relevance of *Gene Messengers* to practice

Table 5 shows the relevance of *Gene Messengers* varied widely. The *Gene Messengers* on hereditary breast cancer, hemochromatosis and codeine pharmacogenomics were rated as most relevant while Type 2 diabetes, sickle cell anemia, and schizophrenia were rated as the least relevant.

The use or application of *Gene Messengers* to patient care

When participants rated a *Gene Messenger* as "relevant", they were asked if they would apply the *Gene Messenger* to at least one of their patients. Table 6 shows that overall 2321/2479 (94%) of *Gene Messengers* rated as "relevant" would be applied (yes or possibly) to at least one of the participant's patients. *Gene Messengers* with the lowest indicated likely use in practice were Type 2 diabetes and schizophrenia. The top 3 ways *Gene Messengers* would be applied (yes or possibly) included: "to counsel this patient about this issue" (1941/2320, 84%), "to discuss impact on family members with my patient" (1551/2320, 67%), and "to better understand a particular issue related to this patient" (1335/2320, 58%).

The expected health benefits of *Gene Messengers*

When participants indicated they would apply a *Gene Messenger* to at least one of their patients, they were asked if they expected any health benefits. Overall 1834/2321 (79%) of *Gene Messenger* ratings indicated expectation of health benefits (yes or possibly). The highest report of possible health benefit was seen in Factor V Leiden (160/187, 86%) and hereditary breast/ovarian cancer (240/280, 86%), and the lowest in type 2 diabetes (97/154, 63%). Possible health benefits expected are listed in Table 7 with the top 2 responses highlighted for each GM.

General feedback on this e-learning activity was received from 381 participants (Table 8). The vast majority were satisfied with *Gene Messengers*, found this method useful for learning about genetics topics, and wanted to continue to receive *Gene Messengers*. Table 9 shows the responses grouped by themes to the short answer question asking for comments on *Gene*

*Messengers* or this method of delivering genetics continuing education with some illustrative quotes.

**Discussion:**

This brief individual evidence-based reflective e-learning method of knowledge translation was useful for learning about genetics and valuable for clinical practice. Our findings contribute to the literature that receiving information by email is associated with positive impact.[17,19,22] In addition, participants reported high levels of satisfaction with these email alerts and perceived them as useful and convenient.[17,19] This e-push of information may be an especially effective method for continuing education in genetic and genomic medicine where discoveries are occurring at a rapid pace and lack of knowledge has been frequently cited as a barrier to integration of genetic services.[7] It enables timely delivery of practice relevant information to primary care providers on a new genomic discovery or test that has appeared in the media and which patients may inquire about. It is possible that *Gene Messengers* also decrease the complexity surrounding new genomic discoveries by distilling information into a useful "bottom line" with which to guide practice. Participating FPs commented that this method was an ideal way to stay up to date in an evolving field such as genomics, and that the email push "forced" them to learn about genomics topics that they might not have sought out.

One of the most important findings of this study was the differential response to various items in the IAM questionnaire, depending on the *Gene Messenger* topic, indicating that participants had indeed read them and reflected on or evaluated their impact on practice. For example, they rated the *Gene Messengers* on hereditary cancer as likely to change their practice but less so the *Gene*

*Messenger* on type 2 diabetes. This fits with the known benefit of identifying those at moderate or increased risk of hereditary breast/ovarian cancer and colorectal cancer in terms of modifying screening or risk reducing medications and surgery,[25-27] and the lack of any such benefit proven for type 2 diabetes. Participants indicated they would change their practice for hereditary hemochromatosis, hereditary colorectal cancer and cardiomyopathy by referring to genetics whereas this was not a high choice for prostate cancer or diabetes, again choices which fit with the evidence as to the limited value of genetic testing in these latter disorders.

Many FPs indicated that a benefit of reading the *GM* was "avoiding unnecessary or inappropriate treatment, diagnostic procedure, surveillance or preventive intervention". This resonates with campaigns such as Choosing Wisely™ and may help inform addition of genomics topics.[28] Lastly, participants indicated that they would use knowledge gained from *Gene Messengers* for discussion of impact on family members, highly relevant behaviour in the area of genomic medicine.

One of the strengths of this study was the use of the IAM, a validated method to assess reflective learning.[20] Our findings contribute to the literature that spaced online delivery of educational information may be associated with improved knowledge and topic-specific learning, although the optimum interval for spacing is not known.[29]

**Limitations:**

Participation in this study was similar to other studies using brief individual reflective e-learning activities.[17] It may have been influenced by our invitation method: the invitation had to be

framed as a research study rather than as a continuing education opportunity, only 3 invitations could be sent (other studies have had rolling continuous enrollment), and the email subject line may not have been sufficiently interesting. That said, this method of continuing education - pushing out high quality information through an existing mechanism such as a widely read journal - is very low cost. Even if only useful to a small proportion of recipients, there is probably a high benefit compared to cost. There is likely, however, a limit to how much information can be delivered by email, given general email overload and a subsequent tendency towards ignoring email educational alerts. It is likely that the family physicians who chose to participate were the most interested, which may have increased the relevance ratings. Compared to the 2010 National Physician Survey (NPS),[30] participants in this study were slightly younger (mean age 46 v age 49 NPS), mostly female (60% v 44% NPS), and more likely to be certificants of the CFPC (63% v 55% NPS).

It is also difficult to know if this knowledge will actually translate into practice or whether patients' health outcomes will be influenced by this electronic push of genomics information. It would be useful in future studies to look at changes in knowledge, intention to refer to genetics or, if possible, appropriateness of referral to genetics clinics. As well, follow-up with key informants using qualitative methods may help to better understand how expected benefits translate into observable outcomes.

Almost all respondents to the end-of-project survey wanted to continue to receive *Gene Messengers* but also requested a website with an easily searchable repository for reference. Partially in response to this study's findings, we have recently launched a platform to meet this

need (http://www.geneticseducation.ca). *Gene Messengers* have been updated and reformatted on this site as "GEC-KO *on the run*" (brief) and "GEC-KO *Messengers*" (more detailed).

**Conclusion:**

This novel continuing education strategy, consisting of email push of brief structured evidence-based summaries of topics in genomic medicine with primary care recommendations, combined with a reflective exercise (IAM questionnaire), was found by family physicians to be useful for learning and relevant to practice. This online e-push of information may be an especially effective method for continuing education in genomic medicine where discoveries occur at a rapid pace and lack of knowledge is a barrier to integration of genetic services.

**Lessons for Practice** (total 100 words)

1. Emailed evidence-based summaries of genomic medicine topics with primary care recommendations (*Gene Messengers*), combined with a reflective exercise (Information Assessment Method), were found by family physicians to be useful and relevant.

2. Online e-push of information may be an effective method for continuing education in genomic medicine where discoveries occur at a rapid pace and lack of knowledge is a barrier to integration of genetic services.

3. GEC-KO Messengers (reformatted *Gene Messengers*) can be found on a number of genetics topics at www.geneticseducation.ca, a website with educational resources on genomic medicine for primary care providers and other non-genetics specialists.

**Figure Legend**

Figure 1 Gene Messenger Template

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**Figure 1. Gene Messenger Template**

**GENE MESSENGER**

☆**Topic:**

☆**Summary:**

☆**Bottom line:**

✓ **The Disease**

✓ **The Genes**

✓ **Consequences of having a faulty gene**

✓ **Who should be offered referral for genetic counselling?**

✓ **Testing - for the faulty gene**

✓ **Benefits of genetic testing**

✓ **Harms/limitations of genetic testing**

☆ **Web Resources:**

☆ **Review Article:**

*"Gene Messenger" is for educational purposes only and should not be used as a substitute for clinical judgement. The "GenetiKit" team aims to aid the practicing clinician by providing informed opinions regarding genetic services that have been developed in a rigorous and evidence-based manner. Physicians must use their own clinical judgement in addition to published articles and the information presented herein. The members of the GenetiKit research team assume no responsibility or liability resulting from the use of information contained on "Gene Messenger".*

Funding provided by CIHR

GenetiKit KNOWLEDGE IN TRANSLATION

**Table 1. Gene Messenger Topics**

| | |
|---|---|
| **1. Alzheimer Disease** | **7. Type 2 Diabetes** |
| **2. Codeine & Breastfeeding** | **8. Sickle Cell (Hemoglobinopathy)** |
| **3. Hemochromatosis** | **9. Hypertrophic Cardiomyopathy** |
| **4. Hereditary Breast / Ovarian Cancer** | **10. Schizophrenia** |
| **5. Hereditary Colorectal Cancer** | **11. Familial Melanoma** |
| **6. Prostate Cancer** | **12. Factor V Leiden** |

**Table 2. Participant Demographics (n=1402)**

| Characteristic | Mean (SD), Range |
|---|---|
| **Age (years)** | 46 (11), 25-85 |
| | **n (%)** |
| **Gender:** | |
| Female | 842 (60) |
| **Status:** | |
| In full-time or part-time practice | 1250 (89) |
| Certificant of College of Family Physicians of Canada (CFPC) | 883 (63) |
| **Work Setting* (Top 5 Responses):** | |
| Private office / clinic | 984 (70) |
| Community hospital | 598 (43) |
| Emergency department | 322 (23) |
| Community clinic / Community health centre | 294 (21) |
| Nursing home / home for the aged | 235 (17) |
| **Areas of Medical Practice* (Top 5 Responses):** | |
| Family practice / general practice | 1313 (94) |
| Chronic disease management | 838 (60) |
| Geriatric medicine | 748 (53) |
| Paediatrics | 728 (52) |
| Teaching | 610 (44) |

***multiple responses possible**

**Table 3. Cognitive Impact: Impact of Gene Messengers on Practice (n=3291)**

| Gene Messenger | My practice will be changed and improved: Yes/Possibly n (%) |
|---|---|
| Alzheimer Disease (n=297) | 205 (69) |
| Codeine & Breastfeeding (n=332) | 228 (69) |
| Factor V Leiden (n=245) | 208 (85) |
| Familial Melanoma (n=244) | 207 (85) |
| Hemochromatosis (n=330) | 254 (77) |
| Hereditary Breast/ Ovarian Cancer (n=342) | 289 (85) |
| Hereditary Colorectal Cancer (n=249) | 211 (85) |
| Hypertrophic Cardiomyopathy (n=229) | 191 (83) |
| Prostate Cancer (n=278) | 168 (60) |
| Schizophrenia (n=243) | 154 (63) |
| Sickle Cell Anemia (n=228) | 174 (76) |
| Type II Diabetes (n=274) | 128 (47) |
| Overall (n=3291) | 2417 (73) |

**Table 4.** **What Aspect Will Be Changed and Improved?** (Top 3 responses bold and underlined)

| Gene Messenger | Diagnostic Approach % | Health Education % | Disease Prevention/ Screening % | Therapeutic Approach % | Referral to Genetics % | Responding to Patient Concerns & Questions % | Consideration of Other Family Members % |
|---|---|---|---|---|---|---|---|
| **Alzheimer Disease (n=205)** | 51 | **74** | 56 | 19 | **77** | **85** | 72 |
| **Codeine & Breastfeeding (n=228)** | 27 | **76** | 40 | **90** | 30 | **81** | 42 |
| **Factor V Leiden (n=208)** | **81** | 70 | **81** | 35 | 62 | **72** | 66 |
| **Familial Melanoma (n=207)** | 60 | **74** | **80** | 29 | 41 | **73** | 68 |
| **Hemochromatosis (n=254)** | **82** | 65 | **74** | 30 | **75** | 72 | 68 |
| **Hereditary Breast/ Ovarian Cancer (n=289)** | 67 | **85** | **87** | 30 | **85** | **85** | 66 |
| **Hereditary Colorectal Cancer (n=211)** | 70 | 71 | **90** | 31 | **85** | **76** | 67 |
| **Hypertrophic Cardiomyopathy (n=191)** | **81** | 75 | **81** | 31 | **87** | 73 | 70 |
| **Prostate Cancer (n=168)** | 54 | **71** | **74** | 21 | 64 | **77** | 61 |
| **Schizophrenia (n=154)** | 54 | **78** | 53 | 21 | **74** | **82** | 71 |
| **Sickle Cell Anemia (n=174)** | 66 | **70** | **88** | 29 | **74** | 68 | 59 |
| **Type II Diabetes (n=128)** | 48 | **69** | 56 | 20 | **62** | **68** | **62** |

**Table 5.** **Gene Messenger Clinical Relevance Information Index (CRII)**
(In order of relevance)

| Gene Messenger Ratings | Totally Relevant (n) | Partially Relevant (n) | Not Relevant (n) | CRII* |
|---|---|---|---|---|
| **Hereditary Breast/ Ovarian Cancer (n=330)** | 219 | 77 | 34 | 0.76 |
| **Hemochromatosis (n=322)** | 196 | 71 | 55 | 0.70 |
| **Codeine & Breastfeeding (n=323)** | 185 | 99 | 39 | 0.69 |
| **Factor V Leiden (n=240)** | 128 | 75 | 37 | 0.65 |
| **Prostate Cancer (n=271)** | 137 | 94 | 40 | 0.63 |
| **Familial Melanoma (n=237)** | 111 | 81 | 45 | 0.59 |
| **Hereditary Colorectal Cancer (n=240)** | 111 | 75 | 54 | 0.58 |
| **Alzheimer Disease (n=291)** | 107 | 128 | 56 | 0.51 |
| **Hypertrophic Cardiomyopathy (n=219)** | 89 | 57 | 73 | 0.51 |
| **Type II Diabetes (n=263)** | 95 | 91 | 77 | 0.48 |
| **Sickle Cell Anemia (n=218)** | 71 | 73 | 74 | 0.44 |
| **Schizophrenia (n=237)** | 64 | 97 | 76 | 0.39 |

*CRII values measure the relevance of each Gene Messenger for at least one of the participants' patients. Each value is in the range between 0 (no relevance) and 1 (maximum relevance).

**Table 6. Use/Application of Gene Messengers (n=2479*)**

| Gene Messenger | Will you apply this Gene Messenger to at least one of your patients? Yes/Possibly n (%) |
|---|---|
| Alzheimer Disease (n=228) | 204 (90) |
| Codeine & Breastfeeding (n=281) | 269 (96) |
| Factor V Leiden (n=195) | 187 (96) |
| Familial Melanoma (n=191) | 182 (95) |
| Hemochromatosis (n=263) | 255 (97) |
| Hereditary Breast/ Ovarian Cancer (n=288) | 280 (97) |
| Hereditary Colorectal Cancer (n=181) | 173 (96) |
| Hypertrophic Cardiomyopathy (n=145) | 137 (95) |
| Prostate Cancer (n=224) | 206 (92) |
| Schizophrenia (n=159) | 139 (87) |
| Sickle Cell Anemia (n=142) | 135 (95) |
| Type II Diabetes (n=182) | 154 (85) |
| Overall (n=2479) | 2321 (94) |

*Number of respondents who indicated that the GM was relevant for at least one of their patients

**Table 7.** **Expected Health Benefits** (Top 2 responses bold and underlined)

| Gene Messenger | Increasing patient knowledge about health or healthcare (%) | Avoiding unnecessary or inappropriate treatment, diagnostic procedure surveillance or preventive intervention (%) | Increasing patient acceptability of treatment, diagnostic procedure, surveillance or preventive intervention (%) | Preventing disease or health deterioration (%) | Improving patient health or functioning or resilience (%) |
|---|---|---|---|---|---|
| **Alzheimer Disease (n=137)** | **84** | **64** | 56 | 21 | 46 |
| **Codeine & Breastfeeding (n=222)** | **61** | **77** | 57 | 60 | 32 |
| **Factor V Leiden (n=160)** | **69** | 47 | 61 | **66** | 31 |
| **Familial Melanoma (n=153)** | **78** | 39 | **75** | 68 | 33 |
| **Hemochromatosis (n=206)** | **73** | 64 | 64 | **68** | 43 |
| **Hereditary Breast/ Ovarian Cancer (n=240)** | **88** | 54 | **73** | 61 | 49 |
| **Hereditary Colorectal Cancer (n=145)** | **81** | 49 | **79** | 66 | 43 |
| **Hypertrophic Cardiomyopathy (n=116)** | **75** | 38 | 69 | **71** | 49 |
| **Prostate Cancer (n=147)** | **78** | **71** | 56 | 31 | 23 |
| **Schizophrenia (n=97)** | **77** | **61** | 56 | 34 | 43 |
| **Sickle Cell Anemia (n=114)** | **85** | 27 | **68** | 67 | 37 |
| **Type II Diabetes (n=97)** | **81** | 58 | **60** | 56 | 46 |

**Table 8. Project Feedback**

| | **n (%)** |
|---|---|
| Overall, how satisfied were you with e-Gene Messengers? | 337/381 (88)<br>Somewhat / Very Satisfied |
| How useful is this method for learning about genetics topics in primary care? | 336/381 (88)<br>Somewhat / Very Useful |
| Overall, how useful were e-Gene Messengers for clinical practice? | 291/381 (76)<br>Somewhat / Very Useful |
| Would you like to continue receiving e-Gene Messengers? | 354/377 (94)<br>Yes |
| Would you recommend this service to colleagues? | 340/371 (92)<br>Yes |

**Table 9. Comments on *e-Gene Messengers* or this method of delivering information about genetics in primary care** [n= 118 who completed feedback questionnaire]

| Theme | # of responses (multiple possible) | Illustrative quotes |
|---|---|---|
| Value of Gene Messengers<br>- relevant, clinically useful, interesting, keeps FPs up-to-date, improves knowledge/understanding | 61 | *"I found this really interesting and as it is such an evolving field, this is a wonderful way of staying up to date. Thank you"* |
| Attitudes to Gene Messenger Continuing Education Program (through email push)<br>- excellent program, should continue | 35 | *"I think it is great and should be used for other subjects as well"*<br>*"I appreciated the simplicity of the program-quick and easy pearls for practice"* |
| Valued features of Gene Messengers<br>- brief, well written, understandable, excellent format, organized | 26 | *"Nice summary format – not too lengthy"*<br>*"I found the messages well-organized - seemed to provide good overviews with useful information"* |
| What did they like about this method of learning about genetics?<br>- email "forced" them to read Gene Messenger, convenient, able to access at any time, like email, liked continuing education credits | 16 | *"Excellent idea-forced me to read and learn about specific topics. Good choices for clinical medicine were picked. An easy way to learn and gain CME credits on my own time. I am more likely to read these than research on my own on the net."* |
| Suggestions for change<br>- to Gene Messengers<br>o clear recommendations re test, who to refer to genetics and simplify genetic terminology<br><br>- to continuing education program<br>o link to searchable website for entire collection of Gene Messengers, ability to save as PDF and print, prefer mailed/printed, email updates, more recognizable subject line | 8<br><br>24 | *"Some of the genetics stuff can be confusing. A simple breakdown of who should be screened is the most useful for us as family physicians, as well as where we can send people or the specific test to order."*<br><br>*"I like the idea of a website to search so that the emails don't have to be stored and the info would be easier to access at work and at home."* |

## Appendix A.

**e-GENE MESSENGER RATING FORM**

**Gene Messenger Topic: Hereditary Breast and Ovarian Cancers**
Receive 0.1 Mainpro M1 credit from the CFPC for completing this assessment.

**Q1. What is the impact of this e-Gene Messenger on you or your practice?**

**Q1a.** My practice is (will be) changed and improved
- O Yes
- O Possibly
- O No

**Q1b. If Yes or Possibly, what aspect will be changed and improved?**

| | Yes | Possibly | No |
|---|---|---|---|
| i. Diagnostic Approach | O | O | O |
| ii. Health Education | O | O | O |
| iii. Disease Prevention/Screening | O | O | O |
| iv. Therapeutic Approach | O | O | O |
| v. Prognostic Approach | O | O | O |
| vi. Referral to Genetics | O | O | O |
| vii. Responding to patient concerns and questions | O | O | O |
| viii. Consideration of other family members | O | O | O |
| ix. Other (please specify) | | | |

| **Q1c.** | Yes | Possibly | No | |
|---|---|---|---|---|
| i. I learned something new | O | O | O | |
| ii. I am motivated to learn more | O | O | O | |
| iii. This information confirmed I did (am doing) the right thing | O | O | O | |
| iv. I am reassured | O | O | O | |
| v. I am reminded of something I already knew | O | O | O | |
| vi. I am dissatisfied | O | O | O | |
| vii. There is a problem with this information | O | O | O | ☛**If Yes or Possibly, Go To Question 1d** |

**Q1d. Which of the following problems did you encounter?**

| | Yes | Possibly | No |
|---|---|---|---|
| i. Too much information | O | O | O |
| ii. Not enough information | O | O | O |
| iii. Information poorly written | O | O | O |
| iv. Information too technical | O | O | O |
| v. Other problem *(please specify)* | O | O | O |

| **Q1e.** | Yes | Possibly | No |
|---|---|---|---|
| i. I disagree with the content of this information | O | O | O |
| ii. I think this information is potentially harmful | O | O | O |

**Your feedback is important to us. Please help us investigate any concerns by filling in the Comment Box at the end of this questionnaire.**

**Q2. Is this Gene Messenger relevant for at least one of your patients?**

- O Totally relevant
- O Partially relevant
- O Not relevant ☛***If not relevant please go to Question 5***

**Q3. Will you apply this Gene Messenger to at least one patient?**

- OYes ☛***If Yes, please go to Question 3a***
- OPossibly ☛***If Possibly, please go to Question 3a***
- ONo ☛***If No, please go to Question 5***

**Q3a.** How will you apply it? Please check **YES** or **POSSIBLY** for at least one:

| | Yes | Possibly | No |
|---|---|---|---|
| i. To better understand a particular issue related to this patient | O | O | O |
| ii. To counsel this patient about this issue | O | O | O |
| iii. To justify or maintain the management of this patient | O | O | O |
| iv. To modify the management of this patient | O | O | O |
| v. To discuss impact on family members with my patient | O | O | O |
| vi. To persuade other health professionals or patients to make changes | O | O | O |
| vii. Other (specify): | | | |

**Q4. Do you expect any health benefits from applying this Gene Messenger to a particular patient?**

OYes ☛ ***If Yes, please go to Question 4a***
OPossibly ☛ ***If Possibly, please go to Question 4a***
ONo ☛ ***If No, please go to Question 5***

**Q4a.** What benefits do you expect? Please check **YES** or **POSSIBLY** for at least one:

| | Yes | Possibly | No |
|---|---|---|---|
| i. Increasing patient knowledge about health or healthcare | O | O | O |
| ii. Avoiding unnecessary or inappropriate treatment, diagnostic procedure, surveillance or preventive intervention | O | O | O |
| iii. Increasing patient acceptability of treatment, diagnostic procedure, surveillance or preventive intervention | O | O | O |
| iv. Preventing disease or health deterioration (including acute episode of chronic disease) | O | O | O |
| v. Improving patient health or functioning or resilience (i.e., how well the patient faces difficulties) | O | O | O |
| vi. Other (specify): | O | O | O |

**Q5. Do you have any comments on this Gene Messenger or this questionnaire?**

**Thank you for participating. Your next e-Gene Messenger will arrive in 2 weeks!**