Report No: AUS0002876

Estonia
Enhanced Care Management in Estonia
Project summary and findings

May 2022

DIME Team

ACRONYMS

DIME	Development Impact Evaluation
ECM	Enhanced Care Management
EHIF	Estonia Health Insurance Fund
GP	General Physician
ICD10	International Classification of Diseases 10
LMIC	Low-and-Middle Income Countries
NCD	Non-Communicable Diseases
QBS	Quality Bonus Scheme
RAS	Reimbursable Advisory Services
RCT	Randomized Control Trial
SIEF	Strategic Impact Evaluation Fund
UK	United Kingdom
US	United States
WBG	World Bank Group

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

Non-communicable diseases (NCDs) have become a major area of policy interest in the industrialized world over the last few decades and are emerging as a global issue as low- and middle-income countries (LMICs) continue their demographic transitions.

- **Non-communicable diseases such as diabetes, hypertension, and cardiovascular diseases account for over 70% of deaths worldwide[1].** The burden of co-occurrence of multiple chronic illnesses, also known as multi-morbidity, is worsening for adults in high-income countries. Multiple chronic conditions become more common with aging populations and can lead to high mortality, high expenditure on inpatient, specialized and ambulatory services, and reduced functionality[2-4].

- More than three-quarters of fatalities from NCDs now occur in low- and middle-income countries (LMICs)[1]. In sub-Saharan Africa, NCDs are projected to be the leading cause of fatalities by 2035. In India, 60% of all fatalities can be attributed to NCDs[6]. Thus, there is an urgent need for the World Bank to better understand the treatment of NCDs.

- NCDs are particularly damaging for vulnerable and aging populations in LMICs, especially in the absence of high-quality universal health coverage. In Latin America and the Caribbean, older people are 1.5 times more likely to utilize outpatient healthcare services and twice as likely to be hospitalized, causing a substantial financial burden due to healthcare costs amongst older populations[7]. Programs that provide financial and social support for managing NCDs, or that reduce the need for expensive out-of-pocket care, are therefore essential for the Sustainable Development Goals (SDGs) on reduction in health inequality[8].

- Improving quality is a universal priority in health care systems. **One response has been a global move towards a more patient-centered primary care model**. This includes more proactive care by primary care physicians and their team in coordinating care for patients based on their specific needs for specialist care, nursing care, preventative care, and social services care. However, the evidence bases on how best to design patient-centered primary care models at scales that fit within feasible budget constraints is limited. Given the Bank's expertise in the administration of health services across the world, it can play a catalytic role in developing the evidence base for building such models.

Estonia offers a unique opportunity to produce rigorous evidence on improvement of NCD management by health authorities.

- Estonia has a unique public health system that has gone through tremendous transformations since Independence and the establishment of its national insurance scheme. With a national push to improve and expand primary care services to the population, coupled with the availability of

digital medical records to track utilization and cost, Estonia provides a health care system capable of deploying and evaluating the impact of primary care for NCDs on a multidimensional range of outcomes.

- The Health Nutrition and Population Global Practice at the World Bank Group (WBG) conducted two phases of Reimbursable Advisory Services (RAS) led by Marvin Ploetz and Ian Forde in partnership with the Estonia Health Insurance Fund (EHIF) in 2017. The first RAS was an assessment of strategies to roll out the program that will be assessed in this report, coupled with technical assistance developing the framework for the Enhanced Care Management (ECM) program for NCDs. They found that many inpatient hospital admissions and outpatient services were avoidable needs for some chronic conditions. The main suggestion from this evaluation was that a more proactive primary care setup would improve the performance of the Estonian health care system. For the second RAS, the WBG team supported the implementation of a pilot of ECM which created a roadmap for scale up and measurement of ECM across primary care. Thus, this report builds on a long-term and productive relationship between the World Bank and EHIF.

- As part of the 2017 RAS, a pilot of the ECM program was undertaken. The pilot conducted by the WBG team was small in scale, with just 10 physicians who were early adopters of the practices promoted in the ECM program. To find evidence of ECM at scale, EHIF agreed to develop and implement a randomized control trial of ECM with the research team at DIME, in partnership with researchers at the Harvard T.H. Chan School of Public Health and Georgetown University. This RCT would include different components of analysis of the intervention such as field survey of physicians, use of the EHIF billing data to track impact of the program, costing of the implementation and healthcare utilization, and implementation fidelity assessment of the program during initial scale up.

- Since 2019, the ECM research team has successfully negotiated licensed access to the entire EHIF insurance billing data for the last ten years. As such, the relationship between EHIF and DIME has continued to provide both practical guidance to EHIF's programming as well as unique insights for the Bank's wider work in the delivery of health services for combatting NCDs.

This report outlines how the ECM Evaluation Team has successfully paired EHIF's pilot expansion of the ECM program with a well-powered RCT design at the clinic and patient levels.

- **The ECM intervention consists of training and coaching doctors and their teams to develop holistic care and proactive outreach plans for chronically ill patients or those vulnerable to developing chronic illnesses**. ECM incorporates four key elements: identifying high-risk patients through risk stratification, developing care management plans by the primary care physician, proactively linking care physicians towards providing more holistic care of patients, and developing a collaborative approach to healthcare with patients and/or their caregivers.

- Due to delays caused by the COVID-19 pandemic in Estonia, the program's rollout to physicians began in the fourth quarter of 2020. Leading up to this, the research team conducted assessments of the medical system, and developed and reached agreement with EHIF and members of the Estonian Family Doctors Association on an approach for a two-stage randomized trial -- first, randomizing clinics into the ECM program; then, randomizing assignment among eligible patients, in line with practical and budgetary constraints.

- **The RCT randomly assigned 144 family physicians of 786 practicing to the ECM program.** By the time of patient randomization, 97 physicians (71 clinics) who were offered ECM had agreed to participate in the program and 47 refused to be enrolled/ had dropped out.

- **Among those 97 participating physicians' 6,739 ECM-eligible patients, the RCT randomly assigned 2,389 patients into the ECM program.** It did so using stratified randomization across clinics and the intensity of patient chronic illness, allowing for a nuanced set of results within those groups. Using complete insurance billing records with a 10-year history, we will evaluate effects of ECM enrollment on: (1) Patient healthcare utilization throughout the health system; (2) ECM physicians' patient management behavior; and (3) ECM patient health outcomes over time. Design-based estimates based on baseline data indicate the study is well-powered to detect relevant changes in key outcomes. The evaluation is one of the most detailed of its like in the world.

- Since the rollout, EHIF has successfully:
  - Deployed the training program for the practices in collaboration with its field coordinators serving as coaches.
  - Completed the enrollment of physicians into ECM program in November 2020.
  - Implemented three field surveys with ECM physicians and coordinators for tracking progress.
  - Completed the enrollment of patients in the ECM program in two phases. The first phase was completed in June 2021 and the second in September 2021.
  - Started patient enrollment of ECM assigned patients since August 2021.
  - Currently, physicians are completing patient enrolment and making care plans for the patients included in ECM.

- As of April 2022, 85 out of 144 assigned physicians have successfully participated in ECM, after an attrition of 59 physicians. Of participating physicians, 60 physicians have started enrolling patients assigned to the ECM program and 40 have completed making care plans for all patients assigned to ECM.

- As of April 2022, 56% of the eligible patients assigned to ECM have been enrolled with a care plan. Since the launch of the program to patients in August 2021, there is a statistically significant increase in the average annual consultations with nurses and physicians per person for eligible

patients assigned to ECM compared to eligible patients assigned to control. This trend stays the same for mild/moderate risk eligible patients.

- As such, this trial provides concrete evidence of the successful rollout of an enhanced care model targeted at reducing NCDs. Continued tracking of patients in the multiple arms will allow EHIF for an understanding of the long-term benefits of such a program on patient health.

- This report:
  - Summarizes all the key activities conducted as a part of the intervention,
  - Provides a timeline of all ECM activities conducted,
  - Provides a measurement framework for the evaluation of the program,
  - Describes the results of the baseline surveys conducted and,
  - Summarizes the initial intent-to-treat results on the patient population assigned to the program.

KEY RECOMMENDATIONS

An example for the Bank's wider work on chronic care

- This report provides indications that Estonia's Enhanced Care Management Program has positively impacted on the relationship between health services staff and targeted patients. As such, it provides some of the first evidence of the success of a large-scale healthcare management scheme targeting NCD-affected patients. **This provides EHIF with a strong foundation on which to build and refine on ECM further, and a case study for other countries to learn from.**
- The study also provides an example of how changes in the administration of health can have direct impacts on the quality of care downstream.

Building on ECM's current strengths

- Clinic staff have welcomed these developments but required significant handholding from a set of dedicated coordinators and trainers at the launch of the scheme. Such a dedicated set of resource persons, with each GP associated with a dedicated trainer, was critical to the success of the scheme. **As such, the scale-up of ECM to other clinics will require a similar level of support from EHIF staff. Similarly, the initiation of schemes in other countries should make resources available for such a cadre of coaches in the early stages of program development and outreach.**
- **Patient care plans should be reviewed to be more engaging, along the lines of the international best-practice examples shared by the evaluation team.** These should be automatically generated in clinic software and embedded in a wider pack of motivating literature.

Inclusion criteria for patients

- **ECM should experiment with targeting vulnerable, but not yet chronically ill patients.** Vulnerable patients are often those for whom improved interactions with their GP can have the most significant health benefits by limiting the onset of chronic conditions. Though this impact evaluation attempted to include such a population, GPs found the guidance provided difficult to implement. Further work should be undertaken on creating a set of guideline s
- Currently, the EHIF algorithm that identifies patients at risk targets all patients at least 18 years old that meet other requirements (diagnosed with chronic conditions). It was observed during implementing ECM activities that patients of older age (for instance above 85 years) are benefiting less from the scheme due to memory issues and difficulty in engaging with the care team or implementing ECM activities on a routine basis. **Thus, an upper age limit should potentially be imposed on inclusion in the scheme.**
- **EHIF should trial inclusion of a small random sample of patients not currently assessed as at risk from across the patient lists.** This will allow EHIF insights into whether there are groups who would benefit from ECM but are not yet targeted.

Evaluation work in the future

- **A review of workload between doctors and nurses should be made over the year to come to ensure that ECM guidance optimizes the workload and effort by physicians to provide better care for their patients across clinics.** This can be monitored using the new program codes setup under the evaluation and program rollout. Where nurses have been able to provide greater support, they may be able to provide capacity building or guidance to their colleagues in other clinics.

- The success of such patient-centered care models relies on coproduction of care and active coordination between physicians, nurses and patients themselves. **It would be useful to undertake a survey of ECM patients in the coming year to assess their experience with the scheme.** The current impact evaluation did not have resources for such an exercise, but such measurement would be advisable.

- **There should be a continuation of the evaluation approach set out by this impact evaluation for next few years.** This means holding constant treatment and control groups within their current status. Such an approach will allow EHIF to continue to assess how the ECM scheme impacts on citizen health. The costings we calculated for the program should be judged against wider health benefits. Given the delays due to COVID, such benefits cannot be identified at this stage. A current strength of the program is the randomisation of patients.

- **Throughout scale-up, randomisation of patients as outlined in this report should be continued.** This will allow for further analysis at the clinic level as to where the program is working and where greater efforts are required to improve its efficacy.

- The goal of NCD care programs in the long-term is to reduce costs and stress on the health care system caused by advancing chronic illness. **EHIF should plan a five-year review to assess whether corresponding reductions in patient costs are observed and how these compare to program costs** (such as those outlined in this report).

1. INTRODUCTION

Prevalence of NCDs

Multiple chronic conditions become more common with aging populations and can lead to high mortality, high expenditure on inpatient and ambulatory services, and reduced functionality[2-4]. Based on the Survey of Health, Ageing and Retirement in Europe (SHARE) in 2013, Eastern and Central European countries have the highest share of prevalence of multiple chronic conditions at 35.2% and 34.8% respectively[10]. In England, estimates point to an increase in the prevalence of multiple chronic conditions by 2035, especially for individuals with more than four conditions[11]. Some of the most common chronic disease co-occurrences include diabetes as the primary condition, clustered with cardiovascular diseases, chronic obstructive pulmonary disorder (COPD), ischemic heart disease, and stroke[12].

With an increase in multi-morbidity over time, epidemiological findings of the prevalence of multiple chronic illnesses suggest that single-disease-oriented health care practices may be less effective in delivering high-quality care as opposed to holistic patient centered healthcare[13-14]. Previous research has associated the need for collaborative management of chronic illness arising from patients' difficulties in functional problems of ageing and implementing lifestyle changes to prevent chronic illness[15]. In most low- and middle-income countries, chronic NCDs are the leading cause of deaths, with roughly 80% of NCD-related deaths occurring in LMIC[16-17]. LMIC suffer a more rapid rate of mortality or disability due to NCDs relative to higher income countries[18-19].

The gaps in holistic and high-quality care for patients in health systems in the US and Europe has been extensively documented. Patient-centered care models have increasingly become more comprehensive, incorporate health system wide elements such as social services, high degree of physicians and patient interaction. There has been some documented evidence on impact of ECM-like programs on reducing hospitalizations, reducing total medical expenditure and reducing inpatient admissions[20]. There has also been some impact reported on patient health management outcomes such as glycosylated haemoglobin (HbA1c), body mass index (BMI), systolic blood pressure (SBP)[21].

However, there is little research that demonstrates how such programs can be designed to be effective; and, if so, whether policy-relevant effects may arise through changes in utilization; changes in physician behaviour; or actual changes in health status and outcomes. Based on a review of 12 studies using lighter versions patient-centered care models before 2010 in the US, their findings were inconclusive on changes in the quality of care provided, cost of care, patient and physician experience but showed suggestive evidence of reductions in hospitalizations and emergency department utilization[22].The most recent evidence from 16 randomized control trials on impact of interventions for multiple chronic illnesses showed very little evidence on change mental health and quality of life, mixed effect on patient functionality and patient health behaviour, medicine management[23].

Estonian context

Estonia provides a unique setup for implementation and evaluation of patient-centered care models for chronic illness management, as well as a unique data system allowing more powerful experimental design and multi-dimensional outcome evaluation. Following the restoration of independence from the Soviet Union in 1991, Estonia led a reform in its healthcare system by creating the national insurance system through the independent Estonian Health Insurance Fund (EHIF) in 2001 and strengthening the use of and incentives for primary healthcare network. Some of the reforms include introduction of the Quality Bonus Scheme (QBS) to incentivize preventative care provision in 2006, expansion of nurse services, establishment of a digital health system to enable digital access to health services such as prescriptions, lab tests and health records in 2008, and adoption of primary healthcare development plan which increases service provision by primary health care physicians and focuses on chronic illness management and improving care continuity[9,24,25]. This was one of the first national level initiatives to incorporate primary health care into family medicine[9].

Estonia has a population of 1.3 million and life expectancy of 78.4 years[26]. Based on an epidemiological study on chronic illness prevalence in 2017, approximately 50% of the population was above the age of 44 and 50% of the total population had at least one chronic illness. The study also found that the share of multiple chronic illness increased with age groups such that amongst the individuals between the ages of 0-18, 18.2% had at least one chronic illness and 3.4% had multiple chronic illnesses. Whereas for individuals between ages of 45 and 65.6% had at least one chronic illness and 71% had multiple chronic illness. Hypertension was found to be the most common illness for the oldest age cohorts, followed by chronic pain associated and arthritis[27].

These population changes have translated into increasing use of specialist and emergency care, straining physicians as well as national health budgets. In response to these developments, the Estonia Health Insurance Fund (EHIF) is attempting to improve proactive management of NCDs by incentivizing and supporting primary care physicians to adopt a new method of organizing care for patients identified as high risk for NCD related complications and have increased use of secondary and tertiary health services. The new program, known as Enhanced Care Management (ECM), involves training family physicians to develop proactive care plans with patients and undertake more active outreach and management with high-risk patients, identified using national health records.

The DIME team at the World Bank Group is conducting a randomized control trial (RCT) in partnership with EHIF to evaluate the impact of ECM on primary health care for NCDs. The RCT randomly assigned 144 family physicians of 786 practicing in Estonia into the ECM program. Among those who were offered to participate in the program, 97 physicians agreed to enrol in the program. Among those 97 physicians' who agreed to participate by the time patient randomization was conducted, 6,739 ECM-eligible patients, the RCT randomly assigned 2,389 patients into the pilot program. Using complete insurance billing records with a 10-year history, we will evaluate the effects of ECM enrolment on:
(1) Patient healthcare utilization throughout EHIF's network of patients and physicians;

(2) ECM physicians' patient management behaviour; and

(3) ECM patient incidence of new conditions over time.

For this report, we will show the initial uptake and treatment effect of making the program available to the ECM assigned patients on the usage of the ECM set codes by utilizing the billing data from August 2021 (start of the intervention).

2. THE ENHANCED CARE MANAGEMENT (ECM) PROGRAM

The Estonian government has launched a program to better manage the burden of chronic illness with primary care services. In Estonia, primary care doctors run private practices, but essentially 94% of the population is covered by national insurance. The Estonian Health Insurance Fund finances and regulates physician practices through law and contractual agreement: It sets reimbursement rates and practice guidelines with the University of Tartu, manages the assignment of patients to physicians, and conducts extensive quality controls.

In 2019, EHIF introduced the **Enhanced Care Management (ECM)** intervention consisting of training and coaching doctors and their teams to develop holistic care and pro-active outreach plans for chronically ill patients or those vulnerable to developing chronic illnesses. These services are intended to eventually be provided by all of Estonia's 786 primary care doctors ("family physicians'') located across 421 clinics. The core goal of ECM is to improve the quality of care provided to complex patients, including by increasing the use of preventive care, better coordinating care across health system levels, and increasing patient involvement in care. These elements can improve patient health and quality of life and may reduce the need for curative medical services -- for example, by supporting patients with diabetes to improve their diet and increase their level of fitness to limit further deterioration in their health.

ECM practices include improved tracking of tests and referrals, follow-up after hospital discharges, tracking medication adherence, monitoring between clinic visits, and focusing on achieving clinical quality. It includes four elements: identifying high-risk patients through risk stratification, developing care management plans by the primary care team, proactively linking care physicians together, and developing a team approach with patients and their care team. Note that the rollout of ECM discussed here did include an attempt to involve those patients who were regarded by Physicians as 'at-risk' of developing chronic illnesses in the near future. By involving those, for example with high body mass index, unhealthy dietary habits and exercise regimes, it was intended that the evaluation could identify the impacts of ECM on 'at-risk' patients as well as those who had already developed chronic illness. However, Physicians were unable to identify sufficient candidates. **Section 4.7** provides further details and recommendations related to this group.

3. INTERNATIONAL EVIDENCE OF BEST PRACTICES

While developing the core activities of ECM, the DIME team conducted information sessions highlighting elements of *ECM like programs* in other countries. The insights from these sessions are summarized by topic in this section.

3.1 CARE MANAGEMENT FOR CHRONICALLY ILL PATIENTS

In July 2020, the DIME team presented EHIF with a summary of chronic care management programs from the UK, USA, Australia and Sweden (**Appendix 1a**). The presentation focused on common elements of care management programs implemented across all four countries:

Element 1: Patient classification: Many programs have implemented policies that identify and target high-risk patients for care management. Programs in the UK created a risk stratification of patients to provide more personalized care management for the people identified as risky. In this approach, all patients are divided into a few defined strata of risk. Though the risk stratification impacted healthcare utilization, there was no indication of improvements to patient health. However, other programs in the US classified patients based on high-need and high-cost and provided support to each of the targeted to their need.

Element 2: Multidisciplinary support teams: Enhanced care programs involve active engagement of patient needs with a support team that includes clinicians, nurses, pharmacists and non-traditional health workers such as community health workers and social workers. The non-traditional support helps not only the patient but also the doctors. The studies reviewed by the DIME team indicate that using a multi-disciplinary support team could reduce hospitalization, mortality, emergency admission.

Element 3: Connection to community and social services: Linking primary care to social services was an integral but untapped resource to improve patient wellbeing. The NHS for instance, has included social referral options where primary care physicians can link patients to support services within the community. These services have proven to increase patient confidence, wellbeing and freed up physician's medical guidance time.

Element 4: Patient self-management support: There is evidence suggesting that helping patients to be better self-managers improves outcomes on a range of chronic illnesses. Even some low intensity behavioural interventions can improve health status of patients. Effective strategies include sharing educational resources with patients that can allow them to self-monitor.

3.2 DESIGNING CARE PLANS FOR ECM

The DIME team conducted a review of care plans implemented in other ECM like programs and summarized a few key guidelines to creating successful care plans (**Appendix 1b**):

Establishing trust through branding: Clear identification of a program generates trust in the quality of the program. Reliable identification can be built by using easily identifiable and consistent logos, covering information on the cover page, connecting with higher government officials, sharing contact information.

Using affirmative language: NHS guidelines focus on using reassuring, empowering, personalized and factual phrases to keep the patients motivated, their care personalized and keep them informed. Care plans should include clear recommendations of dos and don'ts with appropriate reasoning. In general, plans should be accessible and easy to understand. Plans from NHS and Sweden emphasize using personal language to increase connection with the patient who will be using the care plan. Care plans should incorporate other family members in the overall patient care and give detailed information on social care integration for patient care.

Personalization of patient content: Care plans should generally have a section specific to the patient's needs and goals. This can include workbooks for patients to self-monitor certain conditions, progress reports which can be used by the physicians as well. These can include self-testing, home activities and record patient reflections on their health and emotions.

3.3 FRAMEWORK TO SUPPORT ECM CLINIC STAFF

The DIME team conducted literature reviews of other ECM like programs to identify core values to support clinic staff in understanding their role and relationship with implementation of such programs (**Appendix 1c**). The core lessons for ECM were:

Assessing individual and organizational identity: The team recommended conducting baseline surveys of all clinic staff to understand their general attitudes towards the transition, their current levels of satisfaction with their practice.

Introducing the new way of working: With official documents such as "letter of enrolment" can signal to clinic staff that for the patients enrolled in ECM, need more holistic care. Clinic staff should adjust their approach to targeting care based on identification of vulnerable patients in their list and incorporate community resources to their care. This helps in building a sense of collectivism to care provision where clinic staff and doctors understand the role of the "team" in providing enhanced care.

Edutainment: Short videos, newsletters case studies can help physicians understand the change in their role as the health system is changing with implementation of ECM.

Self-reflection: Utilizing the coaching sessions with coordinators that explore the idea of enhanced health management and understanding chronic care practices. These peer sessions help to overcome potential professional identity resistance, align individual goals with ECM's goals.

4. ROLL-OUT OF ECM

Since 2020, the DIME team and EHIF have maintained a collaboration to provide technical assistance to setting up ECM, a framework for evaluation of ECM, engagement with EHIF staff and coordinators to better understand the challenges of clinic staff to the novel approaches and measure the implementation of ECM by means of surveys and analytics from the billing data. Some of the milestones for the roll-out of ECM are:

4.1 DISRUPTION DUE TO COVID PANDEMIC

Due to delays caused by the COVID-19 pandemic in Estonia, the program's rollout to physicians began in the first quarter of 2021. Leading up to this, the research team conducted assessments of the medical system, and developed and reached agreement with EHIF and members of the physician's association on an approach for a two-stage randomization trial – first, randomizing clinics into the ECM program; then, randomizing enrolment among eligible patients, in line with practical and budgetary constraints.

4.2 ECM OPERATING FRAMEWORK

After a thorough review of other ECM like programs, the DIME team and EHIF had extensive discussions regarding elements of ECM such as:

- *Introduction of patients to ECM*: EHIF and the DIME team discussed creating welcome packs for all patients enrolled in ECM. The pack would explain the details of the program, central and local resources for the patient, and start the official onboarding process for the patient. The packet would contain a care plan for the patient and space for patients to write their self-management goals.
- *Clinic ECM relationship:*
    - Both teams discussed the idea of baseline surveys for the clinic staff to understand receptiveness to the program.
    - The teams discussed training of the clinic staff with the coordinators. The training will include enrollment of patients, follow-up visits with coordinators to discuss challenges faced in understanding or implementing ECM elements.
    - The teams discussed conducting an endline survey of the clinic staff at the end of this pilot to get feedback on specific elements of the program.
- *Patient support program:* The teams discussed ideas of patient support by four different models:
    - Clinic led model in which the clinic staff will get training on prioritizing and managing communication with patients,
    - Coach led model in which a coach manages 20 clinics in terms of managing follow up schedule with patients, support clinic staff for a few hours per day
    - Specialized coach-led model in which there is a coach in every clinic, and it is the point of contact for all non-medical needs

- Additional staff led model is a call-center like model in which one or more staff is hired to handle patient calls and all non-medical needs

Each of these discussions strengthened ECM by improving the design of the program or linking it more clearly to international best practice. As such, the embeddedness of the evaluation team with the ECM development team has ensured a continued role of the World Bank in building the ECM program on from the 2017 RAS.

4.3 ECM MEASUREMENT FRAMEWORK

Evaluating whether ECM has any impact on patient experience and health, or other outcomes is key to whether it should be sustained, reformed, or targeted to a subset of patients. A rigorous, micro-level evaluation of ECM will provide the evidence base on which to assess the efficacy of ECM and maximize the use of public resources. The DIME team, EHIF and Ariadne Labs constructed a measurement framework (**appendix 3**) combining all the discussions on evaluating ECM which includes:

- Explaining the method of physician and patient randomization into the ECM program.
- Defining the primary surveys to be conducted at each level of implementation:
  - A survey for all nurses and physicians in Estonia emphasizing on changes in their psychosocial self-care, working and management style due to COVID-19.
  - A coaching review survey for all the coordinators to be filled out after each training session
  - Evaluation of care plans for all the coordinators evaluating a random set of care plans created by the care teams
  - Endline survey of nurses and physicians
- Measuring implementation fidelity of the program
- Defining outcomes for evaluating ECM
- Developing a costing structure of the program

4.3 ECM TIMELINE

		Timeline	Activity	Description
2019		Sep-Nov 2019	First project discussions	1. Project planning starts between EHIF and World Bank (WB) with discussions about data collection and potential impact evaluation questions. 2. Data agreement of EHIF claims data signed between World Bank and EHIF. 3. Preparation for recruitment of coordinators (TORs, etc.) EHIF's lead, WB's support.
		Dec 2019	Market summary presentation to EHIF	The DIME team provided EHIF with a "ECM Health Market Summary", summarizing the characteristics of ECM clinics, patients and overall illness burden. To disseminate this, a workshop was conducted with Ariadne Labs, EHIF, advising
2020		Jan 2020	Hiring coaches	EHIF hires five coordinators who will be coaching the GPs once ECM rolls out.
		Mar-May 2020	DIME EHIF QBS Review	The DIME team conducted an analytical review of the QBS scoring scheme based on the data from 2018. The review and recommendations were discussed with EHIF. The findings from the report are summarized in the report "Improving incentives for fairness in qbs: A "need-adjusted" approach to coverage."
		Jun-Jul 2020	Claims data de-identification	The DIME team began the de-identification and masking of the claims data before beginning analysis.
		Aug-Sept 2020	ECM framework	There were several discussions about the fundamental framework of ECM with EHIF on: 2. **Designing Patient Care Plans:** Lessons for ECM from UK NHS and Sweden's Healthcare System Social Care Integration for Chronically Ill Patients: Beyond 'Taking the Pills', key elements to make care plans 3. **Role of clinic staff** and GPs in ECM, there were discussions about how organisational identities of GPs and clinic staff would shift as the program rolls out.
		Oct 2020	Final discussion on ECM clinic sampling Training coordinators	1. DIME and EHIF engaged in dicussions regarding roll out of ECM and randomisation of clinics into ECM. 2. Around this time, the onboarding and training of coordinators had also begun.
		Nov-2020	Clinic level randomisation of ECM	Based on the discussions, DIME conducts randomisation of clinics into ECM program.
		Dec-2020	ECM Information	First information day for treatment group clinics. In this coaches had one on one sessions with GPs to introduce them to the ECM program and address any questions they have.
2021		Jan 2021	ECM Measurement document	The DIME team constructed a measurement document titled "Measuring Enhanced Care Management" outlining the measurement of each step of ECM implementation.
		Mar-Apr 2021	Coaching review survey	1. The DIME team prepares a survey to understand the functionality of GPs, how COVID-19 has impacted their day to day work and their preparedness for ECM. 2. The DIME team also created a survey for coaches to be filled after every meeting with a GP. 3.Both survey updates were discussed with the EHIF team.
		May-Jun-2021	Patient randomisation	The DIME team conducts the randomisation of patients into ECM.
		Aug-21	ECM launch to patients	1. Coordinators work with GPs to invite patients to ECM program. 2. Coordinators start helping GPs to create care plans.
		Oct-Dec 2021	Webinar series for coaches Making care plans	1. The DIME team organized a series of webinars for the EHIF team on -measuring ECM, -assessing care plans (conducted by Ariadne Labs), -analysis plan for ECM, -primary healthcare literature 2. GPs make care plans for ECM patients, the coaches assess five random care plans from each GP and score it
2022		Jan-22-ongoing	Completion of care plans	Currently GPs are making care plans for their patient population and getting evaluated with coordinators

Table title: **ECM PROJECT TIMELINE 2019-2022**

4.4 CLINIC RANDOMIZATION

After a series of discussions with EHIF, we conducted the clinic level randomization to invite clinics to join the ECM program. The randomization was done at the level of clinic, where all the physicians in the

selected clinic were assigned to ECM. EHIF identified 421 clinics (786 physicians) who were eligible for the ECM program. Out of this, the sampling frame of ECM excluded the clinics who had participated in the first pilot of the study and any clinics that were not currently operational. Additionally, due to potential logistical challenges in implementing ECM to clinics with many practicing physicians, the sampling frame excluded all the clinics that had five or more practicing physicians.

To ensure that the sample of clinics that would be assigned to the ECM program are comparable to statistically similar clinics not assigned in the ECM program two quality indicators were used to ensure balanced representation of physicians were used for stratification. We conducted a stratified sampling based on coarsened exact matching using the distribution of two of the quality-of-care measurement indicators -- the Quality Bonus Scheme (QBS) score and a management score given to each clinic. The QBS score uses coverage ratios of pre-specified indicators for each physician to award quality points. The management scores are based on the sum of scores on 15 indicators about the clinics' working practices. We grouped all the clinics in "blocks" of similar performance based on the QBS and management score. From each performance block, we randomly assigned a fourth of the clinics into ECM program with global misfit handling applied when the number of clinics in a block is not exactly divisible by four. Any performance block with no clinic for comparison is dropped from the sampling frame.

All clinics assigned to ECM within a performance block statistically match the non-selected clinics on the specified range of QBS and management score within that block (**table 1-2)**. This ensures that each performance block is represented in the sample of clinics invited to participate in ECM and control clinics, reducing potential variation in quality indicators in assigned ECM and control assigned clinics. Within each selected clinic, all the physicians are offered to enrol in the ECM program. This resulted in 144 physicians assigned to ECM and 402 physicians assigned as control.

By the time of patient randomization, 97 assigned to ECM physicians (71 clinics) agreed to participate in the program, with attrition of 47 assigned to ECM physicians. Section 7 discusses the attrition rate amongst clinics and the final mapping of clinics included in this pilot as of April 2022.

4.5 PATIENT RANDOMIZATION

Overall, patients eligible for the ECM program are older than the general population with the average age of 68 years. Approximately 8% of female primary health care users and 6% of male primary health care users were classified as "risky" according to the EHIF-determined patient eligibility algorithm, based on claims records in 2017 **(figure 1).**

From each participating ECM physician, EHIF decided to assign 25 patients into the ECM program. EHIF's contract with the participating family physicians is budgeted for ECM activities to be implemented on 25 patients. Each year, EHIF's algorithm uses claims data to identify patients who have multiple chronic illnesses categorized as "*risky*". For this project, the physicians selected in ECM gave an additional risk score to each of the patients identified by the claims data:

o   Mild/moderate risk of deteriorating health
o   Severe risk of deteriorating health

Given the mix of mild/moderate and severe patients within each physician, we conducted a stratified random sampling of patients into ECM based on the risk classification, such that every patient within each risk classification group has equal probability of assignment, and there are at most 25 patients assigned into the ECM program from each physician. All the patients within every physician are grouped into two strata – mild/moderate risk and severe risk. From each stratum we randomly assign patients into the treatment proportional to their share in the strata with a maximum of 25 patients assigned to treatment. Five physicians had identified fewer than 25 patients who have a risk of deteriorating health. For these physicians, all the patients were included in treatment. **Section 7** discusses the patient enrolment in ECM. **Figure 2** shows the outcomes of the patient randomization.

Patient randomization into ECM was conducted in two phases – the first phase was completed in June 2021, and the second phase was completed in September 2021. By the time the first phase of patient randomization started; 47 physicians assigned to ECM refused to enrol into the program. For these physicians, their patient population was excluded from the patient sample. **At the time of patient randomization, there were 97 assigned to ECM physicians, who were enrolled in the program, with a total eligible patient population of 6,739 out of which 2,389 patients were assigned to ECM.**

One of the goals of the ECM program is to promote the use of primary services and decrease the utilization of secondary and tertiary services. We measure the balance between treatment and control patients on their healthcare utilization patterns before 2019. For this, we have used the billing data history since 2009, to compute the average number of healthcare interactions for different care services per patient per year. Each of the healthcare utilization indicators is constructed using the billing data, where every bill listed in the data corresponds to healthcare interaction. For all these indicators, we measure the average number of interactions for healthcare services per year for data between 2009-2019. From **table 3**, we find that on average, both treatment and control patients use primary health services five times a year. Out of all the primary care follow ups, telephone consultations with the physician and consultations with the nurse occur on average once a year. On all these utilization outcomes, both treatment and control patients are well balanced.

4.6 EHIF COACHES REFLECTIONS ON ECM

To complement our process evaluation and quantitative assessments, between October 2021 and February 2022 we undertook a series of workshops with coaches to collect insights from their experience of implementing coaching around ECM.

During coaching sessions with the physicians' teams, coordinators have reflected on potential improvements to the ECM design:

- One suggestion was to reconsider the age of included patients. Currently, the algorithm that identifies patients at risk targets all patients at least 18 years old that meet other requirements (diagnosed with chronic conditions). But it has been observed that implementing ECM activities with patients of older age (for instance above 85 years) can be challenging due to memory issues and difficulty in engaging with the care team or implementing ECM activities on a routine basis.
- The second suggestion was to identify the group of people who would benefit the most from ECM. The coordinators and EHIF discussed whether younger patients whose conditions are not classified by the algorithm as risky, but their physicians believe they might meet the criteria soon.
- In terms of efforts of the physicians, the coordinators and EHIF suggested identifying areas to optimize the workload and effort by physicians to provide better care for their patients.
- Coordinators experienced that their role supported the care teams to continue the project and experience success. The less experienced with organizing work in a systemic way or, for example, participating in other projects, the more teams benefitted from coordinators' support.
- In their view, active collaborating between physicians and nurses would benefit the smooth functioning of ECM program.

4.7 NOTE ON AT-RISK PATIENT INCLUSION

The most significant gap in the evaluation outlined in this report is our inability to discuss the impacts of ECM on those patients who are at-risk of developing chronic illness but not yet regarded as having done so. Such a group may benefit differentially from ECM to those who are already chronically ill for several reasons. This group may be able to limit the onset of chronic illness and have more options for effective treatment than those with existing chronic conditions. Conversely, this group may be less likely to engage with the scheme given their lack of current illness. Thus, the impact of the scheme on this group may not be represented by those who already have chronic conditions. As such, it was felt that it would be useful to include them in the evaluation to gain empirical estimates of their responses.

However, we are unable to report on the impact of ECM on this group because they were not included as patients in this round of the scheme. Though physicians were requested to identify a number of their patients who could be seen as at-risk of developing chronic illness in the next few years, this task was challenging and complex. We therefore did not receive sufficient responses to this request and so decided not to include an 'at-risk' group in ECM or the corresponding evaluation.

Chronic illness frequently arises from individual behaviours related to diet, exercise and drug use such as smoking and alcohol consumption. As such, individual behaviour and characteristics are good indicators of the future risk of chronic illness. However, the complex nature of chronic illness makes prediction of exactly which patient will develop chronic care needs challenging.

Our assessment, building on the existing international evidence base, is that the group of 'at-risk' individuals in Estonia's healthcare system may benefit significantly from enrolment in ECM. Though the evidence base is evolving, it seems that slowing the onset of chronic illness is feasible and has significant

benefits to patients. It may be that ECM-type support has a larger benefit for this group than for already-ill patients. Though an expansion of ECM to this wider population would entail additional investments, the costly nature of chronic illness on the healthcare system implies these investments may yield medium- to long-term financial savings as cases of chronic care are avoided. We would recommend providing clear guidance to Physicians in the scale-up of ECM to identify members of this group. The development of a set of clear guidelines on how to identify 'at-risk' patients could be partly informed by assessment of EHIF's historical claims data. For example, what are the variables contained in that database that best predicted the onset of chronic illness.

The uncertainties around questions of benefit and cost of including an 'at-risk' group in ECM scheme is a central reason why we were motivated to include corresponding patients in the ECM evaluation. We recommend extending the evaluation methodology outlined in this report to at-risk patients in any scale-up and to undertake a rigorous analysis of their responses and the associated benefits. This would mean that for each clinic, the scale-up requests Physicians to identify a larger number of patients than would be enrolled in ECM and then randomizing within list which patients are treated. Comparison of the treated and control patients would then provide clear estimates of the impacts on the 'at-risk' group.

4.8 COSTING EXERCISE

To track the costs of these activities, the DIME team have produced an estimate of the cost of the ECM rollout, split between program costs, coaching costs, and evaluation costs for one year. This analysis will be crucial for EHIF to understand the cost implications and potential budgeting needs to scale up ECM. Our closest estimation on the time spent on each ECM activity by all relevant groups such as EHIF, doctors, nurses, coordinators and aggregate their cost uses publicly available data EHIF annual reports. **Appendix 2** shows the costing file with all the elements examined.

- *EHIF staff:* With most ECM activities being implemented in 2021, we estimated EHIF staff to spend 12.1% of their salaried time on ECM activities. This time will be spent coordinating activities with the participating physicians. This estimate is derived from the average time spent with one physician and scaling it to 97 enrolled physicians.
- *ECM participating practices*: For all the participating physicians, we estimate the 4 hours spent on invitations to patients to enroll in ECM, 45 hours (about 2 days) on patient selection and initial patient appointments and 137 hours (about 5 and a half days) on monthly follow up.
- *Nursing staff*: For the nursing staff, we estimate 20 hours will be spent on training for ECM. With a national scale up of ECM, the number of physicians and nurses will increase but we estimate the time spent on activities to be consistent.
- *ECM coordinators*: For this project, EHIF had initially hired 5 coaches to conduct the training of physicians, advise on designing care plans. We estimate the salary of the coaches from *Statistics Estonia*.

Based on our estimations, the annual cost of implementing ECM including EHIF staff and Primary care staff is approximately $553,968 (519,516.73 Euros), which is equivalent to $232 (216 Euros) per enrolled-patient cost (assuming all 2,389 patients assigned to ECM are enrolled in the program). The research and evaluation cost includes the time spent by the research team including the leads of the project, research assistance, field coordination and support from Ariadne Labs. The total estimated research cost of the project was $125,131 (110,421.23 Euros). With a national scale up, research on an impact evaluation would mostly utilize research time spent with the EHIF billing data to measure outcomes. Additionally, some administrative (potentially one-time) costs such as publicity and outreach of the program, training personnel coordination, programming software and data development costs are estimated at $89,138 (83,582.92 Euros). **Table 4** shows the different elements and their aggregate cost. **Appendix 2** attached includes the complete cost calculation sheets with all the different elements that go into the costing exercise.

Such an exercise is the first step towards a full cost-benefit analysis. The numbers above allow us to model costs incorporating distinct components of the rollout. For example, EHIF may want to disregard the cost of the evaluation given that this was externally funded. EHIF may want to add additional costs such as the provision of incentives to Physicians or change the number of coordinators if their role becomes a routine part of ECM service.

The costing exercise also allows average and marginal costs to be determined. To calculate average costs, total cost can be divided by a measure of the individuals treated under ECM, such as those with a care plan recorded in the claims data.

Similarly, one can assess marginal cost by ignoring costs that have been sunk (such as the coaching of Physicians and clinic staff, publicity and outreach cost, programming, and any data development cost) and only assess the marginal cost of a new patient.

These estimates, and refined versions of them, allow EHIF to make cost-benefits assessments of the ECM program. Calculating benefits for comparison with costs requires EHIF to assess the monetary value of the health benefits from the scheme. Given the delays in rollout, the evaluation team are unable to make a fair assessment of such health improvements at this stage. However, even with the above costing exercise, EHIF can make their own assessment as to whether the scheme has been cost effective by asking whether the perceived benefit is higher than the average or marginal thresholds outlined above.

As the ECM program scales up, the average and marginal costs of implementation will change for several reasons including: i) the initial investments in program materials and coaching/physicians' expertise will be spread across the broader program participation; ii) targeting of patients who will benefit from the scheme may improve. Thus, annual, or more frequent assessments of the relative costs and benefits of the program are recommended.

5. ECM IMPLEMENTATION SURVEYS

To track the progress of implementation, highlight any challenges during the rollout of ECM, the DIME team and EHIF conducted three types of surveys during the process of implementation of the pilot:

5.1 PHYSICIAN BASELINE COVID SURVEY

The team conducted a baseline survey of all physicians in Estonia before the rollout of ECM to understand how well the Physicians are coping with COVID-19, how the general management approach changed during COVID-19 and how general satisfaction with their practice changed with COVID-19.

The survey was offered to all practicing Physicians in Estonia. 41 Physicians responded to the survey, all of whom were participating in ECM. Out of all the physicians that responded, 28% physicians have not been coping well with the emotional and physical stress of the pandemic. 48% of the responding physicians felt that they did not get enough support to cope with the pandemic. 29% of the responding physicians felt that the child and family care impacted their ability to work. 47% of the responding physicians reported a deteriorated psychological health during the pandemic. In terms of physical health, 60% of the responding physicians reported no change during the pandemic. 22 out of 39 responding physicians (56%) reported that it has been more difficult to manage teams during the pandemic. **Figure 3** shows some reflections from physicians.

The physicians were also asked about their views on the healthcare system since the start of the pandemic. The physicians were also asked about their opinion on the amount of care their patients receive, not just from them but from other specialists as well. Before the pandemic, 64% (25 out of 39) of the physicians who responded believed that the amount of care is just about right. On the day of the survey, there was a higher share of physicians (41%) who believe that patients receive too little overall care (**figure 4**). Before the COVID-19 pandemic, over 60% of the physicians who responded, believed that the healthcare system works well and requires only minor changes. This remained consistent across both time periods with only very few physicians changing their opinion in view of the pandemic (**figure 5**).

5.2 COACHING SESSION SURVEY

For all physician and care teams participating in ECM, the coordinators hired by EHIF conducted coaching sessions with the physicians and nurses. Each session covered discussions on various elements of the program such as:
- Goals of the ECM program,
- Challenges in implementing ECM activities in physician's practice,
- Inviting patients to join the ECM program,
- Creating care plans for the patients.

After each session, the coordinators filled out a survey summarizing the coaching session. Starting in April 2021, there have been a total of 196 sessions up until March 2022. The different topics covered in these coaching sessions are shown in **figure 6**.

Overall, coordinators recorded that over 90% physicians have a good or excellent understanding of the goals of program throughout the various sessions conducted. Most physicians are receptive to the new materials that are introduced and adapted to their work (**figure 7-8**).

5.3 EVALUATION OF CARE PLAN SURVEY

Since August 2021, ECM physicians started enrolling patients assigned to the ECM program. For every patient, the physician prepared a care plan with the patient's self-management goals, including non-medical activities tailored to the patient's specific needs. The DIME team provided the coordinators five random care plan numbers from each physician, which coordinators evaluated.

Panel 9 shows the overall evaluation on four elements in the care plan – including activities that promote holistic health, whether the care plan was specific to the patient's needs, whether the goals are time bound and measurable, and whether the information in the care plan is easy to understand. Over 50% of the care plans evaluated are rated as *"excellent", "good" and "satisfactory"* on the four indicators. In many cases with *"unsatisfactory" or "absent"* indicating that the element was either not sufficiently expressed or was absent from the care plan, the coordinators helped the physicians to update the existing care plan.

Reflections from physicians on challenges during COVID-19

o *"Aja planeerimine\nmeeskonna motiveerimine"* **Lack of time / team motivation**
o *"Operatiivse info küllus, eesmärkide seadmine/muutmine"* **Considerable extent of operational information, setting or changing goals**
o *"Suure ülekoormuse ja emotsionaalse pinge juures jätkuva motivatsiooni hoidmine"* **How to keep being motivated while under emotional stress and overwhelmed**
o *"pingeliste situatsioonide lahendamine, töökorralduse organiseerimine, personali kaitsmine"* **Solving intense situations, organizing work, protecting personnel**
o *"1. pidevalt uueneva infoga töötajate kursis hoidmine; 2. töötajate toimetulek ja vastupidamine suurenenud töökoormuse tingimustes (vaktsineerimine, tavatöö)"* Continous flow of new information; employees coping with increased workload (vaccinations + usual work)

6. BASELINE TRENDS AND BALANCE

6.1 BASELINE PHYSICIAN BEHAVIOR

Table 5a and 5b show differences between ECM participating physicians and control assigned physicians on physician care compliance for the year 2018 for type-II diabetes and myocardial infarction. Physician care compliance is measured for each physician as meeting the care requirements set forth by the QBS rubric. For this, we utilize the claims data for the year 2018 (the year before ECM was introduced).

Here, we include all the eligible patients from ECM participating physicians who had a diagnosis of type-II diabetes (ICD10 E11) or myocardial infarction (MI) (ICD10 I21-I23, I25.2) in 2018. For each physician, we measure whether the monitoring indicators mention in the QBS rubric were conducted at least once in 2018. The management of a condition is considered QBS compliant if all of the monitoring and prescriptions indicators are met. Here, since we consider the monitoring indicators only, if all indicators are completed, patient management is considered QBS compliant.

For myocardial infarction (MI), the physician's QBS compliant management over their patient population with a diagnosis of MI in 2018 is balanced for ECM and Non-ECM physicians. For type-II diabetes, there is some imbalance arising due to statistically significant differences in in completion of glycosylated haemoglobin test, completion of creatinine test and testing total cholesterol levels. However, one caveat to note here is that the patient population eligible for each QBS indicator is pre-defined by EHIF. Since here we include all patients with a diagnosis of type-II diabetes irrespective of whether they were identified as eligible for QBS management in 2018, this group of patients could be different from patients determined by EHIF as eligible for the QBS management.

6.2 BASELINE PATIENT CHARACTERISTICS

6.2.1 BASELINE PATIENT UTILIZATION TRENDS

Table 3 show baseline differences between ECM assigned and control assigned patients on healthcare utilization indicators. One of the goals of the ECM program is to promote the use of primary services and gradually reduce the burden of utilization of secondary and tertiary services. Each of the healthcare utilization indicators is constructed using the EHIF claims data, where every bill listed in the data corresponds to a healthcare interaction. For all these indicators, we measure the average number of interactions per year for years 2009-2018.

We see that the ECM assigned sample of patients is mostly balanced with control assigned patients on average number of primary healthcare interactions, follow-ups, outpatient and day-care services. We see high rate of primary care interactions, nurse follow-ups, our patient interactions and, inpatient (hospitalizations) for both groups. These patterns are similar for female and male ECM assigned and control assigned sample population too. The pre-analysis plan attached in the appendix (**appendix 4**)

shows the balance on healthcare utilization indicators between ECM and Non-ECM females (4b) and males (4c). **Table 4d of appendix 4** shows the balance of healthcare utilization indicators between ECM eligible and non-eligible populations. This difference in means allows us to measure whether the population targeted for ECM is statistically different from the ineligible population in terms of their trends of utilization of health services. For almost every indicator the mean utilization of the ineligible population is less than that of the ECM eligible population with differences on all indicators being statistically significant.

6.2.2 BASELINE PATIENT ILLNESS PREVALENCE

Table 6 shows baseline difference at the patient level on prevalence of tracer conditions. This difference allows us to measure the difference in the disease history of the patient population. For all these comparisons, prevalence is defined as any diagnosis of a given tracer condition recorded in the billing data between 2009-2018. We exclude 2019 in this analysis since we do not have complete data for it. We construct dummy variables for each of the tracer conditions and aggregate them at the patient level. **Table 6** shows that the prevalence of certain conditions such as Arthritis, Asthma, Atrial Fibrillation, COPD, Type-II diabetes, Hypertension, Hyperlipidemia is relatively high. Overall, ECM and non-ECM patient populations are well balanced on tracer condition prevalence.

In **appendix 4, table 5b and 5c** show the prevalence of tracer conditions amongst females (5b) and males (5c). Females in ECM have a relatively high prevalence rate of Hypertension, Hypertensive heart disease, Arthritis, and Hyperlipidemia. While over 60% of females have had a diagnosis of Hyperlipidemia and Arthritis, males have a relatively lower prevalence of these conditions, but a higher prevalence of Hypertension, Ischemic heart disease.

Table 5d (appendix 4) shows the balance between ECM eligible and non-eligible patients. First, here we see that the difference in the means of the conditions is statistically different between both groups. The group of patients not eligible for ECM also includes younger cohorts who might have lower prevalence of some conditions. Second, the prevalence of Arthritis, Hyperlipidemia, Hypertension, Ischemic heart disease is still high amongst the group of patients not eligible for ECM. For each of these differences in table 5d, we control for provider level fixed effects.

7. ECM PROGRAM UPTAKE AND TREATMENT EFFECT

7.1 PHYSICIAN UPTAKE

Physician enrolment in ECM

The outcome of the clinic level randomization included 144 physicians (93 clinics) who were invited to participate in ECM and 402 physicians (282 clinics) who were assigned as control group. By the time the patient randomization into the program started, 47 physicians refused to participate (dropped out). Since then, an additional 12 physicians have dropped out or refused to join the program. As of April 2022, there are 59 physicians who have dropped out or refused to join the program. **Figure 10** shows the reasons mentioned for dropping out of the program. **Figure 11** shows the final mapping of total number of clinics and physicians in ECM.

Out of the 85 physicians who agreed to participate in ECM as of April 2022, 61 have gotten a payment of 91,500 Euros for enrolling patients in the program and making their care plans.

Physicians' progress of enrolling of ECM assigned patients

Here we track the rate of patient inclusion since the launch of ECM for patients in August 2021. Here, we include the 85 participating physicians who are currently participating in ECM. **Figure 12** shows the status of enrolment of ECM assigned patients by physicians. 60 participating physicians have enrolled at least one ECM assigned patient to the program; 25 participating physicians have not yet recorded ECM assigned patient enrolment.

7.2 TREATMENT EFFECT OF ECM PATIENT ASSIGNMENT

The following services are used as ECM activities and are recorded with a specific code in the claims data:

- Patient inclusion/refusal in ECM,
- Development or renewal of a care plan for the patient,
- In-person consultation with a physician,
- In-person consultation by a nurse,
- Telephone consultation with a nurse,
- Telephone consultation with a physician,
- Email consultation with a nurse,
- Email consultation with a nurse.

We track the treatment effect of ECM assignment on annual use of ECM services per person since the start of the intervention in August 2021. **This tells us the impact of making the program available to an**

eligible person who was assigned to ECM on their utilization. Here we use the ECM eligible population based of 97 physicians who agreed to participate in the program at the time of patient randomization. Based on those physicians', there are 2,389 patients assigned to ECM out of 6,739 ECM eligible patients, the remaining 4,350 patients are assigned to control. Further, we track the treatment effect on ECM assignment for patients who are categorised as *"mild/moderate risk"* and *"severe risk."*

Table 7 shows the treatment effect of ECM random patient assignment on the utilization of the ECM service codes. Overall, 55% of patients assigned to ECM have been enrolled in the program as opposed to approximately 1% in the enrolment in control assigned patients. Physicians were given a list of replacement patients consisting of control assigned patients in case of patient refusals. 56% of ECM assigned patients are enrolled with a care plan.

Development or renewal of a care plan for the patient

Figure 13 shows the treatment effect of ECM patient assignment on creation of care plans for patients. Out of all the patient who are ECM assigned, 55% have been enrolled in the program. As a patient enrols in ECM, their physician develops a care plan for them as a part of the program. Of all patients randomly assigned to the ECM program, 56% are enrolled in the program with a care plan, compared to < 1% in the control groups, a significant difference at normal thresholds of statistical significance of making the program available to ECM assigned patients on care plan creation. **Figure 14** shows the treatment effect of ECM assignment on development of a care plan by each risk category of eligible patients.

Consultations

Physician consultations

Figure 15 shows the statistical difference on physician consultations between ECM assigned and control assigned patients. ECM assigned patients have had an average 4.54 consultations per person per year with a physician compared to 4.36 for control assigned patients, with the 4% difference in physician consultations statistically significant, which is being driven by mild/moderate risk ECM assigned patients who have a 7.5% statistically significant higher utilization of physician consultations than mild/moderate risk eligible patients assigned to control **(figure 16)**. Of all the physician consultations, only the difference between the annual consultations with physicians over telephone is statistically significant amongst the mild/moderate eligible patient group (**table 8**). For severe risk eligible patients, the average annual number of physician consultations in-person is 0.55 for eligible patients assigned to ECM compared to 0.32 for eligible patients assigned to control. However, the overall average annual physician consultations difference between the two groups of severe patients is not statistically significant (**table 9**).

Nurse consultations

Figure 17 shows the statistical difference on nurse consultations between eligible patients assigned to ECM, eligible patients assigned to control. ECM assigned patients have had on average approximately 3.44 annual consultations with a nurse since the start of the intervention in August 2021, compared to approximately 2.60 consultations for the control assigned group, which is a 32% statistically significant difference in nurse consultations by eligible patients assigned to ECM. Amongst the consultations with a nurse, ECM assigned patients have had on average 1.37 annual in-person consultation with a nurse, with an average of 1.08 for control assigned patients, the difference being statistically significant. ECM assigned patients have had on average 2.01 consultations with a nurse over telephone compared to 1.48 for control assigned patients, with the 35% difference being statistically significant. **Figure 18** breaks down the eligible patient group by risk severity. For eligible mild/moderate risk patients, the average annual number of nurse consultations is 3.27 for eligible patients assigned to ECM compared to 2.41 for eligible patients assigned to control. For eligible severe patients, the average annual nurse consultations are 3.7 for eligible patients assigned to ECM compared to 2.8 for eligible patients assigned to control **(table 8-9)**.

The design of the experiment allows EHIF to continue developing their understanding of the impacts of the ECM program. By tabulating the outcomes of patients in the treatment and control groups, EHIF will be able to continually assess the impact of ECM over time. In fact, given that randomization was undertaken stratified by GP, such comparisons can be undertaken GP by GP, leading to a distribution of impacts across clinics.

8. ECM VISION FOR FUTURE

Overarching Assessment Based on Evidence So Far

The ability of the evaluation to fulfil the original scope of work has been affected by the delay to program rollout described in **section 4**. A comprehensive assessment of health impacts requires sufficient time to pass between care plans being created and physicians potentially changing their treatment approaches. Delays in the initiation of the program have meant delays in the creation of care plans, and thus in any changes in treatment. Thus, at this stage it is premature to judge the efficacy of the program's impacts on health. That we do not detect substantial impacts at this stage is likely to be related to the fact that the program has not had time to improve health outcomes.

However, at this stage the evaluation can clearly argue that chronic care management is a frontier concern for many advanced health systems. The international experience reviewed in section 3 provides motivation for EHIF to continue pushing towards a program that works for the Estonian context. Given the ambiguity faced as to how to best implement the program so to maximize its impacts, the measurement and evaluation approach taken forward so far ensures the program's effects will become increasingly clear over time. Such measurement and evaluation should continue to be at the heart of the program for the foreseeable future.

Beyond the motivation of the challenge ahead and the international focus on programs such as ECM, there is evidence of increased utilization of the ECM services for patients to whom the program is made available (**Section 7 for treatment effects)**.

Discussions within EHIF team

EHIF plans to add ECM to the list of health care services as of January 2023. Currently, the details of this future service are under discussion. These include requirements for reimbursement. Once these details are in place, a proposal for adding will be submitted to the committee that evaluates the service proposal from cost-effectiveness, safety and efficiency perspectives. If approved, the inclusion process will be taken forward.

Pre-analysis plan

The DIME team is currently working towards a comprehensive pre-analysis plan which outlines the hypothesis and models for evaluation of impact of ECM on:
- Healthcare utilization trends
- Provider of behavior
- Patient health

Appendix 4 with the report is a working draft of the pre-analysis with the theory of change, econometric model and baseline analysis. This manuscript will outline the exact outcome measures, and statistical

specification before evaluating the program in 2022. The benefits of a pre-analysis plan are to generate correctly sized estimation for every outcome.

Full scale one-year evaluation

As ECM activities have started, the team intends to continue the evaluation of ECM on physician behaviour, healthcare utilization and patient health outcomes. For this the team would use EHIF billing data from 2022 to evaluate. Additionally, the team is also planning to conduct an endline survey of all the ECM physicians to get a self-reported impact of ECM on physician's awareness, feedback on interaction with patients and overall feedback on the ECM program.

Appendix 1

1a. Care management for chronically ill – *Attachment 1a*

1b. Designing patient care plans – *Attachment 1b*

1c. Framework to support clinic staff – *Attachment 1c*

Appendix 2

Costing framework – *Attachment 2*

Appendix 3

Measurement document – *Attachment 3*

Appendix 4

Pre-analysis plan – *Attachment 4*

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Tables

Table 1. Balance on ECM clinic randomization

Observable	(1) ECM		(2) Non-ECM		(3) Pilot		t-test Difference (ECM)-(Non-ECM)	t-test Difference (ECM)-(Pilot)	t-test Difference (Non-ECM)-(Pilot)
	N	Mean/SD	N	Mean/SD	N	Mean/SD			
Clinic level									
Number of lists in clinic	93	1.559 [0.890]	282	1.429 [0.842]	13	2.923 [1.977]	0.130	-1.364***	-1.494***
Management score (0-20)	93	10.704 [6.772]	282	10.590 [6.696]	13	11.923 [5.777]	0.114	-1.219	-1.333
F-test of joint significance (F-stat)							0.985	7.473***	15.864***
F-test, number of observations							375	106	295
Provider level									
Provider QBS score (Domain II)	144	305.806 [67.555]	402	309.296 [64.447]	38	339.447 [31.541]	-3.490	-33.642	-30.151
Total chronic care eligible population (Domain II)	144	4170.174 [1864.520]	402	4037.928 [1662.738]	38	3433.026 [827.934]	132.246	737.147*	604.902***
Total number of patients served (Domain II)	144	3865.632 [1722.338]	402	3762.736 [1584.766]	38	3265.816 [778.115]	102.896	599.816*	496.920***
F-test of joint significance (F-stat)							0.738	1.300	3.376**
F-test, number of observations							546	182	440

Notes:
- The value displayed for t-tests are the differences in the means across the groups.
- The value displayed for the F-test are on the F-statistics.
- The covariate variable representing the performance block of the clinic is included in all estimations
- ***, **, and * indicate significance at the 1, 5, and 10 percent critical level

Table 2. Balance on QBS indicators post clinic randomization

QBS Domain-II indicators coverage 2019	ECM providers Mean	N	NonECM providers Mean	N	ECM-NonECM Difference	S.E	p-value
Diabetes Type II: Monitor	73%	144	75%	402	0.013	0.011	0.260
Diabetes Type II: Treat	72%	144	72%	402	-0.002	0.010	0.836
Hypertension Low Risk: Monitor	71%	144	72%	402	0.016	0.011	0.174
Hypertension Med Risk: Monitor	66%	144	66%	402	0.030	0.010	0.004
Hypertension High Risk: Monitor	72%	144	73%	402	0.015	0.014	0.275
Hypertension Med-High Risk Level: Treat	83%	144	83%	402	0.000	0.007	0.946
Myocardial Infarction: Monitor	76%	144	78%	402	0.012	0.014	0.382
Myocardial Infarction Beta Blockers: Treat	69%	144	67%	402	0.011	0.015	0.456
Myocardial Infarction Statins: Treat	66%	144	66%	402	0.003	0.016	0.827
Hypothyroidism: Monitor	85%	144	87%	402	-0.002	0.009	0.786

Notes:
- The above table shows the average coverage in 2019 for QBS indicators of the population eligible to receive QBS standard of care.
- The mean shows the % eligible patients who received the monitoring and treatment care as set by the QBS guidelines

Table 3. Balance on healthcare utilization between ECM assigned and control patient between 2009- 2018

Utilization average before 2019	ECM		Non ECM		ECM-Non ECM		
	Mean	N	Mean	N	Difference	S.E	p-value
Average # PHC interactions per year	4.93	2389	5.03	4350	-0.01	0.06	0.86
Average # telephone follow up per year	1.15	2389	1.18	4350	-0.01	0.02	0.65
Average # nurse follow up per year	1.29	2389	1.30	4350	0.01	0.02	0.64
Average # chronic illness follow up	0.06	2389	0.06	4350	0.00	0.00	0.57
Average # nurse telephoone follow up	0.38	2389	0.34	4350	0.01	0.01	0.38
Average # hospitalizations per year	0.85	2389	0.90	4350	-0.05	0.02	0.01
Average # ambulance use per year	0.17	2389	0.19	4350	-0.02	0.01	0.03
Average # inpatient nursing rehab per year	0.07	2389	0.08	4350	-0.01	0.01	0.29
Average # outpatient per year	3.51	2389	3.54	4350	0.01	0.06	0.84
Average # outpatient nursing rehab per year	0.47	2389	0.47	4350	0.00	0.02	0.89
Average # daycare per year	0.39	2389	0.44	4350	-0.03	0.02	0.04

Notes:

-The value displayed for t-tests are the differences in means across the groups.

- The difference in means is conditional upon the risk strata of the patient.

- All patients with missing records in any given year are treated as having no healthcare interactions for that year.

Table 4. ECM costing

Ingredients	Category	Quantity	Unit	Source of Quantity	Unit Price	Source of Unit Price	Total Cost
EHIF and Primary Care Staff							
Board members' gross salaries	Salary	11.8%	Total Board Compensation	% of Participating Lists	$5,15,970	EHIF Annual Report (2020)	$60,664
Lead technical officer gross salary	Salary	11.8%	Avg. Scientific/Technical Salary	% of Participating Lists	$23,501	Statistics Estonia	$2,763
Additional technical officer gross salary	Salary	11.8%	Avg. Scientific/Technical Salary	% of Participating Lists	$23,501	Statistics Estonia	$2,763
Nurse training time	Labor (Non-Salary)	182	Avg. Hourly Wage	Total Participating Nurses	$206	Administrative data + self-report	$37,477
Doctor training time	Labor (Non-Salary)	97	Avg. Hourly Wage	Total Participating Doctors	$3,467	Administrative data + self-report	$3,36,326
Administration staff time	Labor (Non-Salary)					EHIF budget office report	$0
Administrative support for communication	Labor (Non-Salary)					EHIF budget office report	$0
Ministry of Social Affairs advisers	Labor (Non-Salary)	25%	Avg. Public Administration Salary	Estimated time spent on ECM	$25,412	Statistics Estonia	$6,353
Administrative support at primary health facilities	Labor (Non-Salary)					Activity and time reporting + self-report	$0
Coaches salary	Salary	5	Avg. Human Health/Social Work Salary	5	$21,524	Statistics Estonia	$1,07,622
Technical Assistance and Evaluation Team							
Evaluation team co-PIs	Salary	30%	Avg. Assistant Professor Salary	3 PIs at 10%	$1,13,600	AAUP Faculty Compensation Survey (2020 avg.)	$34,080
Research Assistance	Salary	50%	Avg. RA Salary	1 RA at 50%	$44,962	WBG Annual Report	$22,481
Field coordinator gross salary	Salary	50%	Avg. Field Coordinator Contract	50% of 150 day contract	$87,141	WBG Annual Report	$43,571
Ariadne Labs	Contract sum				$24,999	WBG budget records	$24,999
Other Program Implementation Costs							
Publicity and outreach costs	Other Monetary	11.8%	Total Publicity Expenditure	% of Participating Lists	$4,680	EHIF Annual Report (2020)	$550
Administrative resources and assets	Other Monetary					Reporting by admin. assistants at health facilities	$0
Facility costs	Other Monetary	11.8%	Total Facility Expenditure	% of Participating Lists	$6,54,030	EHIF Annual Report (2020)	$76,896
Training personnel transportation and related costs	Other Monetary	11.8%	Total Transportation Expenditure	% of Participating Lists	$12,870	Receipt submission to EHIF	$1,513
Programming and other database development costs	Other Monetary	11.8%	Total Programming & Development Expenditure	% of Participating Lists	$86,580	EHIF Annual Report (2020)	$10,179
TOTAL COST OF INTERVENTION (EHIF AND PRIMARY CARE STAFF + RESEARCH TEAM + OTHER PROGRAM COSTS)							**$7,68,238**

Table 5. Baseline physician care behavior

Table 5a: Share of QBS compliant management of myocardial infarction in 2018

Myocardial infarction QBS compliance	ECM physicians		Non-ECM physicians		ECM-NonECM		
% patients QBS compliant per provider	Mean	N	Mean	N	Difference	S.E	p-value
% patients QBS compliant per provider	72%	95	67%	398	0.02	0.02	0.33
- Completed Hb1ac test	80%	95	80%	398	-0.02	0.02	0.35
- Provided counselling	87%	95	83%	398	0.02	0.02	0.24
- Tested for cholesterol level	79%	95	78%	398	-0.01	0.02	0.68
- Tested for cholesterol fractions	77%	95	75%	398	0.00	0.02	0.89

Table 5b: Share of QBS compliant management of type-II diabetes in 2018

Type-II diabetes QBS compliance	ECM physicians		Non-ECM physicians		ECM - NonECM		
	Mean	N	Mean	N	Difference	S.E	p-value
% patients QBS compliance per provider	78%	96	72%	399	0.04	0.01	0.00
- Completed Hb1ac test	84%	96	81%	399	0.02	0.01	0.10
- Completed creatinine test	85%	96	81%	399	0.03	0.01	0.02
- Provided counselling	87%	96	83%	399	0.02	0.01	0.10
- Tested for cholesterol level	83%	96	80%	399	0.02	0.01	0.07
- Tested for cholesterol fractions	56%	96	53%	399	0.02	0.03	0.55

Notes (5a-5b):

-Tables 5a and 5b measure the share of patients managed in compliance with QBS per provider for diagnosis of myocardial infarction (MI) (3a) and type-II diabetes (3b) in 2018.

- This reflects the attrition amongst physicians at the time of patient randomization, the current attrition rates are still being compiled.

- 2 physicians participating in ECM have missing data for myocardial infarction; 4 control physicians have missing data for myocardial infarction.

- 1 physician participating in ECM has missing data for type-II diabetes care; 3 control physicians have missing data for type-II diabetes care.

-The patient aggregates in the tables include all the patients with a diagnosis of myocardial infarction and type-II diabetes in 2018.

-The value displayed for t-tests are the differences in the means across the groups.

-The covariate variable identifying the performance block for each provider is included in all estimation regressions.

Table 6: Baseline prevalence of tracer conditions before 2019 between ECM assigned and control patients

Tracer conditions (any diagnosis between 2009-2018)	ECM		Non ECM		ECM-Non ECM		
	Mean	N	Mean	N	Difference	S.E	p-value
Alcohol abuse	0.04	2389	0.03	4350	0.00	0.01	0.65
Arthritis	0.52	2389	0.55	4350	-0.01	0.01	0.38
Asthma	0.23	2389	0.23	4350	0.00	0.01	0.73
Atrial fibrillation	0.19	2389	0.21	4350	-0.01	0.01	0.28
Cancer (Colon, lung, breast, prostate)	0.02	2389	0.02	4350	0.00	0.00	0.26
Chronic kidney disease	0.02	2389	0.03	4350	0.00	0.00	0.40
Chronic Obstructive Pulmonary Disorder (COPD)	0.23	2389	0.23	4350	0.00	0.01	0.73
Depressive disorder	0.16	2389	0.17	4350	-0.01	0.01	0.58
Type-II diabetes	0.22	2389	0.23	4350	0.00	0.01	0.99
Substance use	0.02	2389	0.01	4350	0.00	0.00	0.18
Hyperlipidemia	0.58	2389	0.60	4350	0.00	0.01	0.83
Hypertension	0.88	2389	0.90	4350	0.00	0.01	0.68
Hypertensive heart disease	0.72	2389	0.75	4350	0.01	0.01	0.63
Ischemic heart disease	0.37	2389	0.40	4350	-0.01	0.01	0.26
Acute myocardial infarction	0.08	2389	0.09	4350	-0.01	0.01	0.32
Osteoporosis	0.07	2389	0.07	4350	0.00	0.01	0.55
Number of comorbidities	3.11	2389	3.34	4350	-0.09	0.04	0.03

Notes:

-The table shows baseline prevalence and balance on tracer conditions between ECM assigned and control patients.

- The difference is conditional upon the risk strata of the patient

-Any patient with a missing record in the billing data is treated as not having the diagnosis in their disease history.

-The column 'p-value' demonstrates the statistical significance of the difference in means

Table 7: Treatment effect of ECM assignment on ECM service utilization

ECM services	Eligible: assigned to ECM Mean	N	Eligible: assigned to Control Mean	N	Conditional difference ECM assigned - control patients	S.E	p-value
Patients enrolled in ECM since August 2021	55%	2389	1%	4350	0.54	0.01	0.00
Patients with care plans since August 2021	56%	2389	1%	4350	0.55	0.01	0.00
Annual physician consultations	4.54	2389	4.36	4350	0.21	0.09	0.02
Annual physician consultation in-person	0.57	2389	0.32	4350	0.25	0.02	0.00
Annual physician consultation by telephone	3.92	2389	4.01	4350	-0.07	0.09	0.44
Annual physician consultation by email	0.06	2389	0.04	4350	0.02	0.01	0.01
Annual nurse consultations	3.44	2389	2.60	4350	0.85	0.07	0.00
Annual nurse consultations in-person	1.37	2389	1.08	4350	0.29	0.04	0.00
Annual nurse consultation by telephone	2.01	2389	1.48	4350	0.54	0.06	0.00
Annual nurse consultation by email	0.06	2389	0.04	4350	0.02	0.01	0.00

Notes:
-The table shows treatment effect of ECM assignment on use of ECM service codes.
- The difference is conditional upon the risk strata of the patient.
- Any patient with a missing record in the billing data is treated as having zero as their service utilization.
- The column 'p-value' demonstrates the statistical significance of the difference in means
- The first ECM assigned patient was enrolled in the program in August 2021 and is chosen as start of the intervention.

Table 8: Treatment effect of ECM assignment on ECM service utilization for **mild/moderate** risk patients

ECM services	Eligible: assigned to ECM Mean	N	Eligible: assigned to Control Mean	N	Conditional difference ECM assigned - control patients	S.E	p-value
Patients enrolled in ECM since August 2021	55%	1501	1%	2609	0.54	0.01	0.00
Patients with care plans since August 2021	57%	1501	1%	2609	0.55	0.01	0.00
Annual physician consultations	4.30	1501	4.00	2609	0.25	0.10	0.01
Annual physician consultation in-person	0.58	1501	0.31	2609	0.19	0.02	0.00
Annual physician consultation by telephone	3.67	1501	3.65	2609	0.06	0.10	0.57
Annual physician consultation by email	0.05	1501	0.03	2609	0.00	0.01	0.92
Annual nurse consultations	3.27	1501	2.41	2609	0.57	0.08	0.00
Annual nurse consultations in-person	1.34	1501	1.06	2609	0.22	0.04	0.00
Annual nurse consultation by telephone	1.87	1501	1.31	2609	0.35	0.06	0.00
Annual nurse consultation by email	0.06	1501	0.04	2609	0.00	0.01	0.95

Notes:
-The table shows treatment effect of ECM assignment on use of ECM service codes for patients categorized as having mild/moderate risk.
- The difference is conditional upon the risk strata of the patient.
- Any patient with a missing record in the billing data is treated as having zero as their service utilization.
- The column 'p-value' demonstrates the statistical significance of the difference in means
- The first ECM assigned patient was enrolled in the program in August 2021 and is chosen as start of the intervention.

Table 9: Treatment effect of ECM assignment on ECM service utilization for **severe risk** patients

ECM services	Eligible: assigned to ECM		Eligible: assigned to Control		Conditional difference		
	Mean	N	Mean	N	ECM assigned - control patients	S.E	p-value
Patients enrolled in ECM since August 2021	**55%**	**888**	**1%**	**1741**	**0.54**	**0.01**	**0.00**
Patients with care plans since August 2021	**56%**	**888**	**1%**	**1741**	**0.55**	**0.01**	**0.00**
Annual physician consultations	**4.96**	**888**	**4.90**	**1741**	**0.05**	**0.15**	**0.74**
Annual physician consultation in-person	0.55	888	0.32	1741	0.20	0.03	0.00
Annual physician consultation by telephone	4.34	888	4.54	1741	-0.15	0.14	0.28
Annual physician consultation by email	0.07	888	0.04	1741	0.00	0.01	0.87
Annual nurse consultations	**3.73**	**888**	**2.88**	**1741**	**0.45**	**0.11**	**0.00**
Annual nurse consultations in-person	1.41	888	1.13	1741	0.18	0.06	0.00
Annual nurse consultation by telephone	2.25	888	1.73	1741	0.24	0.08	0.00
Annual nurse consultation by email	0.06	888	0.03	1741	0.03	0.01	0.03

Notes:

-The table shows treatment effect of ECM assignment on use of ECM service codes for patients categorized as having mild/moderate risk.

- The difference is conditional upon the risk strata of the patient.

- Any patient with a missing record in the billing data is treated as having zero as their service utilization.

- The column 'p-value' demonstrates the statistical significance of the difference in means

- The first ECM assigned patient was enrolled in the program in August 2021 and is chosen as start of the intervention.

Figures
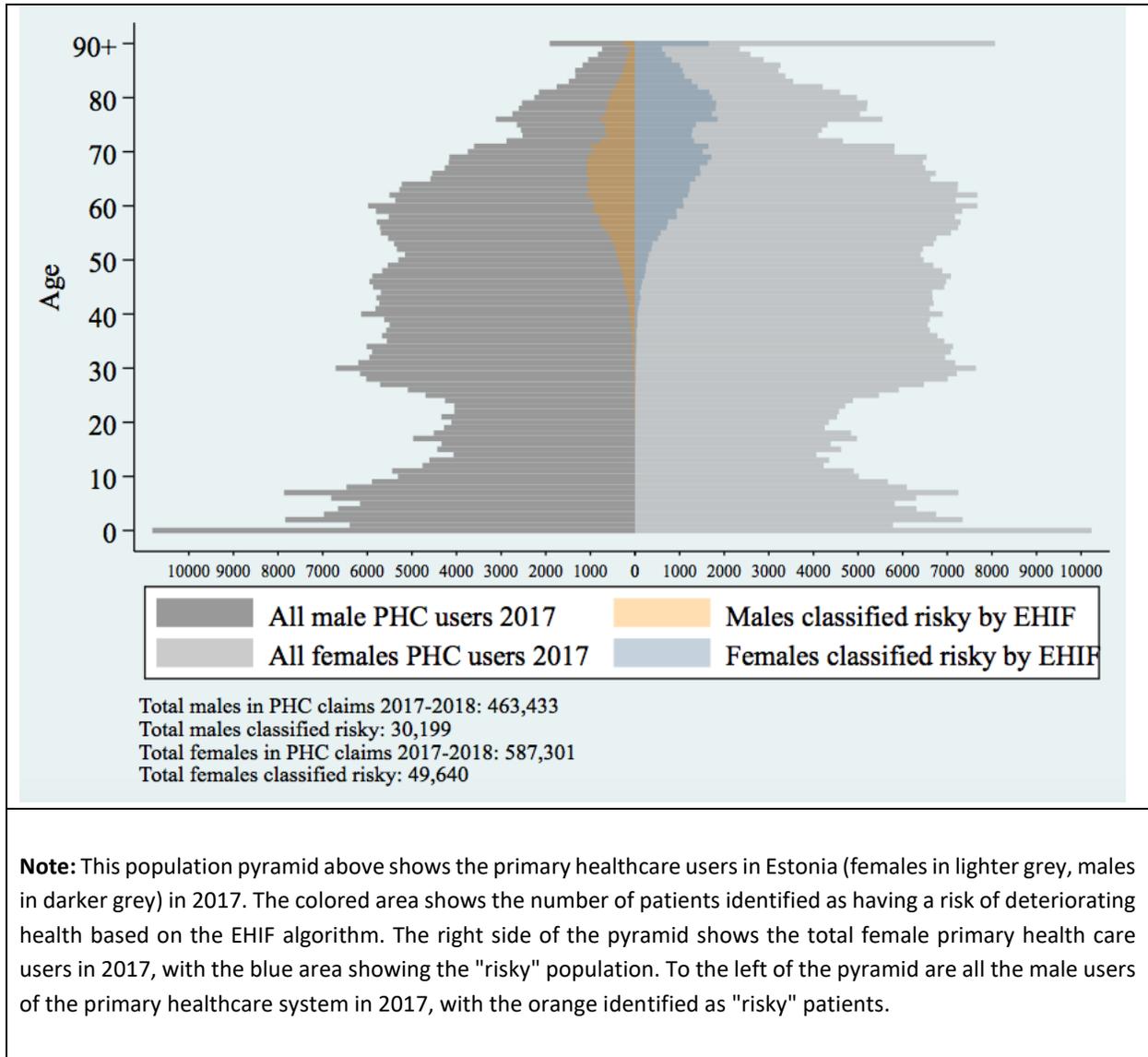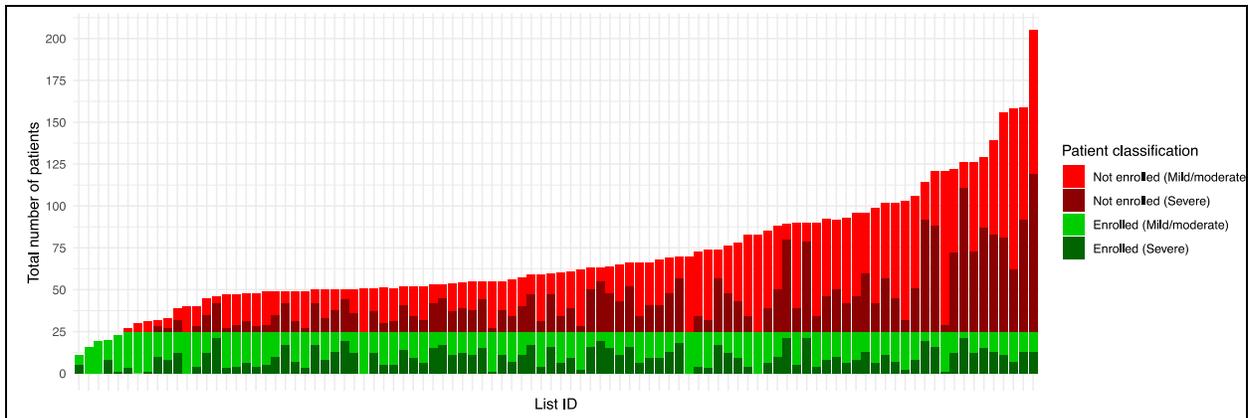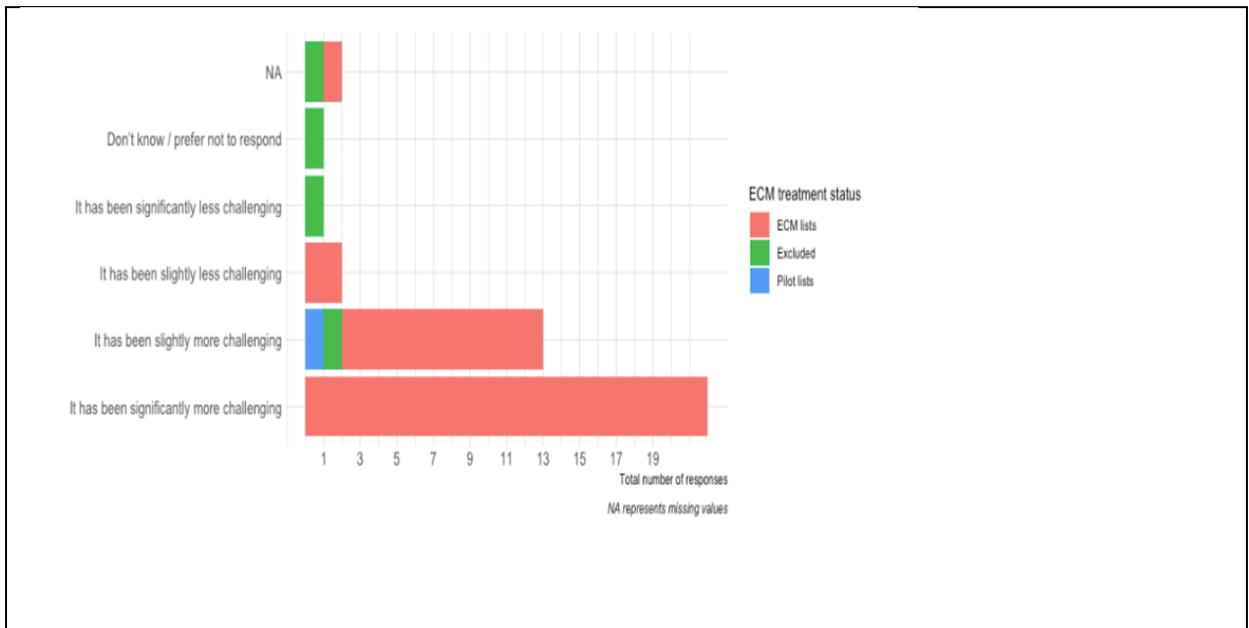
Figure 1. Patient population for ECM

Total males in PHC claims 2017-2018: 463,433
Total males classified risky: 30,199
Total females in PHC claims 2017-2018: 587,301
Total females classified risky: 49,640

Note: This population pyramid above shows the primary healthcare users in Estonia (females in lighter grey, males in darker grey) in 2017. The colored area shows the number of patients identified as having a risk of deteriorating health based on the EHIF algorithm. The right side of the pyramid shows the total female primary health care users in 2017, with the blue area showing the "risky" population. To the left of the pyramid are all the male users of the primary healthcare system in 2017, with the orange identified as "risky" patients.

Figure 2. ECM patient randomization outcome

Note: This figure shows the randomization output at the patient level. Each bar represents a physician, and the vertical axis represents the number of patients eligible for ECM from the physician. The number of patients highlighted in green represents the patients who are assigned to the ECM program. The patients in red are patients who are assigned as control patients and will be comparison patients. The different shades of green and red highlight the risk severity of the patients with the dark green and dark red representing patients categorized as having severe risk and lighter shades are for patients categorized as having mild/moderate risk.

Figure 3. Physicians' responses on team management challenges since the start of the COVID-19 crisis

Note: The vertical axis represents the different responses on challenges since start of COVID-19. The horizontal axis represents the number of responses from physicians for each category.
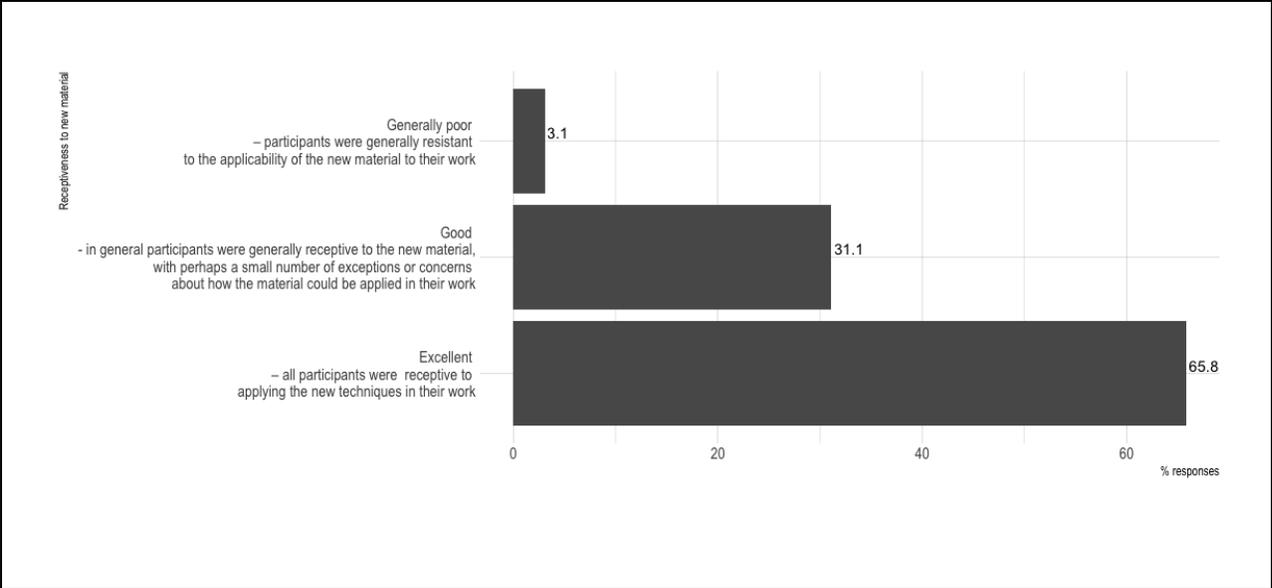
Figure 4. Views on amount of care patients receive

Note: The left bar shows the range of responses received before COVID-19. The right bar are the responses received for the day the survey was answered. The height of the box and of the colors represent the number of responses for the given choice. The direction from left to right panel indicates the change in responses across the two time periods for each physician.
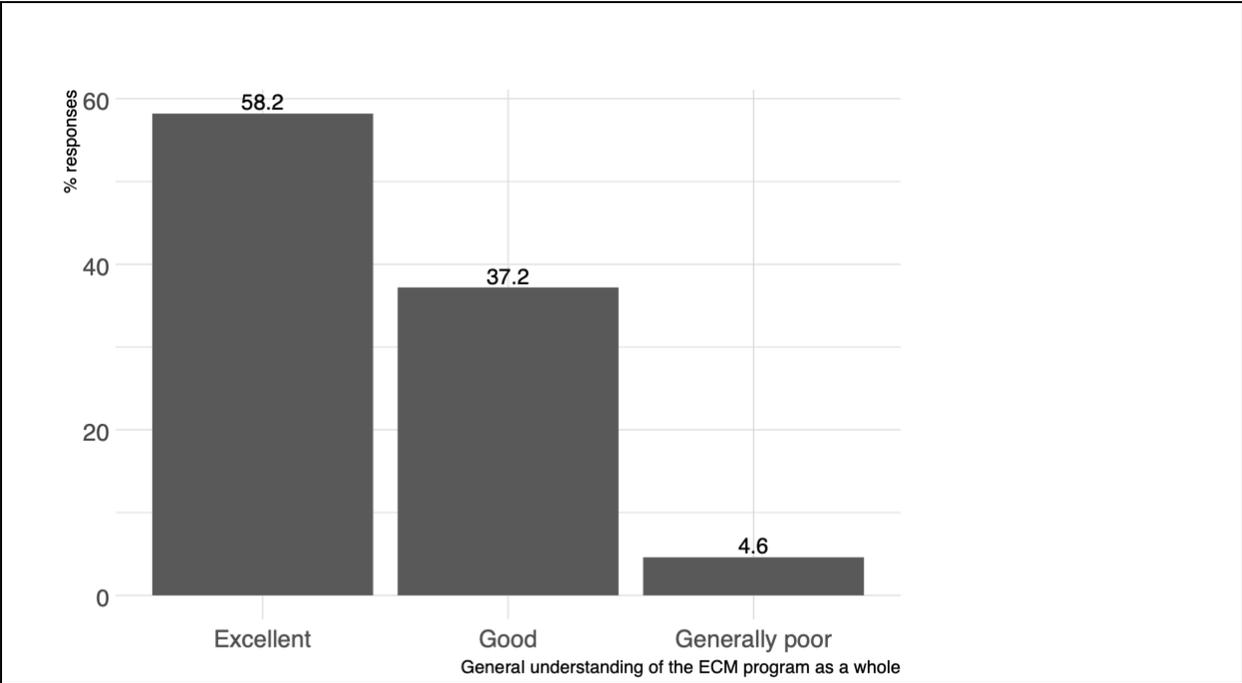
Figure 5. Views on healthcare system before COVID-19 and on the day of the survey

Note: The left bar shows the range of responses received before COVID-19. The right bar are the responses received for the day the survey was answered. The height of the box and of the colors represent the number of responses for the given choice. The direction from left to right panel indicates the change in responses across the two time periods for each physician.

Figure 6. Topics covered in sessions with coordinators

Note: Each bar represents a topic covered in coaching session with coordinators. The horizontal axis shows the % of sessions which discussed the topic on the vertical axis.

Figure 7. Evaluation of receptiveness of new material overall

Note: The vertical axis represents the coordinator's evaluation of the physician's reception of the new materials introduced as a part of ECM. The horizontal axis represents the share of sessions with the given evaluation.

Figure 8. Evaluation of understanding of the ECM program as a whole

Note: The horizontal axis represents the coordinator's evaluation of the physician's understanding of the ECM program. The vertical axis represents the share of sessions with the given evaluation.

Figure 9. Panel on care plan evaluations

9a. Does the care plan provide a series of non-medical activities that promote holistic health?	**9b. Does the care plan seem to be specific to the needs of the individual patient?**

9a. Excellent 27.2, Good 29, Satisfactory 21.4, Unsatisfactory 12.5, Absent 6.7, NA 3.2

9b. Excellent 30.4, Good 39.1, Satisfactory 20.3, Unsatisfactory 4.9, Absent 1.7, NA 3.5

9c. Are patient goals measurable and timebound in care plan?	**9d. Is all the information easy to grasp and understandable from the patient's point of view?**

9c. Excellent 22.9, Good 21.4, Satisfactory 24.6, Unsatisfactory 22, Absent 5.8, NA 3.2

9d. Excellent 31.9, Good 34.8, Satisfactory 19.1, Unsatisfactory 7.5, Absent 3.2, NA 3.5

Note: In panel 9(a-d), each bar represents the percentage of care plans evaluated with the given rating (on the horizontal axis)

Figure 10. Physicians' attrition tracking

Total # GP attrition = 59

Note: The horizontal axis shows the different reasons given from dropping out of the ECM program. The vertical axis shows the number of physicians for each reason.
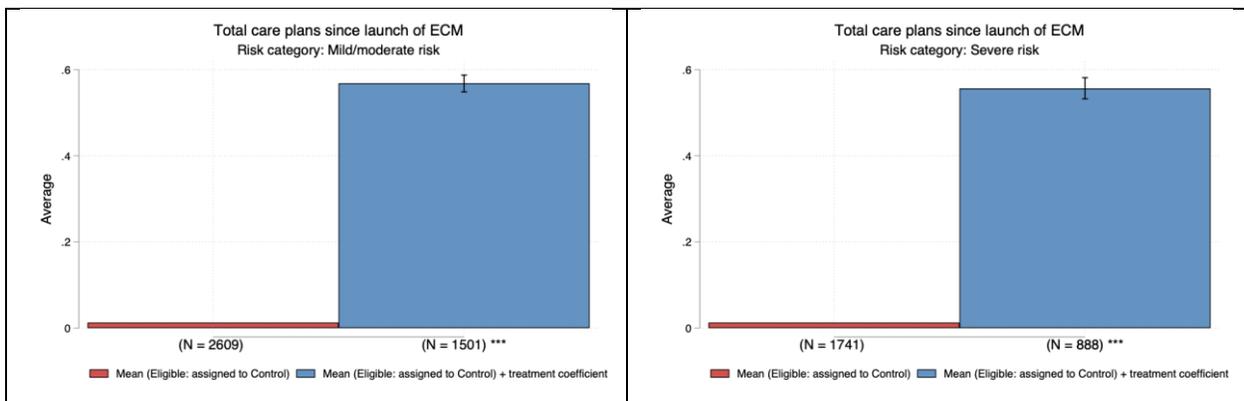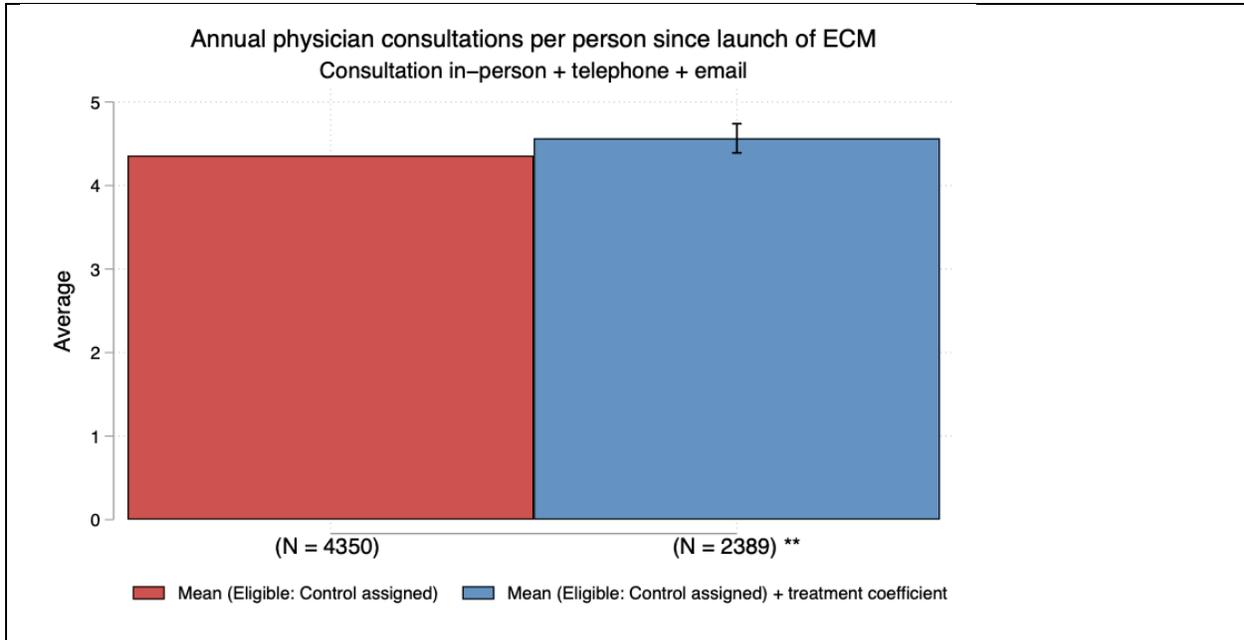
Figure 11. Physician tracking

Figure 12. Patient enrolment status

Figure 13. Treatment effect of ECM assignment on care plans

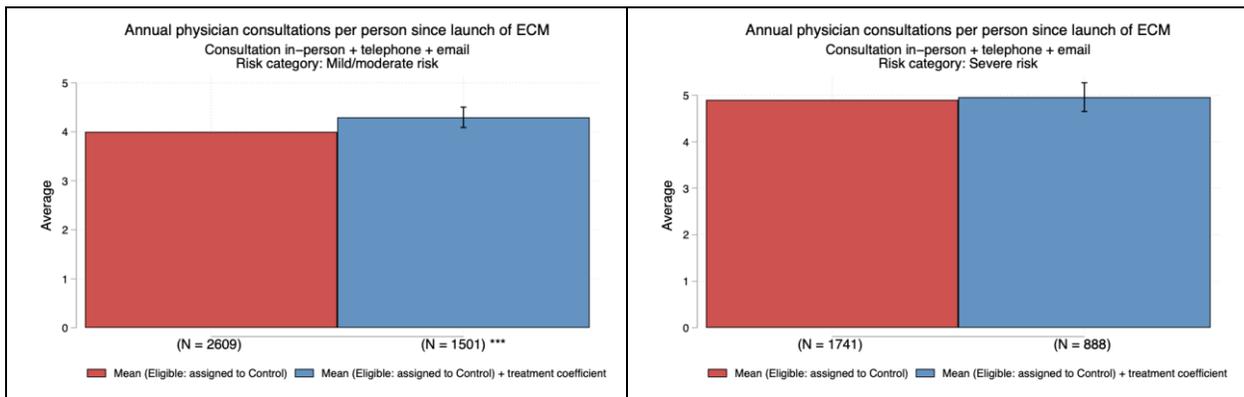**Note:** The above figure shows the mean number of care plans made since launch of ECM. The red bar shows the average number of care plans for the control assigned patients. The blue bar shows the mean number of care plans for control assigned + the treatment coefficient representing the effect of making the program available to the ECM assigned patients. The N for each bar represents the number of patients assigned to ECM and control.

Figure 14. Treatment effect of ECM assignment on care plans by risk category

Note: The above figure shows the mean number of care plans made since launch of ECM for mild/moderate risk patients on the left and severe risk patients on the right. The red bar shows the average number of care plans for the

control assigned patients. The blue bar shows the mean number of care plans for control assigned + the treatment coefficient representing the effect of making the program available to the ECM assigned patients. The N for each bar represents the number of patients assigned to ECM and control.

Figure 15. Treatment effect of ECM assignment on annual consultations with physicians

Note: The above shows the annual number of physician consultations (combining in-person, telephone and email) per person. The red bar shows the average number of physician consultations for the control assigned patients. The blue bar shows the mean annual number of physician consultations for control assigned + the treatment coefficient representing the effect making the program available to the ECM assigned patients. The N for each bar represents the number of patients assigned to ECM and control.
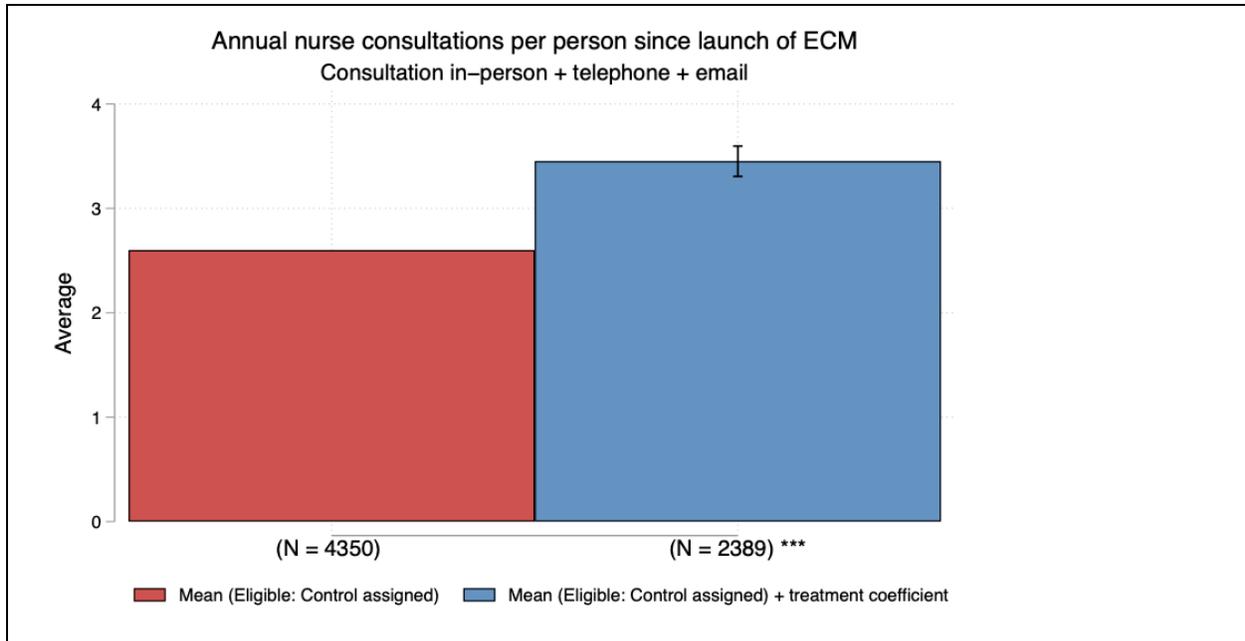
Figure 16. Treatment effect of ECM assignment on annual consultations with physicians by risk category

Note: The above shows the annual number of physician consultations (combining in-person, telephone and email) per person for mild/moderate risk patients on the left and severe risk patients on the right. The red bar shows the average number of physician consultations for the control assigned patients. The blue bar shows the mean annual number of physician consultations for control assigned + the treatment coefficient representing the effect making
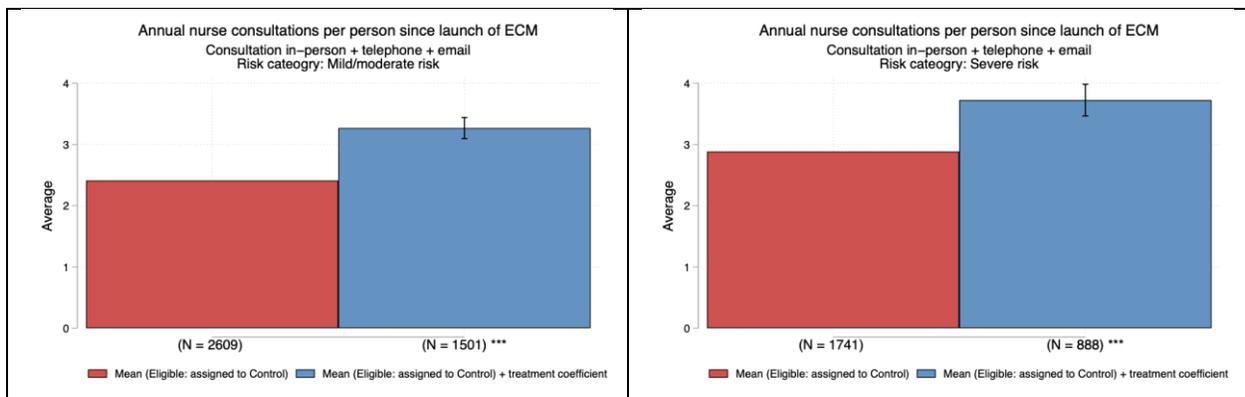
Figure 17. Treatment effect of ECM assignment on annual consultations with nurses

Note: The above shows the annual number of nurse consultations (combining in-person, telephone and email) per person. The red bar shows the average number of annual consultations per person for the control assigned patients. The blue bar shows the mean annual number of nurse consultations for control assigned + the treatment coefficient representing the effect making the program available to the ECM assigned patients. The N for each bar represents the number of patients assigned to ECM and control.

Figure 18. Treatment effect of ECM assignment on consultations with nurses by risk category

Note: The above shows the annual number of nurse consultations (combining in-person, telephone and email) for mild/moderate risk patients on the left and severe risk patients on the right. The red bar shows the average annual consultation per person for the control assigned patients. The blue bar shows the mean annual number of nurse consultations for control assigned + the treatment coefficient representing the effect making the program available to the ECM assigned patients. The N for each bar represents the number of eligible patients assigned to ECM and control.