

AWARD NUMBER: W81XWH-21-1-0421

TITLE: Improving Diagnosis and Clinical Management of Familial Hypercholesterolemia Through Integrated Machine Learning, Implementation Science, and Behavioral Economics

PRINCIPAL INVESTIGATOR: Dr. Kevin Volpp

CONTRACTING ORGANIZATION: University of Pennsylvania, Philadelphia, PA

REPORT DATE: July 2022

TYPE OF REPORT: Annual

PREPARED FOR: U.S. Army Medical Research and Development Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release, Distribution Unlimited

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REPORT DOCUMENTATION PAGEForm Approved
OMB No. 0704-0188

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1. REPORT DATE July 2022		2. REPORT TYPE Annual		3. DATES COVERED 01Jul2021-30Jun2022	
4. TITLE AND SUBTITLE Improving Diagnosis and Clinical Management of Familial Hypercholesterolemia Through Integrated Machine Learning, Implementation Science, and Behavioral Economics				5a. CONTRACT NUMBER W81XWH-21-1-0421	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Dr. Dan Rader (Initiating PI) Dr. Kevin Volpp (Partnering PI)				5d. PROJECT NUMBER 0011627111	
				5e. TASK NUMBER	
E-Mail: rader@penncare.upenn.edu , volpp70@wharton.upenn.edu				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Trustees of the University of Pennsylvania 3451 Walnut Street, Ste 440A Philadelphia, PA 19104-6205				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Medical Research and Development Command Fort Detrick, Maryland 21702-5012				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution Unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT The overarching goal of the proposed project is to increase diagnosis and effective treatment of persons with Familial Hypercholesterolemia (FH). The proposed project aims to improve FH diagnosis by (1) using a validated machine learning tool in a large healthcare system (Penn Medicine) to flag individuals at high risk of having FH; (2) employing effective interventions based on implementation science (IS) and behavioral economics (BE) to engage the healthcare system, clinicians, and patients to ensure that the diagnosis of FH is appropriately made; and (3) to improve the uptake of, and adherence to, evidence-based practices (EBP) for these patients, resulting in a reduction in LDL-C and ultimately improved CV outcomes. The project initiated on July 1, 2021 and multiple work streams have been initiated to achieve specific goals of Aim 1 and Aim 2.					
15. SUBJECT TERMS None listed.					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified	Unclassified	14	USAMRDC
					19b. TELEPHONE NUMBER (include area code)

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

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1. INTRODUCTION:

The overarching goal of the proposed project is to increase diagnosis and effective treatment of persons with Familial Hypercholesterolemia (FH). The proposed project aims to improve FH diagnosis by (1) using a validated machine learning tool in a large healthcare system (Penn Medicine) to flag individuals at high risk of having FH; (2) employing effective interventions based on implementation science (IS) and behavioral economics (BE) to engage the healthcare system, clinicians, and patients to ensure that the diagnosis of FH is appropriately made; and (3) to improve the uptake of, and adherence to, evidence-based practices (EBP) for these patients, resulting in a reduction in LDL-C and ultimately improved CV outcomes.

2. KEYWORDS:

Familial hypercholesterolemia, Machine Learning, Implementation Science, Behavioral Economics

3. ACCOMPLISHMENTS:

In the last year of the grant period (7/1/21- 7/31/21) we have accomplished the following:

Meetings:

- Established regular meetings between all stakeholders at University of Pennsylvania and the Family Heart Foundation in order to establish operational and reporting roles and provide opportunities for high level discussion and decision making
- Established sub-teams and ongoing meeting schedules for the following:
 - o Data Informatics Sub-team was established to work on refining the FIND FH[®] algorithm tool that will be applied to Penn Medicine patients at the Hospital of the University of Pennsylvania and Penn Presbyterian Medical Center (HUP/PPMC) for the identification of patients with potential FH for the pilot testing phase (Aim 1). The work stream included extracting and sending a Limited Dataset of electronic health records to the Family Heart Foundation so they could adjust the precision and reach of the FIND FH[®] algorithm tool. Dr. Rader (Initiating PI) obtained high level approval from the VP of Information Services – Analytics & Research at Penn Medicine to designate data informatics resources at Penn Medicine towards extracting and de-identifying the dataset to transfer to the Family Heart Foundation. During the last year, the existing Data Use Agreement (DUA) between the University of Pennsylvania and the Family Heart Foundation was amended to include sharing this new Limited Dataset as a continuation of a foundational project to develop the FIND FH[®] algorithm tool with Penn Medicine. In addition to amending the original DUA, a second DUA was executed between the University of Pennsylvania and the Family Heart Foundation in order to be able to share Penn Medicine patient contact information for the purpose of Family Heart Foundation outreach as part of the piloting phase (Aim 2). This second DUA was required before identifiable patient data could be shared with the Family Heart Foundation for these purposes.

In the last year, the Data Informatics Sub-team adjusted the precision and reach of the FIND FH[®] algorithm tool and were able to optimize and configure the FIND FH model to work on the Penn Population and make adjustments as necessary. After making the necessary adjustments to the model, the Data Informatics Sub-team applied the updated FIND FH model the Penn Population and identified probable FH cases and assigned patients FIND FH scores based on the FIND FH[®] algorithm tool. Roughly 400 patients within the Penn Population were identified by the FIND FH[®] algorithm tool as having probable FH. In the upcoming year, the team is working to identify specific factors and characteristics of missed opportunities by looking at the ‘false negative’ patient population and ‘false positive’ patient population in more detail to refine the algorithm as necessary.

- Implementation Science Sub-team was established to develop interview materials and conduct interviews with both providers and patients (Aim 2). The team consisted of members of the Family Heart Foundation as well as a qualitative expert from the University of Pennsylvania, Dr. Tamar Klaiman, and Co-Investigator, Dr. Rinad Beidas. During the development phase of the qualitative interview guides, the qualitative sub-team met on a weekly basis to refine the interview guides with additional input from Drs. Volpp and Rader to finalize interview guides.

Upon much brainstorming, it was decided that the provider interview would seek to determine ways to effectively implement the FIND FH[®] algorithm tool to increase the screening and diagnosis of FH, in addition to identifying appropriate interventions for the intensification of treatment of FH. The clinician interview guides were finalized during this last year. The clinician interview guides focused on 6 key behaviors: (1) identifying flagged patients who may have FH for further evaluation; (2) engaging the patient and clinician to engage in screening for FH; (3) making the clinical and/or genetic diagnosis; (4) communicating the FH diagnosis; (5) communicating the need to engage with family members around cascade screening; (6) understanding barriers and facilitators for medication initiation, adherence, intensification, and lifestyle changes. In further preparation, two pilot interviews were conducted with two providers outside the sample to help further refine the interview guide. Once the interview guides were finalized and upon the University of Pennsylvania IRB and HRPO IRB approval, we launched recruitment for providers on February 17, 2022, with the goal of conducting 20 interviews with clinicians, or as many as needed until thematic saturation was reached. To date, 17 provider interviews have been completed. After review of the transcripts, the qualitative team determined they had achieved thematic saturation with these 17 interviews.

For the patient interviews, we developed and finalized a patient interview guide that focused on patients' understanding of the risks associated with high LDL-C and family history, the role of genetics in ASCVD risk, and behavioral risk factors, as well as motivators and barriers to behavioral change, particularly in regard to medication adherence and sustainability of behavior change. As with the clinician interview, we conducted two pilot interviews with patients identified by the Family Heart Foundation to refine the interview guides. Upon the University of Pennsylvania and HRPO IRB approval of the patient interview guides, we launched patient recruitment on February 17, 2022, with the goal of conducting 20 patient interviews with individuals who are at high risk for FH, as identified by the FIND FH[®] algorithm tool. To date, 21 patient interviews have been completed.

During the recruitment phase for both provider and patient interviews, the qualitative sub-team continued to meet weekly to discuss and problem solve any recruitment challenges or any questions that arose while conducting the qualitative interviews with providers and patients. During the initial meetings the qualitative sub-team also informally discussed some potential themes that could help inform the implementation strategies of the piloting phase.

- After a majority of the qualitative interviews with providers and patients were completed and transcribed, we established a Qualitative Interview Coding Sub-Team to code the transcripts from the qualitative interviews to inform the development of the pilots. The Qualitative Interview Coding sub-team met on a weekly basis to review interview transcripts and develop codebooks for the interviews to identify core themes that arose from both the provider and patient interviews. The Qualitative Interview Coding sub-team is led by Dr. Tamar Klaiman, a qualitative expert from the University of Pennsylvania. The team is using ATLAS.ti to conduct thematic analysis of the interviews, with Dr. Tamar Klaiman overseeing the entire process.

- The Pilot Development Sub-Team was established in March 2022 to brainstorm and discuss logistics for developing the pilots that will be tested and implemented in the Penn Medicine health system. The team consists of members of the Family Heart Foundation as well as study team leadership at the University of Pennsylvania. During the current development phase, the pilot development sub-team meets on a bi-weekly basis to refine processes, develop specific protocols, and brainstorm ways to build decision support tools in the Electronic Health Record to help clinicians diagnose and treat patients who are flagged by the FIND FH[®] algorithm tool and have probable FH. Since March, the sub-team has outlined the various overarching steps that will be undertaken in the pilots. The pilots will focus on 1) ordering lipid panels for anyone who has been flagged by the FIND FH[®] algorithm tool and does not have a lipid panel on their chart, 2) conducting an internal study team validity check by conducting minor chart review for flagged patients to rule out anyone that does not have FH, 3) encouraging clinicians to diagnose patients who passed the validity check using a study team developed familial hypercholesterolemia diagnosis care protocol (DCP); the DCP will be incorporated within electronic health record decision support tools, after which clinicians will communicate the FH diagnosis to patients with the help of Family Heart Foundation outreach, and lastly 4) encouraging clinicians to prescribe guideline-recommended therapies with the help of electronic health record decision support tools. The pilot development sub-team has been consulting with the informatics team at University of Pennsylvania; the informatics team will be helping to build these decision support tools in the electronic health record system. The pilot development sub-team has also been consulting primary care clinicians, ensuring that we are testing feasible decision support tools that work within clinician workflow. This is an iterative process that involves collaboration and gaining buy-in from many different stakeholders. It is the goal of this group to engage with clinicians to make sure we can build and implement useful decision support tools to enable the diagnosis and treatment of patients with familial hypercholesterolemia. This work is ongoing.

While the team is in the process of deciding exactly which decision support tools to use that will work with clinician workflow in collaboration with primary care clinicians and our informatics team at Penn Medicine, the internal study team has finalized the protocol for the internal study team validity check. The study team has also finalized the FH Diagnosis Care Protocol (DCP), a simplified diagnostic tool for clinicians to use that involves a short series of yes/no questions that will enable clinicians to identify patients with highly probable FH based on their patient charts.

- Initiating and Partnering PIs (Drs. Rader and Volpp) meet with the Project Director bi-weekly to review overall progress

Regulatory Accomplishments:

- Subcontract between the University of Pennsylvania and the Family Heart Foundation was initiated and executed.
- UPenn IRB approval for refining the FIND FH[®] algorithm tool (Aim 1) and conducting the Implementation Science Qualitative Interviews (Aim 2) was obtained on September 16, 2021. The initial HRPO IRB submission for DoD was submitted on October 20, 2021.
- In addition, a Master Collaboration Agreement and Scope of Work templates were fully executed on February 9, 2022, between the Family Heart Foundation and UPenn to cover all upcoming work related to the use of the FIND FH[®] algorithm tool at Penn Medicine and future collaborations.
- The existing Data Use Agreement (DUA) between the University of Pennsylvania and the Family Heart Foundation was amended to include sharing a new Limited Dataset of Penn Medicine electronic health records for the Family Heart Foundation to use to adjust the precision and reach of FIND FH[®] algorithm tool as a continuation of a foundational project to develop the FIND FH[®] algorithm tool with Penn Medicine.
- UPenn IRB modification approval for refining the FIND FH[®] algorithm tool (Aim 1) and conducting qualitative interviews with Penn Medicine patients and providers (Aim 2) was obtained on February 8,

2022. The HRPO IRB modification for the qualitative interviews was submitted to HRPO IRB on February 11, 2022. The qualitative interview modification received HRPO IRB approval on February 15, 2022 (Volpp) and February 17, 2022 (Rader).

- Lastly, a separate Data Use Agreement (DUA) was finalized and approved for execution between UPenn and Family Heart Foundation in order to be able to share Penn Medicine patient contact information for purposes of Family Heart Foundation reach out as part of the BE piloting phase (Aim 2). This DUA is required before identifiable patient data could be shared with Family Heart Foundation for these purposes.

Personnel:

- Dr. Kevin Volpp requested and received approval for a change in Key Personnel. Dr. Mitesh Patel who was originally listed as the Co-Investigator on the award, left the University of Pennsylvania effective 7/1/2021.
- Dr. Volpp and Dr. Patel also identified Dr. Srinath Adusumalli to replace Dr. Patel on the DOD grant, and Dr. Adusumalli agreed to participate. The request to add Dr. Adusumalli on the grant had no impact on the awarded Budget, Specific aims, or Statement of Work and allowed Dr. Adusumalli to seamlessly join the Data Informatics sub-team and provide expertise in machine learning and the Penn Medicine electronic health record. As of the current reporting period, Dr. Srinath Adusumalli is set to leave the University of Pennsylvania effective 7/31/2022. We are currently working on identifying individuals to work with that can provide us with expertise in data informatics and machine learning and the Penn Medicine electronic health record.
- Project Director Laurie Norton was identified to work on the project. Over the last year Laurie Norton, Project Director, continued to oversee work on the project, with specific focus on 1) coordinating the execution of Data Use Agreements between UPenn and the FH Foundation 2) compiling agendas and follow up for the monthly group meetings between UPenn and FH Foundation 3) attending Aim 1 sub-team meetings and 4) regular touch downs with co-PIs Dan Rader and Kevin Volpp.
- Project Manager, Catherine Reale supported the project with a specific focus on 1) IRB and regulatory requirements including the UPenn IRB, the HRPO IRB, eBRAP, and ClinicalTrials.gov and 2) support and coordination of the Implementation Science (Aim 2) Sub-team. During the last year, another Project Manager, Jennifer Orr was hired, and she replaced Catherine Reale on the project starting 1/10/2022. In addition to taking over Catherine's original responsibilities, Jennifer also supported the project with a specific focus on 1) launching the qualitative interviews for Aim 2 and 2) leading the coordinating and development of the piloting phase of the project.
- A Clinical Research Coordinator, Maeve Moran, was hired and started work on this project as of October 25, 2021. Maeve continued to work on the Implementation Science Sub-team to coordinate the qualitative interview process, take meeting minutes, and coordinate upcoming piloting activities. In this last year, with the Aim 2 Sub-team, Maeve finalized the interview guides, and conducted outreach to recruit clinicians for qualitative interviews. Maeve conducted all the clinician qualitative interviews and has helped coordinate the development process for the upcoming pilots. Maeve also facilitated the transcription process of all the qualitative interviews and participated in the initial identification of qualitative interview themes A temporary Clinical Research Coordinator, Jenna Steckel, was brought on to help conduct the patient and provider interviews. Jenna helped finalize the interview guides for the Implementation Science Sub-team, recruited patient participants, and conducted all patient interviews. Jenna is also a part of the Qualitative Interview Coding Sub-Team where she is working under the supervision of Tamar Klaiman to code the interviews using ATLAS.ti.
- A Research Coordinator, Diane MacDougall, was hired by the Family Heart Foundation in August 2021 to coordinate activities between the Family Heart Foundation and University of Pennsylvania and continues to do so.

What were the major goals of the project?

Specific Aim 1: To apply a “big data” machine-learning strategy (the FIND FH[©] tool) to identify individuals at high risk of FH within UPHS EHR databases	Timeline (Months)	Site 1 (Initiating PI)	Site 2 (Partnering PI)	Status	% Complete
Major Task 1: <i>Adjust the precision and reach of the FIND FH[©] tool</i>	1-3	X		Completed	100%
Subtask 1: Work with Penn IT group to secure EHR Limited Dataset	1	X		Completed	100%
Subtask 2: Optimize and configure FIND FH [©] model to work on unrestricted Penn Population	1-3	X		Completed	100%
Subtask 3: Evaluate performance statistics and make adjustments	2-3	X		Completed	100%
Major Task 2: <i>Identify and prioritize undiagnosed probable FH cases</i>	4-5	X		Completed	100%
Subtask 1: Apply updated FIND FH [©] model to Penn Population	4	X		Completed	100%
Subtask 2: Assess and ensure quality of model application	4-5	X		Completed	100%
Subtask 3: Identify probable FH cases and apply triage rules to prioritize the patients for care	4-5	X		Completed	100%
Milestone: <i>Probable FH Individuals flagged and prioritized</i>	5	X		Completed	100%
Major Task 3: <i>Analyze factors associated diagnosis and insufficient treatment for hypercholesterolemia</i>	6	X		In Progress	50%
Subtask 1: Compare model scores with prior FIND FH [©] implementations to assess, improve, and compare scores over time		X		Completed	100%
Subtask 2: Identify specific factors and characteristics of missed opportunities: - ‘False Negative’ patient population – i.e. those training individuals known to have FH that the model scored very low - ‘False Positive’ patient population – i.e. those training individuals known to NOT have FH but that the model scored very high	6	X		Not Started	0%

Specific Aim 2: Apply principles of implementation science and behavioral economics, many of which were pioneered by members of the research team, to design and implement a novel approach in which flagged individuals are reliably evaluated for diagnosis of FH and	Timeline (Months)	Site 1 (Initiating PI)	Site 2 (Partnering PI)	Status	% Complete

appropriately treated					
Major Task 1: Qualitative interviews	1-6		X	In Progress	75%
Subtask 1: Prepare launch of qualitative interviews (Penn IRB submission and approval, HRPO submission and approval, onboard any new staff)	1-3		X	Completed	100%
Subtask 2: Conduct key informant interviews with four stakeholder groups (clinicians and patients from HUP/PPMC and from LGH) to explore barriers and facilitators in diagnosing FH and initiating or intensifying therapy for individuals with FH or taking lipid-lowering therapies	3-4		X	Completed	100%
Subtask 3: Code and analyze interviews with two stakeholder groups	4-5		X	In Progress	16%
Subtask 4: Construction of a behavioral roadmap with guidelines used to refine implementation strategies proposed in the pilots	6		X	Not Started Yet	0%
Milestone: Interviews completed and evaluated	5		X	In Progress	58%
Milestone: Behavioral roadmap completed	6		X	Not Started Yet	0%

What was accomplished under these goals?

Over the first year of the grant period, multiple sub-teams worked to achieve the subtasks/milestones set for Aims 1 and 2. Regular monthly meetings between all stakeholders at the University of Pennsylvania and the Family Heart Foundation provided an opportunity for high level discussion and decision making. These meetings also provided a forum for sub-teams to report on and receive input from the larger group. The Data Informatics sub-team and the Implementation Science Sub-Team continued to meet on a reoccurring basis to refine the FIND FH[®] algorithm tool (Aim 1) and to develop and conduct qualitative interviews that would inform the implementation of the pilot phase (Aim 2).

In the last year, the Aim 1 Data Informatics Sub-team met as needed to refine the FIND FH[®] algorithm tool. In this last year, they applied the FIND FH[®] algorithm tool to the Penn Medicine patients at the Hospital of the University of Pennsylvania and Penn Presbyterian Medical Center (HUP/PPMC) to identify patients with potential FH for the pilot testing phase. The Family Heart Foundation adjusted the precision and reach of the FIND FH[®] algorithm tool using the Limited Dataset of electronic health records for the Penn Population. The Family Heart Foundation assessed and ensured the quality of the application of the FIND FH[®] algorithm tool and modified the final model to be more inclusive of the entire Penn Population dataset.

In the last year, the Implementation Science Sub-team developed the interview guides. After receiving University of Pennsylvania IRB modification approval (obtained on February 8, 2022) and HRPO IRB approval (obtained on February 15, 2022 – Volpp, & February 17, 2022 – Rader) for refining the FIND FH[®] algorithm tool (Aim 1) and conducting qualitative interviews with Penn Medicine patients and providers (Aim 2), the Implementation Science Sub-team launched the qualitative interviews. The team recruited 53 participants and completed interviews with a total of 38 participants. A total of 17 interviews with clinicians and 21 patient interviews were conducted, and upon reviewing the transcripts, the Implementation Science Sub-team determined they had received thematic saturation with the 38 interviews.

As the Implementation Science Sub-Team wrapped up the qualitative interviews with clinicians and providers, a Qualitative Coding Sub-Team was established. The Qualitative Coding Sub-Team met weekly to review the interview transcriptions and develop codebooks for the thematic analysis of the interviews under the guidance of our qualitative expert. In the last month, the Qualitative Coding Sub-Team has coded 6 (5 patient, 1 clinician) of the 38 qualitative interviews.

An additional Pilot Development Sub-Team was established between all stakeholders from both groups to brainstorm and develop the process for the pilots. During this last year, the Pilot Development Sub-Team has finalized the Study Team Validity Check process as well as the Familial Hypercholesterolemia Diagnosis Care Protocol, which are key components that will be used in several the steps for the pilots that will be implemented within the Penn Medicine healthcare system.

The overall research staffing shortages and hiring freezes due to Covid-19 that had initially presented obstacles to hiring staff continue to impact the timeline. Staff were hired, onboarded, and trained during the last year on the grant. Laurie Norton, Project Director, continued to oversee work on the project, with specific focus on 1) coordinating the execution of Data Use Agreements between UPenn and the Family Heart Foundation 2) compiling agendas and follow up for the monthly group meetings between UPenn and Family Heart Foundation 3) attending Aim 1 sub-team meetings and 4) regular touch downs with co-PIs Dan Rader and Kevin Volpp. Jennifer Orr, Project Manager took over for Catherine Reale's former activities and worked on moving forward the 1) IRB and regulatory requirements including the UPenn IRB, the HRPO IRB, eBRAP and ClinicalTrials.gov, 2) support and coordination of the Aim 2 sub-team interviews, and 3) managing the brainstorming and meetings to discuss the upcoming piloting phase of the project. Maeve Moran, a Clinical Research Coordinator continued to work on the Aim 2 sub-team and coordinate the qualitative interview process, conducted provider interviews, took meeting minutes, and worked to coordinate upcoming piloting activities. Jenna Steckel, a temporary Clinical Research Coordinator continued to help conduct the patient interviews and contributed to the coding of the qualitative interviews. A Research Coordinator, Diane MacDougall at the Family Heart Foundation, continues to coordinate activities between the Family Heart Foundation and University of Pennsylvania.

REGULATORY PROTOCOL AND ACTIVITY STATUS

In the last year, the University of Pennsylvania acquired IRB approval for refining the FIND FH[®] algorithm tool (Aim 1) and conducting the Implementation Science Qualitative Interviews (Aim 2) on September 16, 2021. The initial HRPO IRB submission for DoD was submitted on October 20, 2021.

The University of Pennsylvania submitted a modification to the UPenn IRB once the qualitative interview guides were finalized for the clinician and patient interviews. The UPenn IRB modification approval for the qualitative interviews was obtained on February 8, 2022. The HRPO IRB modification for the qualitative interviews was submitted to HRPO IRB on February 11, 2022. The qualitative interviews modification received HRPO IRB approval on February 15, 2022 (Volpp) and February 17, 2022 (Rader).

In the last year, a subcontract between the University of Pennsylvania and the Family Heart Foundation was initiated and executed. Additionally, both a Master Collaboration Agreement and Scope of Work template were fully executed as of February 9, 2022, between the Family Heart Foundation and the University of Pennsylvania to cover all upcoming work related to the use of the FIND FH[®] algorithm tool at Penn Medicine and future collaborations.

As part of this study, in the last 2 years, an existing Data Use Agreement (DUA) was amended, and a new DUA was executed for the purposes of the study. An existing DUA between the University of Pennsylvania and the Family Heart Foundation was amended to include sharing a new Limited Dataset of Penn Medicine electronic health records for the Family Heart Foundation to use to adjust the precision and reach of the FIND FH[®] algorithm tool as a continuation of a foundational project to develop the FIND FH[®] algorithm tool with Penn

Medicine. A separate Data Use Agreement (DUA) was finalized and approved for execution between UPenn and Family Heart Foundation in order to be able to share Penn Medicine patient contact information for purposes of Family Heart Foundation reach out as part of the BE piloting phase (Aim 2). This DUA was required before identifiable patient data could be shared with Family Heart Foundation for these purposes.

PROTOCOL (1 of 1 total):

Protocol [ACURO Assigned Number]: **PR201840P1**

Title: **Improving diagnosis and clinical management of familial hypercholesterolemia through integrated machine learning, implementation science, and behavioral economics**

Target required for statistical significance: **38 (21 patients and 17 providers)**

Target approved for statistical significance: **40 (20 patients and 20 providers)**

Total subjects to date: 38

SUBMITTED TO AND APPROVED BY:

Ms. Jill Graygo, MPH, MSED

STATUS:

			Enter information regarding number of subjects					
<u>HRPO Protocol Number</u>	<u>Protocol PI Name</u>	<u>Organization (Site)</u>	<u># Target</u>	<u># Enrolled</u>	<u># Completed</u>	<u># Screened</u>	<u># Recruited</u>	<u>Other</u>
PR201840P1	Dr. Kevin Volpp	UPENN	40	38	38	38	53	

What opportunities for training and professional development has the project provided?

Nothing to Report

How were the results disseminated to communities of interest?

Nothing to Report

What do you plan to do during the next reporting period to accomplish the goals?

The full project team and all sub-teams will continue to meet regularly to accomplish the goals set out in Aims 1 and 2. The Family Heart Foundation and Data Informatics sub-team will finalize the patient list identified by the FIND FH[®] algorithm tool and send the list to the University of Pennsylvania study team for further validation and to tee up the pilot phase.

The coding of the qualitative interviews with providers and patients for Aim 2 will conclude in Q1 of Year 2. Additionally, regular meetings will continue to proceed with the Pilot Development Sub-team focused on the design and execution of the piloting phase. The Pilot Development Sub-team will continue to engage with

external stakeholders to get input on the feasibility and practicality of potential decision support tools in Penn Medicine's electronic health record and the impact this will have on clinician workflow. Sub-teams will continue to expedite work wherever possible to make up for time lost in this last year to Covid-19 related delays.

4. **IMPACT:**

What was the impact on the development of the principal discipline(s) of the project?

Nothing to Report

What was the impact on other disciplines?

Nothing to Report

What was the impact on technology transfer?

Nothing to Report

What was the impact on society beyond science and technology?

Nothing to Report

5. **CHANGES/PROBLEMS:**

Changes in approach and reasons for change

Nothing to Report

Actual or anticipated problems or delays and actions or plans to resolve them

There were delays in getting this study up and running due to Covid-19 related constraints in the last year, and our subtask and milestone completion dates are still behind schedule. However, we are more on track than before, and we plan to redouble our efforts to achieve our subtask and milestone completion dates whenever possible in the following year as we move forward on the development and execution of the piloting phase.

Changes that had a significant impact on expenditures

Nothing to report

Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Significant changes in use or care of human subjects

Nothing to Report

Significant changes in use or care of vertebrate animals

Nothing to Report

Significant changes in use of biohazards and/or select agents

Nothing to Report

6. PRODUCTS:

- **Publications, conference papers, and presentations**

Nothing to Report

- **Journal publications.**

Nothing to Report

- **Books or other non-periodical, one-time publications.**

Nothing to Report

- **Other publications, conference papers and presentations.**

Nothing to Report

- **Website(s) or other Internet site(s)**

Nothing to Report

- **Technologies or techniques**

Nothing to Report

- **Inventions, patent applications, and/or licenses**

Nothing to Report

- **Other Products**

Nothing to Report

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

Name	Project Role	Researcher Identifier	% Effort	Contribution to Project:	Funding Support:
Dan Rader, MD	Initiating PI		10%	Initiating PI, Oversight	Grant
Kevin Volpp, MD, PhD	Partnering PI		10%	Partnering PI, Oversight	Grant
Rinad Beidas, PhD	Co-Investigator		10%	Co-investigator - oversight of Implementation Science	Grant
Sri Adusumalli, MD, MSc, FACC	Co-Investigator		2%	Co-investigator, advises on Penn Medicine Data Informatics	Grant
Tamar Klaiman, PhD	Sr. Qualitative Research Scientist		5%	Oversight of qualitative framework approach, Interview guide development for patients and providers	Grant
Laurie Norton	Project Director		20%	Project administration, budget oversight, grant reporting, support for Data Informatics sub-team	Grant

Jennifer Orr	Project Manager		50%	IRB, regulatory, support for Implementation Science sub-team, pilot planning	Grant
Maeve Moran	Clinical Research Coordinator		50%	Overall project support, support for Implementation Science sub-team, qualitative interviews	Grant
Jenna Steckel	Clinical Research Coordinator		50%	Qualitative interviews	Grant

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

Nothing to Report

What other organizations were involved as partners?

Organization Name: Family Heart Foundation

Location of Organization: 680 E. Colorado Blvd. Suite 180, Pasadena, CA 91101

Partner's contribution to the project:

Collaborator: The Family Heart Foundation is a non-profit research and advocacy organization founded in 2011 to address gaps in healthcare that lead to misdiagnosis, delayed care, preventable heart attacks, the need for stents or coronary artery bypass graft surgery, and premature death for individuals with FH. The Family Heart Foundation collaborates closely with the UPenn group. This includes regular monthly leadership meetings between UPenn and Family Heart Foundation for high level discussion and decision making. In addition, the sub-teams are comprised of UPenn and Family Heart Foundation collaborators who are developing the qualitative interviews and focus groups to inform the Implementation Science approaches as well the Data Informatics sub-team, comprised of experts at both UPenn and the Family Heart Foundation who will refine and implement the FIND FH[®] algorithm tool.

SPECIAL REPORTING REQUIREMENTS

COLLABORATIVE AWARDS:

QUAD CHARTS:

A Quad chart is not applicable. A duplicative report will be submitted by both the Initiating PI (Dr. Rader) and the Collaborating PI (Dr. Volpp).

8. APPENDICES:

Nothing to Report