The role of digital claims management for Estonia’s health insurance

A leverage for making healthcare purchasing more strategic
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COUNTRY STUDIES SERIES ON DIGITAL TECHNOLOGIES FOR HEALTH FINANCING
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Acknowledgements

The paper was prepared by Kristiina Kahur (Senior Consultant, HC Management Consulting Ltd), with contributions from Inke Mathauer (Senior Health Financing Specialist, World Health Organization headquarters), and supported by Triin Habicht (Senior Health Economist, Barcelona Office for Health Systems Financing, WHO Regional Office for Europe).

Valuable comments, information and peer review were provided by staff from the Estonian Health Insurance Fund, namely Seidi Vilba (Head of Development Department), Riho Peek (Head of Financial Department), Marko Tähnas (Head of Partnership Communications Department), Kadri Kikkatalo-Haller (Head of Analytics Department) and Pille Banhard (Member of the Management Board).

Special thanks go to Maarten Oranje (WHO headquarters) for his comments and critical inputs to the paper. WHO also thanks David Novillo (WHO Regional Office for Europe), Fahdi Dkhimi (WHO headquarters) and Justine Hsu (WHO headquarters) for their peer review comments.

Finally, WHO gratefully acknowledges financial support received for this project from the Government of Canada.
## Abbreviations and acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CeHWIS</td>
<td>Centre for Health and Welfare Information Systems</td>
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<td>DRG</td>
<td>Diagnosis-related groups</td>
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<td>DT</td>
<td>Digital technology</td>
</tr>
<tr>
<td>EHIF</td>
<td>Estonian Health Insurance Fund</td>
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<td>FFS</td>
<td>Fee-for-service</td>
</tr>
<tr>
<td>HIS</td>
<td>Health Information System</td>
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<tr>
<td>ID</td>
<td>Identification code</td>
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<tr>
<td>IT</td>
<td>Information technology</td>
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<td>MISP</td>
<td>Mini Information System Portal</td>
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<tr>
<td>ML</td>
<td>Machine learning</td>
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<tr>
<td>NCD</td>
<td>Noncommunicable disease</td>
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<tr>
<td>P4P</td>
<td>Payment for performance</td>
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<tr>
<td>QBS</td>
<td>Quality Bonus System</td>
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<td>UHC</td>
<td>Universal health coverage</td>
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<tr>
<td>X-tee</td>
<td>Trusted execution environment</td>
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1. Introduction

1.1 Study focus

This study assesses the use of digital technologies for health financing in Estonia. Specifically, it explores how the claims management process of the Estonian Health Insurance Fund (EHIF) has been developed over time from a manual process to a digital one, how this has enabled the introduction of other advanced purchasing instruments and what effects digitalization of claims has for health financing. The study helps to understand whether and how digital technologies can support the purchasing function in contributing to realizing desirable health financing attributes and the intermediate and final objectives of universal health coverage (UHC) (1), on the basis of which to draw lessons also for other countries.

After an overview in Chapter 1 of the health financing system and the health financing and digitalization reforms in Estonia, Chapter 2 begins with an outline of the evolution of the past claims management process and its stages of digitalization over the past decades (Section 2.1). Next, the business process of the current digital claims management system, which is an upgraded e-channel for digital claims, is presented (Section 2.2), followed by an exploration of some implementation issues (Section 2.3). Based on this, Chapter 3 assesses further digital innovations – namely the use of digital claims for provider payment setting, contract setting and automatic monitoring of contract execution. The effects of digital technologies for health financing are assessed in Chapter 4. The last chapter serves to draw lessons from the process, outlines future options for further optimizing Estonia's digital claims management and offers options and policy questions for other countries.

This assessment is based on a variety of data sources. In-depth discussions were held with key informants and resource persons from within the EHIF. Moreover, secondary data analysis was undertaken by exploring various indicators that the EHIF uses for monitoring. Thirdly, the assessment is based on document review (EHIF reports, illustrations from EHIF webpage functions etc.).
1.2 Estonia’s health financing system

Estonia has a centralized health system with a single health insurance fund. In 2001, the country’s 17 local sickness funds and the Central Sickness Fund were merged into a quasi-independent public legal body, the Estonian Health Insurance Fund EHIF. The health-care system is mainly publicly funded through an earmarked payroll tax, i.e. solidarity-based mandatory health insurance contributions which are pooled by the EHIF. The Fund is responsible for organizing national health insurance and assuring access to and purchasing of necessary health-care services, medicines and medical devices as well as cash benefits. As of 1 January 2021, about 94% of the population were covered by mandatory health insurance (2).

The supreme body of the Estonian Health Insurance Fund is the Supervisory Board, the members of which represent the interests of employers, insured persons and the state. The chairperson of the Supervisory Board is the Minister of Health and Labour. The Fund’s daily operations are managed by a four-member management board, with each member responsible for an area of work. One of the four work areas is responsible for digital services, which indicates the importance given to this area. As of 2021, the EHIF had some 200 employees. The organization’s structure is presented in Annex 1.

Government revenues and compulsory insurance contributions account for 77% of Estonian health spending, with the vast majority (88%) of these public funds spent via the EHIF. Around 22% of spending is from out-of-pocket (OOP) payments, mostly in the form of co-payments for medicines and dental care (3). A very minor share (1.4%) of spending comes from voluntary health insurance schemes.

Purchasing of health services is based on a contractual relationship between the EHIF and health-care providers. The main source of information on the core activities in health-service provision is the health insurance claims data. The contracts stipulate the conditions of how claims have to be filled and submitted to the EHIF. Although the primary aim of health providers in submitting claims is to be reimbursed, the EHIF’s use of claims data is much broader and includes the development and revision of payment methods and rates, contract setting, contract/performance monitoring, planning, and improvement of health-care quality and performance.
1.3 Reforms in health financing and digitalization

Estonia has had several health financing reforms in the past decade, as well as efforts to digitalize health data. Thus the digitalization of claims did not take place in a vacuum.

The most important health financing reform, which took effect in 2018, was the decision to broaden gradually the EHIF’s revenue base. This was the culmination of more than a decade of discussions on the financial sustainability of the Estonian health system. A narrow revenue base, mainly related to wages, had been a longstanding threat to the financial sustainability of the health system, mostly due to an ageing population. The share of non-contributing persons (primarily children and pensioners as well as students and pregnant women) represented almost half of the insured population, on behalf of which the state does not make contributions, unlike for the registered unemployed for whom contributions are made by the state. The reform was considered to be as important as the establishment of the health insurance system itself at the beginning of the 1990s and was expected to make the health system financially sustainable in the medium term and more resilient to future economic shocks (4). As a result of this reform, from 2018 the EHIF’s revenue base was broadened and government budget contributions are now transferred to the Fund’s budget on behalf of non-working pensioners.

In addition, the EHIF has gradually increased its responsibility for purchasing emergency care for the uninsured (about 6% of the population), ambulance care, HIV and drug dependency treatment, as well as other medicines and services that were previously financed from the state budget. These changes were meant to overcome the fragmentation in financing and to increase efficiency.

With respect to reforms related to digitalization, in 2017 the Centre for Health and Welfare Information Systems (CeHWIS) was established. The CeHWIS took over all functions from the Estonian eHealth Foundation (which had been established in 2005 by the Ministry of Social Affairs) and the Ministry of Social Affairs information and communications technology units. The organizational reform aimed to achieve efficiency gains resulting from the integration of statistical and analytical services, registries, management of information technology (IT) infrastructure as well as data standardization.

The CeHWIS is currently responsible for creating new digital services for various public institutions such as the EHIF, the Health Board, the National Institute of Health Development, the State Agency of Medicines, the Social Insurance Board and others. Digital services provided by CeHWIS in health care include, for instance, digital referrals, a patient portal, a national e-booking system for appointments with health providers, digital prescriptions, COVID-19 certificates and COVID-19 statistics.¹

In addition, CeHWIS plays an important role in supporting the exchange of data between individual health-care providers and the national Health Information System (HIS). The HIS is a central database through which health-care providers

¹ For an overview of current and upcoming health care related digital services, see the CeHWIS website at https://www.tehik.ee/en/projects?c%5B0%5D=health (accessed 13 November 2022).
exchange health data and can view patient health data sent by other providers. HIS was launched in December 2008 to store the data collected during the provision of health-care services. The HIS data are standardized and include information on patient medical records, visits to health-care providers and other patients’ health-related information. The HIS improves and accelerates the exchange of information between different providers, enabling the provision of better health-care services and providing a good overview of the treatment process and health data for both medical professionals and patients. Through HIS, for example, the family doctor has access to detailed health data of the patients on his or her list and thus has a comprehensive overview of a patient regardless of where and when the patient was treated.

The legislation states that the providers are obliged to transmit data to the HIS. The central system of the HIS belongs to the state, and the Ministry of Health is responsible for its operation and development. For reimbursement purposes, the providers must submit their claims separately to the EHIF. However, providers record the data only once in their own information system, from where the relevant data are transmitted to both the HIS and the EHIF.

Several incremental changes have been made to digital health services in recent years – such as enabling the disclosure of individual medical claims to patients via the patient portal (Box 1), enhancing the digital platform for improving and broadening digital services, or expanding the use of electronic referrals.

Box 1. Features of the patient portal and its benefits

**Links between the patient portal, HIS and other databases**

Access to the patient portal was first made available at the end of 2008. In July 2013 the portal was relaunched with new features. Patients can log into the patient portal by using, for instance, an identity card, a smart-ID or mobile-ID.

The patient portal allows access to patients’ own health data which have been collected, compiled and transmitted to the HIS during outpatient visits, hospital stays or any contacts with health-care providers. Access to one’s own data is important from the point of view of transparency and awareness. A patient also has the right to restrict visibility of his or her data (partially or fully) to the health-care provider.

All providers operating in Estonia are obliged to transmit the data generated during a patient contact with a provider to the HIS within five working days after the end of hospital treatment or within one working day after the end of outpatient treatment after which the data are visible on the patient portal.
Box 1. (contd.)

Examples of information a patient can see on the patient portal
- His/her own health data (e.g. diagnostic findings, medical reports)
- Current prescription(s) and prescription history
- Medical claims submitted to and paid by the EHIF
- Data on the family doctor (e.g. name, location) and validity of the health insurance.

Examples of actions a patient can take on the patient portal
- Submit declarations of intent (e.g. to donate organs, agree to blood transfusion, donate one’s body after death for learning and research).
- Appoint a representative(s) to perform various tasks (e.g. to view health data, update personal data, lock medical documents, buy prescribed items from the pharmacy).
- Book, change and cancel appointments (including COVID-19 vaccination) through the national digital registry.
- Check by name who has viewed the health data. 2
- The patient portal allows the patient to dispute a claim if the patient the patient considers it is incorrect (see further below).

Benefits regarding fraud detection
- Patients can see what they have paid for and what providers have claimed for from the EHIF. This allows them to detect potential misbehaviour of providers.
- The data that are visualized on the patient portal are linked to the EHIF claims database, and patients can see the cost information about their medical bills reimbursed by the EHIF on a single service level.

Starting from the end of 2020, in case of suspicion, an individual can dispute a claim and inform the EHIF directly through the patient portal. Once logged in to the patient portal and viewing a claim, the person can initiate the dispute by using a specific button (a click on the webpage). Before sending off a dispute, the patient can add further information about the dispute for clarification (Figure 1).

2 In case of viewing documents in the HIS, a unique log entry remains in the system.
Figure 1. Dispute mechanism in the patient portal

Source: (5)
The evolution of the claims management process can be divided into different phases, starting in the mid-1990s. During the pre-digital phase (prior the mid-1990s) the claims were submitted on paper and managed manually. An overview of the evolution of the business process of claims management is depicted in Figure 2.

From the mid-1990s, the development of an electronic solution for the EHIF database had begun. The biggest and most radical modification in the EHIF’s claims submission system took place at the end of the 1990s. This was stimulated by incentives from the EHIF (HiT, 2018), which had an objective of moving to a full electronic claims management system and to end the system of paper-based claims.

By the end of the 1990s, most data were digitized and most local branches of the Central Sickness Fund had electronic databases using various data delivery options: health-care providers carried diskettes, zip-drives and compact disks to the EHIF offices, and in some cases paper claims were submitted. Designated staff entered the data into the EHIF information system.
In 2001 the 17 local sickness funds and the Central Sickness Fund were merged into an independent public legal body (EHIF), which also implied the merging of the local databases and the creation of one national database (i.e. interconnected databases). In the same year, the EHIF launched a project aimed at developing a uniform, centralized and secure information system, called electronic channel (abbreviated as e-channel) based on a standard software solution in order to facilitate data transmission between hospitals and the EHIF. This development was linked to the objective of improving the quality of claims data by introducing automated pre-payment controls in 2003. These were later revised and updated (see Phase 3 below). The e-channel allowed the providers to load claims directly into the EHIF information system, making the process more effective and less time- and resource-consuming. The EHIF procured a new central server to ensure smooth management of the data.

At the beginning of the 2000s, Estonia was also implementing a system of diagnosis-related groups (DRGs) on the basis of the EHIF’s electronic central database. As the e-channel was introduced simultaneously, it was possible to develop a system with a central DRG grouper accommodated in the EHIF server. All the hospitals were able to use the central grouper for the grouping process. This was considered an important step, as otherwise each provider would have needed to purchase its own grouper software. Data-checking would thus have been more time-consuming and implementation would have required both more time and more finances.

By the end of 2002, the EHIF had electronic claims submission with 730 health-care providers which amounted to 75.5% of all providers contracted with the EHIF. The health care providers submitted electronically a total of 7041 summary invoices (or “consolidated invoices”) in 2002 (6), while some of the invoices were still submitted on paper for a short time as part of the system adaption steps needed. A summary invoice consolidates the individual claims submitted by one health-care provider to the EHIF for an agreed period of time into one aggregated invoice to be used as a basis for payment. The e-channel was able to receive up to 2500 claims within one summary invoice. As stipulated in the contract, this agreed period was one month in most cases, while bigger hospitals with high patient numbers submitted claims more frequently.

In 2003, the remaining providers came on board to use the e-channel and shifted to the digital transmission of claims. As from 2004, 100% of health-care providers’ claims were transmitted directly into the EHIF information system via the e-channel.
Starting from 2004, when 100% of claims were transmitted via the e-channel, the EHIF undertook regular maintenance of the e-channel and further fine-tuned it in cooperation with health-care providers. Additional automated controls were introduced and were regularly revised and updated according to the changes in the benefits package which specifies the list of the health-care services covered by the EHIF, as well as their tariffs and the coverage terms.

However, during this phase, the contract monitoring process was still separate from the processes for claims management and payment, for which the e-channel was in use. Contract monitoring was built on EHIF’s principal software management platform, whereas the claims management and payment were based on a separate digital solution. Hence, there was no automated link between the two processes. The claims were transferred in electronic form via the e-channel, but further processing of claims data and contract monitoring was carried out by transferring claims data into the principal software and using different queries to extract the claims data needed for contract monitoring and to compare it with planned contract volumes (i.e. provider-specific budget and cases). In other words, monitoring of the execution of contracts was only partially automated and various additional actions had to be carried out for that purpose. At the time there was no digital technology in place that was able to monitor the execution of contracts on an ongoing basis. It became increasingly clear over the following decade that there was a strong need to enhance digital communication between the EHIF and providers, to improve the contract monitoring process and to decrease the workload related to it.

Phase 3. Improvements of the e-channel and automated controls (2004–2016)

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By 2016 the e-channel that had been used for over a decade had become outdated. It was based on XML and used different data packages for data exchange between health-care providers and the EHIF. It was not integrated into the principal software platform as other EHIF business processes were. As such, the e-channel needed extra resources for maintenance and updating. In addition, the EHIF had to control providers’ access to the e-channel in order to ensure its security. It became obvious that the system needed to be upgraded.

In 2017, the EHIF launched a new project to upgrade the e-channel and to automate the contract monitoring system by introducing new digital features. The preparation and implementation of these upgrades took almost three years and included testing and piloting followed by implementing changes in the EHIF’s and the providers’ information systems. The new digitalization efforts had the following objectives:

- to integrate the e-channel into the principal software platform;
- to carry out technological innovation and find new and modern solutions for the e-channel;
- to improve significantly the process of managing the contracts and to digitalize the exchange of information between the EHIF and health-care providers;
- to increase the overall automation of the business processes.

Phase 5. Introduction of fully automated claims management and digital contract monitoring (since 2020)

As of January 2020, this new electronic channel became operational. This allows for data exchange of multiple digital services through a trusted execution environment (X-tee) (see section 2.2 and Box 2) and enables fully automated claims processing. The e-channel is linked to each provider’s contract and thus also makes automated contract monitoring possible.

Another important change which became effective in 2020 concerned the claims submission flow. Now, as health-care providers can submit their claims on a continuous basis, they can also receive instant feedback on their status of contract execution. This feature also significantly increased the automation of the contract monitoring process and made contract monitoring more transparent for providers.
2.2 A deep dive: the business process of digital claims management since 2020

Claims management is one of the essential parts of the EHIF’s business process of purchasing. An overview of a typical claim’s life cycle is provided in Figure 3. Claims are submitted to the EHIF via the e-channel where automated controls are applied. Various errors can occur during the claims life cycle – such as errors related to coding and billing compliance, eligibility issues (insurance status of the patient, medical indication etc.). Many of these errors can now be detected by the automated control features prior to the payment process. Claims with errors are rejected and the ones without errors are paid. Errors that need a close review are dealt with in the post-payment phase, during which other non-detected errors may also be addressed.

This kind of claims life cycle is quite generic and is used in many countries, including Estonia. However, two aspects of the Estonian system make it different from the systems of many other countries. First, claims are automatically reviewed in the e-channel before the payment stage and without any human intervention. Second, the execution of contracts is automatically monitored by digital technology.

Figure 3. Life cycle of claims

1. Creation of claims by health-care provider

After a patient’s discharge or visit, a claim is created which includes clinical information combined with information about the patient, provider characteristics, the care setting (inpatient, outpatient, day care/surgery, rehabilitation etc.), health service tariffs and so on (Figure 3, step 1). The patient’s unique identification code (ID) enables the EHIF database to link demographic, administrative and medical data with that patient.
To enter the data into the electronic health record and create a claim, providers use different technical solutions and software. Over the years, most health-care providers have deployed their own information systems supported by different software developers and, consequently, these are not mutually compatible and cannot exchange information easily across providers. However, regardless of different information systems and user interfaces at the level of the health-care provider, the claim structure and the data composition are the same for all providers. An overview of the information submitted on claims is presented in Annex 2.

2. Submission of claims via the e-channel

Claims are submitted through the e-channel (Figure 3, step 2). The e-channel operates on X-tee\(^5\) which is a data exchange layer between different information management systems (see Box 2).

**Box 2. Overview of X-tee**

X-tee is a data exchange layer for information systems. It is a technological and organizational environment that enables secure Internet-based data exchange between information systems. X-tee is a versatile security solution that includes authentication, multi-level authorization, a high-level system for processing logs, and data traffic that is encrypted and signed. Traditional attacking vectors are ineffective against X-tee due to its structure and architecture. X-tee implements different security technologies such as XAdES, ASiC, VPN, RSA, TSL, RFC3161, OCSP and PKI.

Each connected institution is identifiable via an encrypted certificate. All actions are logged constantly. Logs are chained and have non-repudiation value (i.e. they include proof of the origin and the integrity of the data). Any information request initiated by an individual or an institution is counted. This counting helps both to predict productivity bottlenecks and to monitor the security situation.

Providers can access the X-tee via their own information system or, as is the case primarily for smaller providers, by using Mini Information System Portal 2 (MISP2). For providers using their own information system, a specific software module must be integrated into the provider’s information system with specific user interfaces in order to be able to communicate with X-tee and upload the claims on an ongoing basis. As for MISP2, there is no need to integrate a specific software into the provider’s system because MISP2 allows the use of X-tee as an open (and free) service via a normal Internet browser without the need to implement

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\(^5\) Until 2018, it was named X-Road in English. Since 2018, however, X-Road is used only to refer to the technology jointly developed by Estonia, Finland and Iceland through the non-profit association Nordic Institute for Interoperability Solutions. The Estonian X-tee is now also called X-tee in English. See: Data Exchange Layer X-tee at the Estonian Information System Authority (https://www.ria.ee/en/state-information-system/x-tee.html, accessed 13 November 2022).
the corresponding functionality in their own information system. The MISP2 is intended for small and low-budget institutions that are legally required to publish data of some kind. Thus, the MISP2 portal can be used by anyone (e.g. health-care provider, pharmacy) who has registered as a user of X-tee. An overview of the functions and communication flows of X-tee is provided in Figure 4.

Figure 4. Communication over X-tee

![Diagram of X-tee communication](image)

Source: Adapted from the MISP2 user manual (translated into English) (7)

Only patient case-specific claims are transmitted to the EHIF via the e-channel. In the past providers were responsible for submitting summary invoices by merging the individual claims. Since 2020, the EHIF has created summary invoices. For non-case-specific payments (e.g. hospitals’ preparedness fees, family practitioners’ per capita payments and basic allowances etc.) the provider does not need to submit any information to initiate the payment because the EHIF creates the summary invoices on the basis of the principles agreed in the contract. Figure 5 gives an idea of the annual volumes of claims submitted via the e-channel during 2014–2020 in specialized medical care, nursing care and dental care.

Figure 5. Example of the annual claims volumes 2014–2020

![Bar chart showing annual claims volumes](image)

Source: (2)
Once the claims are submitted to the EHIF via the e-channel, automated controls are applied (Figure 3, step 3). The content of the automated controls is under continuous revision. As of December 2021, 368 different controls were applied during the pre-payment verification stage (including COVID-19 treatment-related controls which were added during the pandemic in 2020). The list of controls is publicly available on the EHIF webpage and is accessible to all, thus creating transparency of the EHIF’s claims control process. In line with this list of controls, providers can make necessary adjustments in their information systems and can also verify a claim before sending it to the EHIF. However, most do not do this because it requires extra effort and resources (money and time) to integrate the controls into the providers’ own system and because it would constitute a duplicate action for them. For providers it is easier and takes less effort to submit claims in the e-channel and receive feedback about any errors, so that they can make corrections and re-submit.

There are two types of automated controls: format controls and content controls. The former check if all data fields are filled and the values in each field correspond to agreed requirements and conditions. The latter check if the content of the claim corresponds to the terms and conditions stated in the contract and relevant legislation. Examples of automated control items are shown in Table 1. If the claim does not pass the format control, it receives an error notification and is returned to the provider for corrections (Figure 3, step 3b). Some 300 controls out of the current 368 (as of December 2021) are content controls, while the rest are format controls.

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of control</th>
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</thead>
<tbody>
<tr>
<td>Same diagnosis code cannot be coded repetitively on the same claim</td>
<td>Format</td>
</tr>
<tr>
<td>Date of the service cannot be earlier than date of admission</td>
<td>Format</td>
</tr>
<tr>
<td>Date of discharge cannot be in the future</td>
<td>Format</td>
</tr>
<tr>
<td>In case of disease prevention-related services, the claim cannot be for</td>
<td>Content</td>
</tr>
<tr>
<td>emergency care</td>
<td></td>
</tr>
<tr>
<td>Service codes 7070 (invasive home ventilation therapy) and 7071</td>
<td>Content</td>
</tr>
<tr>
<td>(non-invasive home ventilation therapy) cannot be coded on the same claim</td>
<td></td>
</tr>
<tr>
<td>In case of COVID-19 the maximum number of vaccines per person is limited to</td>
<td>Content</td>
</tr>
<tr>
<td>3 in one year</td>
<td></td>
</tr>
</tbody>
</table>

Source: (8)

The content controls are applied after the claim has passed the format controls. If any error is detected, the claim is again returned to the provider together with an error code and error message. The claim can be submitted multiple times until it
successfully passes through controls and is accepted for payment. Once the claim is accepted, a unique claim identifier is created automatically in the e-channel. The successful claims submission log is sent to the provider for information and further use in case there is need to track the claim later. Importantly, the new e-channel that has been operational since 2020 also allows for the identification of duplicate claims before payment. This avoids the re-submission of claims that have been submitted previously (as may occur due to human or system errors at the provider level).

In addition to format and content controls, the claims which are to be assigned to a DRG are grouped with the DRG grouper (a central grouper within the EHIF information system), followed by checks on whether the claims constitute DRG outliers according to the stated rules. This is an important step in the calculation of the reimbursement rate. If the claim is grouped into a DRG and is not considered as an outlier, the reimbursement amount is a combination of DRG payment, per diem and fee-for-service (FFS) payment. Otherwise, a claim assigned to DRGs but found to be an outlier is reimbursed on the basis of an FFS payment. This process of automated controls and DRG assignment of inpatient claims is shown in Figure 6.

Figure 6. Process of automated controls and DRG assignment of inpatient claims

Source: Based on personal communication with EHIF staff
Importantly, the health-care provider can also use the e-channel to submit a claim for testing and information purposes only. All automated controls, grouping into DRG, determination of DRG outliers and calculation of reimbursement amounts are carried out in the same way as for a claim which is submitted for actual reimbursement purposes. Nevertheless, the system does not assign unique identifiers for the test claim nor is it stored and considered in the contract monitoring process. This test-generated information is useful and often needed by a provider, if the contract execution is close to reaching the volume caps, in order to see whether the claim fits within or exceeds the agreed contract volume.

4. Payments of claims

Another important phase in the claims life cycle is the payment of providers (Figure 3, step 4). The payments for patient-related claims are made once the claim has passed successfully through all automated controls.

Different provider payment methods are used in Estonia depending on the health-care service provided and the care setting (see Table 2) in order to avoid the perverse incentives that a single payment method may create. A mix of payment methods is applied in primary health care and hospital care, whereas dental and outpatient specialist care are paid by FFS payment only. The payment methods, tariffs of health-care services and coverage terms are included – and regulated – in a single government-approved package of benefits. The benefit package and tariffs are updated at least once a year. All providers are paid the same amount for the same service, as indicated in the benefit package, and there is no adjustment for hospital characteristics such as teaching status.

Table 2. Provider payment methods in Estonia

<table>
<thead>
<tr>
<th>Health care services/provider</th>
<th>Payment method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family physicians</td>
<td>Capitation, FFS, P4P, add-on payments (basic monthly allowance distance fee, therapeutic fund, procedure fund, fee for second family nurse etc.)</td>
</tr>
<tr>
<td>Outpatient specialist care</td>
<td>FFS</td>
</tr>
<tr>
<td>Dental care</td>
<td>FFS</td>
</tr>
<tr>
<td>Inpatient care (hospitals)</td>
<td>FFS, per diem, DRG, global budget, bundled payment</td>
</tr>
<tr>
<td>Long-term nursing care</td>
<td>FFS, per diem</td>
</tr>
</tbody>
</table>

Source: (4)

*FFS: fee-for-service; P4P: payment for performance; DRG: diagnosis-related groups.
After the digital claims have been paid and stored in the data warehouse, various post-payment verifications (Figure 3, step 5) are applied. Digital technologies including machine learning play an important role in this process.\(^6\)

The EHIF started to use ML in 2019 with the aim of automating the verification of claims, prescriptions, certificates for sick leave and other digital documents sent to the Fund for reimbursement, with the purpose of detecting potential fraud and/or errors in these. There is a dedicated team in charge of ML in the Analytics Department of the EHIF.

All claims and other digital documents which are submitted via the e-channel and pass the automated controls for payment are processed by a ML model, whereby both supervised and unsupervised ML models are being applied. Supervised learning models enable detection of possible errors in claims which are of a predefined nature – i.e. the type of error or fraud follows a pattern that is known from previous checks. Predictive models are then applied to the claims or providers that require closer attention. Unsupervised learning models allow for screening the claims for outliers of an unknown nature: cases are identified as unusual, although the ML model is not able to classify whether the outlier is just a clinically different case and therefore within an acceptable difference or whether it is actual fraud or error.

Prior to the introduction of ML, only a fraction of claims was controlled manually for fraud on the basis of specific aspects and priorities; it was thus unknown how many fraudulent claims were missed. With the introduction of ML, the number of claims requiring manual control has declined to a small percentage, although it is impossible to precisely determine this decline. With the use of ML, all incoming claims are controlled, whereby potentially flawed claims are identified and marked with a likelihood score to be fraudulent. As a result, only claims with the highest scores are forwarded for manual inspection. The ML model is placed to miss no more than 5% of potentially flawed claims.

For instance, in the second half of 2018, some 3.4 million claims were submitted to the EHIF. Using these data, the ML model identified 6500 claims with a suspected error and all were referred for manual inspection (i.e. a close review)\(^9\). In the second half of 2022, there were 6426 claims controlled, meanwhile using five models of supervised ML.

Suspicious claims are forwarded to the EHIF experts with a medical background for further targeted manual reviews. EHIF experts are granted access to the HIS (the central health database managed and owned by CeHWIS), which also includes electronic discharge letters. The information in the discharge letter is compared with the claim information and, if there is a discrepancy (e.g. concerning the quantity of services, provision of certain services or other variables), the EHIF

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\(^6\) ML is a type of artificial intelligence that uses programmed algorithms that receive and analyse input data to predict output values within an acceptable range. As new data are fed to these algorithms, they learn and optimize their operations to improve performance, developing “intelligence” over time. ML is helpful when large and complex data sets are collected which are difficult to process by using common database management tools or traditional data processing applications. Moreover, ML can find insights from complex and heterogeneous data sets.
has the right to ask the hospital to credit the claim. The claims can be credited during a running calendar year. In case the information in the discharge letter is insufficient, the medical records will be checked. To do this, the EHIF has to ask the health-care provider to provide remote electronic access to a medical document on the hospital’s information system. If remote access is not possible, the medical record is forwarded to the EHIF as an encrypted file.

Supervised ML has also improved the speed of claims processing in the post-payment phase, as it has replaced very different, very time-consuming standard data queries that were previously undertaken manually by EHIF trustee doctors to detect (undesired) variations and to flag suspicious claims according to predefined rules. Moreover, the overall time period for fraud detection is shortened. Meanwhile, there is a monthly control process reviewing the claims sent in the previous quarter of the same year. This improves and speeds up the communication with hospitals, as claims and cases under study are more recent. Finally, instead of applying fines, EHIF can operate on the basis of credits.

To search for new and unknown errors, an unsupervised ML model is used to detect outliers. This involved, for instance, checking for incompatibility of patient characteristics and clinical information (gender or age versus diagnosis or procedure), discrepancies in quantities of services, and deviation from average length of stay/average reimbursement amount per case.

ML has also had an impact on business processes and the way in which payments to providers are managed. In the past, after the analytical reports were checked, the accounting period for crediting the claims was already closed and the EHIF could no longer credit the claim. Instead, an official claim was submitted by the EHIF to the provider in question. In sum, the application of ML has significantly enhanced the ability of the EHIF to use health insurance resources efficiently and purposefully. Finally, ML is also used for other purposes in EHIF, with one example provided in Box 3.

**Box 3. Use of machine learning for patient health management**

ML is also used to support patient health management. A pilot project was launched in 2019 to develop an ML model to predict and stratify patients’ risks for enhanced care management on the basis of their claims data from the previous year. The aim is to avoid acute illness and emergency hospitalization of patients with noncommunicable diseases (NCDs) such as cardiovascular disease, respiratory disease and mental illness (10). A predictive binary classification model is used for this. The ML model creates a list of patients with multiple morbidities according to the probability that these patients would be admitted to the hospital during the next year due to an NCD. This list would give the family physician an indication of which patients should receive special attention in order to prevent acute illness and emergency hospitalization. This model is currently a work in progress but the aim is to further develop and scale it up for actual use at family physician level.
2.3. Implementation issues and costs in relation to the e-channel

Within EHIF, investment costs were budgeted and funds were provided for the implementation of the upgraded e-channel and automated contract monitoring. However, once the system became operational, no additional operational costs have been budgeted because the new system, like most of the other EHIF business processes, uses the principal software platform. Thus the costs related to maintenance of the new system are already covered by the existing contract with the company providing the principal software. As the old e-channel was removed, there was no need for maintenance and expert support any longer, thus reducing those costs.

For providers, the implementation of the new e-channel demanded major changes in their information systems. Thus, software developers who were in charge of maintenance and upgrade of provider IT systems have been involved since the beginning of this project. From the provider’s perspective, the costs related to the development of the information system are a separate component in health-care service prices. However, the costs of switching to the upgraded e-channel were not separately funded by the EHIF.

Preparations for the upgrade of the e-channel and the introduction of the digitalized contract monitoring system began with the creation of a project team within the EHIF and the appointment of a team leader at the beginning of 2017. The initial plan was to launch the new system in 2019 but development work took longer than initially planned. The EHIF project team had regular meetings with health-care providers and software developers who were actively involved from the beginning. In the early stages there was some resistance to the changes at provider level. However, active communication and the involvement of voluntary pilot hospitals facilitated the project’s progress. The EHIF management board strongly supported the project team. For instance, the members of the management board attended the working group meetings at which technical issues were discussed. They also communicated the coming changes on various occasions when hospital managers, software developers and other stakeholders were present. The testing of the new system was carried out by employees of the EHIF who had specific knowledge and experience of IT and who had previously been involved in testing other IT developments.

There were no specific changes within the EHIF as an organization. Likewise, the implications for legal and regulatory provisions were modest. There was however a need for minor changes in the Ministry of Health decree which described the structure of the claim and data fields. In addition, the contract’s annexes related to data exchange and claims transmission were revised.
3. The use of the digital claims management system for setting and revising provider payments, setting contracts and monitoring contract execution

3.1. Setting and revising provider payments

The digital claims data is also used for further development and revision of provider payment mechanisms such as bundled payment for selected care episodes, adjustment in per capita payments based on age groups, and the introduction of pay-for-performance mechanisms in primary health care. The latter two are outlined below in more detail.

Adjustment of per capita payment using digital claims data

After the family physician payment reform in 1998, the capitation payment was the same for all people, irrespective of their age. However, it was clear that some age groups have more health service needs than others. The primary health care providers were keen to have good-quality data that would allow for assessing their performance, and they therefore submitted their activity data to the EHIF (using patient-level data) for analysis and evaluation of the differences between the age groups. The first age adjustments in capitation payments were made in 1999. Capitation payments were further adjusted for age in 2012, this time facilitated by the fully digitalized and centralized claims data that were available. Five age groups were used for the capitation payment, namely: up to 3 years, 3–6 years, 7–49 years, 50–69 years and over 70 years.

Quality bonus system at the primary health care level using digital claims data

In 2006, the EHIF introduced a quality bonus system (QBS) with the overall aim of incentivizing preventive care and the management of chronic conditions at primary health care level. The QBS rewards well-performing family physicians with a top-up payment (FFS payments up to a maximum percentage of their capitation...
The QBS amounted to 3% of the annual primary health care budget in 2020 (11). Specifically, the QBS seeks to:

- encourage family physicians to engage actively in the prevention of illnesses, thereby avoiding subsequent high costs for the treatment of those illnesses or for people’s premature disability to work or death;
- achieve and maintain a critical level of vaccination, thereby helping to prevent the spread of certain infectious diseases;
- assure more effective monitoring of certain chronic conditions, thereby helping to prevent the development of complications;
- incentivize family physicians to provide more broad-based health services (12).

A key requisite for the operation of the QBS was the existence of digital claims submitted by family doctors to the EHIF for reimbursement. The available digital claims information allows automatic calculation of the bonus payments. The detailed patient-level information makes it possible to assess performance measures without the need for additional data collection. Yet, the data only contain process-based information (e.g. which diagnostic tests have been done) but no outcome measures (e.g. values of blood pressure). It is one of the reasons why the QBS is limited to including only process-based indicators.

The QBS is leveraged to drive improvement not only through financial incentives but also by providing feedback to providers on their performance. Implementation of the QBS and the monitoring of performance results have highlighted the importance of clinical guidelines in performance monitoring at primary health care level (13). Improvement and revision of the QBS indicators on the basis of digital claims data is an ongoing process in order to further fine-tune the financial incentives to encourage family physicians continuously to focus on disease prevention, monitoring of patients with chronic illness and increasing their competence. Realizing such policy instruments through digital technologies is again a critical part of making purchasing more strategic.

### 3.2. Contracting and setting contract caps

Contracts with health-care providers are an important element of the EHIF’s endeavours in strategic purchasing, by contributing to more equitable distribution of resources as well as efficiency. Contracting is the institutional format through which the EHIF budget is transformed into benefits in order to distribute resources more equitably across the country and realize efficiency gains through needs-based allocation of resources (14). An overview of the contracting process is provided in Figure 7.
The Health Insurance Act determines the core content of the contracts, while the EHIF's Supervisory Board endorses the key principles for contracting, such as the duration of the contracts, conditions of selective contracting, or the process of selective contracting. Within this context, the EHIF negotiates the standard contract conditions with provider associations such as the Estonian Family Physicians Association and the Estonian Hospital Association. This ensures that the terms of the contract are universal and apply to all providers of the same type. This is in contrast to the early 1990s, when contracts were still rather unsophisticated and when only the capped total budgets were agreed.

Analysis of the available digital claims data informs the setting of (minimum and maximum) contract volumes and amounts to manage available budgetary funds. Importantly, volume and budget caps are not just about setting a maximum of cases. They serve equally to incentivize providers to deliver certain types of care, such as more outpatient care over inpatient care, as well as to ensure a minimum of cases in order to assure access and quality of services.

For specialist care, in addition to the standard contract conditions, there are detailed provider-specific budget- and volume-based financial appendices that are agreed with each provider individually for one year. These budget and case volumes are capped for each half-year. If the actual budget and case volume remains below
the planned volume within the first six months of the year, the unused resources are shifted to the second half-year. However, if the volume of the first half (or full) year is exceeded, a reduced payment rate for individual services per claim is applied. The budget and case volumes are negotiated with each provider and are agreed on the basis of the provider’s specific mix of available specialized inpatient care services, day care and outpatient care. There is a degree of flexibility in the contract conditions which allows each provider to reallocate contract volumes between the specialties or care setting without further negotiation with the EHIF. The contracts are valid for five years for all providers.

One important indicator that guides the contract setting is the proportion of primary visits among all outpatient visits (primary and recurrent combined), whereby a higher proportion of primary visits is preferred. This indicator is used by the EHIF to determine the distribution of contract volumes between the providers and, as such, is meant to incentivize providers to improve the management of patient care and to minimize unnecessary recurrent outpatient visits. Figure 8 is an example of what the EHIF dashboard can do and illustrates this provider comparison, showing the proportions of primary outpatient visits in January–July 2021 by selected hospitals and specialties (blue line), compared to the average of all providers (dashed line).

Figure 8. Comparison of the proportion of primary outpatient visits across selected hospitals

Moreover, the claims data is used for the EHIF’s contracts to include the conditions for geographical access to care (to ensure equitable access), quality of care standards, reimbursement rates and conditions, reporting requirements, and the liabilities of the parties in case of a violation of the conditions. Ultimately, the availability of detailed claims data of high quality is obviously an important element for enabling improved decision-making, i.e. setting contract volume caps, thus critical for making purchasing more strategic.
3.3. Monitoring of contract execution

Along with the implementation of the upgraded e-channel in 2020, a digital solution was created and new features were added to the system in order to automate the monitoring of contract execution and also to create a link between the claims management and automated contract monitoring processes. This closed the previous gap in the system existing until 2020.

The following new parameters are checked during the automatic claims management:

- contract volumes (cases and budget by specialty and care setting);
- specific conditions (including procurement-related aspects) agreed in the contract with each health-care provider;
- service provision which exceeds the agreed volume in the contract – i.e. so-called “overprovided services” (in this case, the reduced tariffs are applied).

As the contract volume of each provider is capped, it is important to monitor contract execution for each provider to ensure that the resources allocated and used meet the health needs of the population. The upgrade of the e-channel for claims submission and the digitalization of contracts starting from 2020 were decisive milestones that changed the EHIF’s business process and enabled automated monitoring of contract execution.

The changes made it possible to link real-time claims data directly with the actual contract volume per provider as to the specialty and care setting under which the health services are performed (e.g. inpatient, outpatient, day care). This is then compared with the planned contract volume and allows for automated monitoring the execution of the contract on an ongoing basis and in real-time.

Even before 2020, the EHIF systems allowed some flexibility related to fluctuations in contract volumes of different medical specialties (oncology, general surgery, gynecology etc.) and care settings. Yet, the automation also allowed for increasing provider freedom to (re)allocate contract volumes across specialties and care settings within the agreed conditions and without the need to contact EHIF. This made the reallocation of the contract volumes less time-consuming, smoother and more flexible without need for negotiation or approval by the EHIF.

In addition to the automated monitoring of contract execution, each health-care provider is assigned to a dedicated EHIF staff in the EHIF’s Partnership Communications Department who monitors the execution of contracts of each health-care provider by medical specialty and by care setting throughout the contract period. These officers will intervene if the deviations are remarkable. Reasons for deviations will be discussed with providers and changes in contract volumes may be negotiated and put in place as a result. There might be need to reallocate volumes, to use reserves, or to increase the contract volumes if justified. EHIF uses Power Business Intelligence (“Power BI”), an interactive software product for data visualization, which allows the creation of different interactive internet portal dashboards and reports. These provide actionable insights into the claims data and point to deviations from planned contract volumes (e.g. the deviations between the average reimbursement per case of a specific medical specialty and the similar reimbursements of other health-care providers, see Table 3).
Table 3. Example of deviations from planned contract volumes of a selected hospital, inpatient care, surgical specialties

<table>
<thead>
<tr>
<th>Provider</th>
<th>Actual no. of cases</th>
<th>Planned no. of cases</th>
<th>Actual vs planned cases (%)</th>
<th>Actual amount (EUR)</th>
<th>Planned amount (EUR)</th>
<th>Actual vs. planned amount (%)</th>
<th>Actual average cost per case (EUR)</th>
<th>Planned average cost per case (EUR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impatient</td>
<td>11,229</td>
<td>11,446</td>
<td>98%</td>
<td>28,245,206</td>
<td>31,486,197</td>
<td>90%</td>
<td>2,746</td>
<td>2,746</td>
</tr>
<tr>
<td>Surgery</td>
<td>11,229</td>
<td>11,446</td>
<td>98%</td>
<td>28,245,206</td>
<td>31,486,197</td>
<td>90%</td>
<td>2,746</td>
<td>2,746</td>
</tr>
<tr>
<td>Otorhinolaryngology</td>
<td>3,010</td>
<td>2,801</td>
<td>107%</td>
<td>2,118,024</td>
<td>2,365,785</td>
<td>90%</td>
<td>704</td>
<td>845</td>
</tr>
<tr>
<td>General surgery</td>
<td>2,169</td>
<td>2,195</td>
<td>99%</td>
<td>5,470,914</td>
<td>6,231,606</td>
<td>88%</td>
<td>2,839</td>
<td></td>
</tr>
<tr>
<td>Orthopedics</td>
<td>1,437</td>
<td>1,377</td>
<td>104%</td>
<td>3,547,721</td>
<td>4,093,745</td>
<td>87%</td>
<td>2,973</td>
<td></td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>1,009</td>
<td>1,149</td>
<td>88%</td>
<td>2,957,209</td>
<td>3,529,800</td>
<td>89%</td>
<td>2,898</td>
<td></td>
</tr>
<tr>
<td>Children's surgery</td>
<td>750</td>
<td>812</td>
<td>92%</td>
<td>911,343</td>
<td>1,062,954</td>
<td>86%</td>
<td>1,309</td>
<td></td>
</tr>
<tr>
<td>Urology</td>
<td>715</td>
<td>774</td>
<td>92%</td>
<td>1,920,888</td>
<td>2,155,880</td>
<td>89%</td>
<td>2,785</td>
<td></td>
</tr>
<tr>
<td>Vascular surgery</td>
<td>685</td>
<td>762</td>
<td>90%</td>
<td>3,279,168</td>
<td>3,719,003</td>
<td>88%</td>
<td>4,881</td>
<td></td>
</tr>
<tr>
<td>Cardiac surgery</td>
<td>655</td>
<td>735</td>
<td>89%</td>
<td>5,964,405</td>
<td>6,159,976</td>
<td>97%</td>
<td>8,381</td>
<td></td>
</tr>
<tr>
<td>Face and jaw surgery</td>
<td>438</td>
<td>502</td>
<td>87%</td>
<td>629,144</td>
<td>675,258</td>
<td>93%</td>
<td>1,345</td>
<td></td>
</tr>
<tr>
<td>Thoracic surgery</td>
<td>361</td>
<td>359</td>
<td>101%</td>
<td>1,446,390</td>
<td>1,692,190</td>
<td>85%</td>
<td>4,714</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>11,229</td>
<td>11,446</td>
<td>98%</td>
<td>28,245,206</td>
<td>31,486,197</td>
<td>90%</td>
<td>2,746</td>
<td></td>
</tr>
</tbody>
</table>

Source: Example taken from the EHIF contract monitoring dashboard (translated into English)

3.4. Publication of contract volume data for visualization, benchmarking and further analytics

All contract volumes (planned and actual) per provider and type of service (primary and specialized health care, dental, disease prevention, nursing care etc.) are available on the EHIF’s webpage (4). They are visible for all health-care providers via specific Internet portal dashboards – built on “Power BI”. The information is available both at an aggregate level and at the level of single services. The contract execution data (extracted and calculated on the basis of the claims data) is updated daily. The objective of the dashboards is to make the contracting system transparent and to allow all providers to see the contract information of other providers and compare themselves with their peers.

Figure 9 presents a dashboard example of the status of contract execution of a selected health-care provider over a 10-month period in 2021. The dashboard summarizes all different health-care services such as specialized care, dental care, nursing care and disease prevention.
Moreover, the comparison of one provider with another helps EHIF, for instance, in detecting the differences in average reimbursement per case by specialties and care settings which, in turn, might create a need to explore the reason for such differences and their justification. Such differences may point to variations in coding practice and the need to harmonize them.

The dashboards also include a limited number of performance and other indicators, such as:

- reimbursed amount per treated patient per county;
- number of high-cost inpatient cases;
- average reimbursement amount per case;
- share of emergency care (cases and expenditure) of total contract volume;
- proportion of primary visits among all outpatient visits (primary and recurrent).

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7 IA high-cost case is considered to be one that costs more than EUR 104 000 in a regional hospital or more than EUR 73 000 in a general or central hospital.
This section explores the effects (benefits, risks and negative impact) of digital technologies on claims management and related business processes.

Figure 10 summarizes and visualize the large range of purchasing-related digital technologies being applied in Estonia and their assumed links to intermediate and final objectives of UHC, noting that multiple purchasing tasks and operations are supported by and made possible through digital claims. More specifically, Table 4 provides an overview and comparison of the new features of the e-channel before and after 2020 to highlight the differences – and hence the advantages of – the latest e-channel system.

4. Assessing the benefits of the digital technologies for claims management and related purchasing task and understanding potential risks

DT = digital technology; ML = machine learning; UHC = universal health coverage; QBS = Quality bonus system
Table 4. Comparison of e-channel features before and after 2020

<table>
<thead>
<tr>
<th>Feature</th>
<th>e-channel up to 2019</th>
<th>e-channel since 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claims submission</td>
<td>Usually at the end of the month</td>
<td>Continuously</td>
</tr>
<tr>
<td>Information management system</td>
<td>Separate/isolated e-channel between single provider and</td>
<td>X-tee MISP</td>
</tr>
<tr>
<td></td>
<td>the EHIF</td>
<td></td>
</tr>
<tr>
<td>Summary invoices</td>
<td>Created and submitted by provider (up to 2500 single</td>
<td>Created by the EHIF and paid without the need for the</td>
</tr>
<tr>
<td></td>
<td>invoices)</td>
<td>provider to submit a summary invoice</td>
</tr>
<tr>
<td>Making changes in the claims forms</td>
<td>Difficult</td>
<td>Easy</td>
</tr>
<tr>
<td>Payment</td>
<td>Usually once a month (other than for bigger hospitals)</td>
<td>Several times per month (for large hospitals)</td>
</tr>
<tr>
<td>Claims control prior to submission</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Automatic post payment verification</td>
<td>No (mostly manual)</td>
<td>Yes</td>
</tr>
<tr>
<td>Use of machine learning for claims</td>
<td>Not in place, but could have been used in view of the</td>
<td>Yes</td>
</tr>
<tr>
<td>review</td>
<td>existence of digital claims</td>
<td></td>
</tr>
<tr>
<td>Use of unified software</td>
<td>No</td>
<td>Integrated into the principal software platform</td>
</tr>
</tbody>
</table>

Based on the analysis of the previous section, we can derive the following effects of these digital technologies for health financing and UHC objectives. In many instances, digital technologies are not the decisive factor for a specific effect, but they are contributors.

1. **Simplified claims submission for providers**

   The previous version of the e-channel required each health-care provider to have its own access to the EHIF system via a specific interface in order to transfer the packages of claims to the EHIF. The new e-channel, starting from 2020, has enormously facilitated – i.e. simplified – the claims submission process for providers. This has been the case especially for the smaller providers with limited knowledge of and capacity for IT. This reduces administrative costs for claims processing at the provider level.
2. Improved claims verification process and claims data quality

The automated controls facilitate the pre-payment verification of claims, improve the quality of claims data, and reduce the time needed to make payments to providers. Furthermore, the new e-channel has reduced the volume of medical documentation subject to examination by EHIF trustee doctors and at the same time has improved the quality of claims control and speeded up the process.

Furthermore, ML speeds up the claims control and conducts the targeted claims reviews shortly after the payment. This in turn allows for crediting erroneous claims during the same calendar year. This also supports effective financial management of both the EHIF as well as providers. Additionally, ML can help to identify issues or questions that were unseen prior to the use of ML.

3. Efficiency gains and optimized use of the EHIF’s human resources in claims management

Digital claims management and related supporting digital technologies have reduced time inputs and human resource costs. The most remarkable changes in this respect took place in 2004 after which all claims were submitted by providers to the EHIF via an e-channel. This reduced the need for EHIF staff to inspect claims data and the use of health insurance benefits. In 2003, 62 person-years were needed for processing health insurance claims whereas in 2004 this went down by 31% to 43 person-years. This also affected the EHIF’s clerks who dealt with claims processing. Their number decreased from 53 in to 23 in 2004 (15). The optimization of the claims management process also led to an optimized use of human resources, since the EHIF could employ predominantly highly-qualified personnel and fewer staff performing routine tasks (16).

4. Stable cash flow for efficient hospital management

At the same time, the digitalization of claims transmission reduced the administrative burden of health providers as the whole process has become smoother. It also contributed to making the cash flow to providers more continuous through the month compared to just one monthly payment in the past. This is because the claims can be transmitted daily in the new system since 2020, which also lightens the processing load on the system. Moreover, claims submission has been tremendously accelerated, which means that the period between service provision and payment for it has reduced considerably. In contrast to the system of earlier years when payments were made only once a month to hospitals, this ongoing cash flow is of critical importance for efficient financial management at provider level.
5. **Patient needs oriented contract setting, efficient contract monitoring and more flexible contract adjustment**

The claims data is essential to plan and set patient needs oriented contract volumes with health care providers and amounts. This is critical to enhance equitable access. Moreover, digital technologies have allowed for the automation of the contract monitoring process, making it less time-consuming and hence more efficient, transparent and user-friendly. The digitalized process also allows for flexible shifting of volume caps across specialties within a provider. The use of Internet portal dashboards allows for easy and comfortable access to visualized contract execution information for all providers. At the same time, they help the EHIF to carry out various analyses and to undertake comparisons between providers, so as to potentially adjust contract volumes, when needed.

6. **Optimized development and revision of the provider payment system**

Digital claims provide granular data and easily accessible information for continuously improving the provider payment system through more regular revisions and adjustments of the payment methods and rates. Moreover, the digital claims data is also used for further developing specific provider payment methods such as bundled payment for selected care episodes, adjustment in per capita payments based on age groups, the pay-for-performance mechanisms in primary health care, or any other payment method to be developed or further fine-tuned.

7. **Improved performance monitoring and benchmarking to enhance quality of care**

Digital claims coupled with data visualization have improved the process of provider performance monitoring as well as the EHIF’s performance feedback process to providers (17) through the provision and assessment of various quality/clinical indicators (18). The indicators shed light on various aspects of performance. The purpose of the performance monitoring is to give providers feedback on their performance. As a result, providers can evaluate and review their own hospital practice – particularly their treatment practices (including clinical variances), use of different diagnostic procedures, coding practice, and drug prescription practices. The results of the performance indicators for health-care providers are calculated and published once a year. Consequently, the digital claims-based performance monitoring is an important contributor to enhancing the quality of health care.
8. Easily accessible health information and improved transparency for patients

Digital solutions have made it possible for individuals to access their own (visualized) health data via the patient portal which is linked to the EHIF claims database. Moreover, patients’ access to their own claims data allows for detecting potential misbehaviour of providers, since some of the misuse can be detected only if a patient confirms there was incorrect information on the medical claim. According to the National Audit Office (19), in 2017 a total of 86 disputes from 79 patients were sent to the EHIF. Most of these were justified and the EHIF claimed the money back from the respective providers. In 2018, this went down to 17 patients who disputed the claims, out of which around half were considered to be intentional misbehaviour and the EHIF claimed the money from the providers. These numbers appear to be quite low. While some questionable cases may remain unreported, the low numbers may also imply that most of the claims are in fact correct. As providers know that the system is highly transparent and that above-average reimbursement amounts per patient will be easily detected, there are disincentives to try to game the payment system.

9. Enhanced transparency and use of claims data for research, media and other users

Digital technologies have led to an increase in the availability and thus transparency of the claims data. The EHIF is continuously developing its infographic solutions and publishing health statistics which enables people to view the financial data (20) and other health-related indicators and statistics electronically (2). Persons interested in the EHIF’s data (researchers, media, public or public institutions etc.) can download data, make their own data inquiries in the health statistics database within the limits of published reports, and can view data in table, figure or graph format. There is also the option for more detailed data requests via a specific interface on the EHIF webpage if publicly available data do not meet the needs.

10. Ability to quickly respond to the challenges resulting from the COVID-19 pandemic

The COVID-19 pandemic did not negatively affect the implementation of the new system of claims management since the system had been launched in January 2020 just before the pandemic started. The way in which the patient claims were processed or contracts were monitored was not changed by the pandemic.

The EHIF covered complementary personnel costs of special COVID-19 wards and beds in intensive care units, additional emergency room costs, the cost of adapting the rooms and the procurement of devices (e.g. laboratory equipment) (21). With regard to additional COVID-19 funding flowing into the health system via the EHIF,
the newly launched e-channel proved its effectiveness. The e-channel included a feature for the automated production of non-personalized invoices by providers (e.g. for hospitals’ preparedness fees, family practitioners’ per capita payments and basic allowances) thus avoiding manual creation of these documents. As part of the health sector response to COVID-19, this existing functionality made it easy to create invoices and make payments for COVID-19-related additional funding. This helped to cover fixed costs (e.g. salaries, maintenance of premises) as the volume of elective treatments decreased (in some hospitals elective care was suspended during the first lockdown) and as the income which the providers would have normally received according to the contract reduced substantially.

Without the existing digital claims management system it would have been much more cumbersome to bring in additional resources to front-line providers for the health sector’s COVID-19 response and – via the claims – to obtain reports on caseloads and hence on patient needs. This helped the health system to better plan for, implement and monitor the COVID-19 health sector response.

Apart from the direct impacts of digital technologies for claims management, Estonia was also able to leverage its existing digital infrastructure to respond to COVID-19. Among various innovations was a novel digital solution that aided the vaccination campaign. The EHIF and primary health-care centres used an IT solution to support vaccine distribution. The solution gave family doctors a clear overview of the timing of vaccine delivery and allowed them to track first and second doses. In addition, from 1 January 2021, a new service was added to the benefits package, enabling teleconsultations in specialized outpatient care. This aimed to initiate and support interdisciplinary consultations to improve care continuity and access to services (22).
For a summary, Box 4 compiles the multiple benefits of the digital technologies in use in Estonia and how these enhance desirable health financing attributes (see Annex 3). In particular, these benefits contribute to making purchasing more strategic.

**Box 4. Multiple benefits of digital technologies for health financing in Estonia**

- The transparency provided through digital claims lowers the number of attempts to game the system and thus also reduces the rate of disputes. Monitoring is administratively much easier with digital claims.
- The system creates trust and is felt to be reliable.
- Digital claims management allows for cost-re-allocation as well as for cost-savings by freeing staff from tedious manual claims management.
- Digital claims management, including automated pre-payment controls, has reduced errors/fraudulent claims.
- Digital claims and data-sharing across care levels enhance care coordination as each provider has all patient information readily available.
- Digital contract monitoring allows for cost-containment and budgetary control, which are important to ensure that budgets are in line with promised benefits.
- Digital claims-informed contract setting improves equitable distribution of resources across the country in line with patient needs (demand) and thus also contributes to more equitable access to health services.
- The digital claims-informed setting of contract volume caps also safeguards the provision of a minimum number of services, thus also contributing to ensuring and improving the quality of care.
- Stable cash flows at hospital level allow for better hospital management and hence ultimately better quality of care for patients.
- Digital claims-informed contract setting allows payment methods and resource allocations to be tailored to support service delivery objectives.
- Digital claims-informed contract setting and monitoring enables providers to manage resources flexibly, and allows the purchaser to report on spending and outputs. This helps to generate real-time information on patient needs, provider behaviour and adjustments needed in payment methods, contract volumes etc. Ultimately, this increases efficiency and supports a better quality of care.
- The volume and budget cap (both minimum and maximum) allow hospitals not to worry about their budget situation or to fight for every claim. There are now fewer incentives to engage in upcoding; instead hospitals can focus on their core business, which is providing quality care.
However, we also need to be aware of (potential) risks regarding the use of these digital technologies in claims arrangements in Estonia. The main risks are not necessarily specific to claims management. At the launch of the new e-channel, problems occurred when many providers submitted their claims at the same time, slowing the system down. The system was eventually optimized through modifications in the software codes. In some areas there could be occasional problems with the Internet connection which have interrupted the work. In addition, there have been cases of server malfunctions due to power outages.

To mitigate against different risks, a 24-hour 7-days monitoring and alert system has been set up and most of the hardware (including servers) are duplicated. In case of a problem there is a switch for transferring from one server to another if e-channel service is not running as it should. If a problem occurs, information about it is disseminated to all relevant stakeholders.

Health data privacy and confidentiality are important issues which should receive close attention when a digital service or solution is being developed. Yet, with the implementation of the new e-channel no separate or specific digital features were developed or established to ensure privacy and confidentiality or to increase security and protection of claims data. This is because the new e-channel system operates on X-tee, which provides a secure environment and security solution. Hence, when the new e-channel was deployed there were no additional risks involved and there was no immediate need to introduce additional activities to ensure data security.

There may also be a tension in relation to the increased transparency and accountability offered by the granular and instantly available data for providers. While this creates trust into the system, its impact could be somewhat offset by feelings about, and the effects of, continuous and comprehensive surveillance of all provider activities and variance. If providers feel that all their steps and treatment choices are captured in the claims data and analysed, it may create an atmosphere of mistrust and fault avoidance.

Finally, it is important to find a good balance between ML-driven fraud detection and a human resources-based claims review in which ML is ideally complementary. When ML puts an overemphasis on efficiency checks, there may be a risk of insufficient attention to equity and quality.
5. Conclusions: lessons, future options and policy questions

5.1 Lessons learned

1. Digitalization is a lever to make purchasing more strategic

The development and use of digital technologies for claims management in Estonia has consistently contributed to the improvement of equitable distribution of resources, efficiency and transparency for providers and the EHIF for more than 20 years. The introduction of the central digital claims database in the EHIF in the beginning of the 2000s, with detailed personalized patient-level fee-for-service information, created a solid basis for the further development and implementation of various digital solutions in the claims management process. This has contributed to improving data quality and strengthening the role of the EHIF as a strategic purchasing organization. Digitalization was also a prerequisite for introducing a DRG-based payment system in 2004 and for further developing other payment methods such as age-adjusted per capita payments and quality bonus payments in primary health care.

Altogether, digital technologies have had numerous benefits for health financing and purchasing. They have helped to save time and reduce administration and opportunity costs, thus contributing to efficiency. They have also enabled better access to processed information for citizens and patients, enhancing accountability and transparency and thus also contributing to improving the quality of care, financial protection and access to health services.

2. Regular system revisions of digital technologies ensure take-up of technological advances

As digital technologies are constantly developing and new ones are emerging, it was obvious that the solution which was innovative in the early 2000s would no longer be state-of-the-art more than 15 years later. The changes which took place in 2017–2019 and which resulted in the launch of a new e-channel for claims submission in 2020 were unavoidable. These changes took the claim submissions by health-care providers to the EHIF to a next technological level with new functionalities and opportunities.
3. Claims digitalization unlocks new business processes that enhance the purchasing function

The digitalization of claims at the end of the 1990s and the optimized use of digital technologies for submission of claims in the early 2000s created solid ground for the further development of other digital services and communications between various stakeholders and the population. Specifically, the upgrade of the e-channel and its integration within the same platform as most of the other EHIF’s other business processes (including contract setting) allowed to unlock other related purchasing tasks, such as automated contract monitoring, performance payment, and the use of machine learning for post-payment verification. These features would be hard to realize without digitalized claims.

4. Prior defragmenting of health financing enhances the opportunities of reaping the benefits from digitalization and information system building

Estonia undertook a pooling reform (unification of the EHIF) before progressively developing and improving the national data platform to inform purchasing decisions. Being a small country, pool fragmentation had particularly severe consequences, and hence defragmentation was important because the solution that Estonia opted for (i.e. the introduction of a standard software solution for the e-channel) would not have been so easily implementable in a context where fragmentation with multiple payer units persisted.

5.2. Future options for further optimizing Estonia’s digital claims management and related functions

As of July 2022, the EHIF has no immediate plans to change the operations of the e-channel or the process of using claims data for automated contract monitoring. Nonetheless, some improvements are under consideration about how to update or integrate additional digital technologies to further improve the claims management process, contracting and other functions and processes.

1. Maximizing automation of claims generation in the provider information system to provide real-time data

Maximum automation of claims generation within the provider information system has been one key goal for further reducing back-office functions. This would mean that claims would be automatically sent to the EHIF once the patient is discharged, and the doctor would close the claim. This has not yet been achieved although it was one of the initial goals. There are various reasons why automated claim generation does not work yet. For instance, there is still a need to first check whether the doctor has recorded all required data, and whether there is enough unused contract volume depending on the contract execution level etc. Thus, the claim is submitted to the EHIF only after it has been internally reviewed and
Conclusions: lessons, future options and policy questions

Most health-care providers have deployed their own information systems which are supported by different software developers. The decentralized approach to e-health solutions in which providers have their own information systems and send data to the centralized system has proven to be challenging in terms of ensuring compatibility and interoperability (4). In the longer term, all hospitals should move towards a unified solution. Unification does not imply that all providers must use the same software but that the current fragmented use of different IT systems should be standardized. This change would make the further implementation of digital technologies smoother as there would be fewer developers to negotiate with and agree on the changes. It would also ease the exchange of information between the providers.

The EHIF deals with some 1400 health providers’ contractual partners. When any changes are made to the text of the contract, all contracts must be edited in Word, converted to PDF and then digitally signed by both parties (i.e. the EHIF’s and provider’s representative).

Digitalization of the contract modification process would decrease the manual workload considerably. The EHIF is planning to change the process by using a digital tool. When there is a need to change the text of the contract, the change will be introduced into the contract management system once. From this, new contracts will be generated for all providers affected by the change, after which the amended contracts will be sent to providers electronically. This will avoid editing individual contracts. As the EHIF database interacts with the e-Business Register (23), it is possible to obtain information about the representative of the health-care provider staff. Larger providers have a separate department or unit to deal with this. This means that a claim cannot currently be submitted when it is generated. The EHIF is working on making this functionality available in future so that claims creation can be initiated at the same time as the electronic health record is opened in the hospital. This will require changes in the providers’ internal processes.

The claims generation time-lag puts some constraints on the claims management process and limits the value of data that are collected through claims. For instance, it is not possible to provide operational feedback to primary health care providers on patient hospitalization. Moreover, generation of the claim should be a by-product of the medical record. That would mean that it should be decided at the data entry point which data are submitted to which stakeholder depending on the purpose (statistical, financial etc.). This would save time for administrative staff dealing with claims processing in the hospital and for medical doctors responsible for the treatment of the patients. It would also decrease the time needed for close reviews by the EHIF staff.

2. Harmonization of hospitals’ information systems

Most health-care providers have deployed their own information systems which are supported by different software developers. The decentralized approach to e-health solutions in which providers have their own information systems and send data to the centralized system has proven to be challenging in terms of ensuring compatibility and interoperability (4). In the longer term, all hospitals should move towards a unified solution. Unification does not imply that all providers must use the same software but that the current fragmented use of different IT systems should be standardized. This change would make the further implementation of digital technologies smoother as there would be fewer developers to negotiate with and agree on the changes. It would also ease the exchange of information between the providers.

3. Automating the contract modification process for non-financial arrangements

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care provider who has the right to sign the contract. This information would be included in automatically generated contracts to ensure the information about the signatory of the contract is correct. Blockchain technology could be the next step.

4. Enhancing integration of various databases with claims data

As various types of data are digitalized, there is potential to link them with each other. One potential application could serve to further refine quality management programmes or payment arrangements. Whereas many such programmes have so far been primarily extracting process-related indicators from claims data, there is a potential to link payments gradually to treatment output and outcome measures if these are linked with the claims database, thus moving closer to the concept of value-based payments.

5.3. Policy considerations for other countries

1. Finding the right level of leapfrogging

One key policy recommendation is to digitalize claims because of the many opportunities that this creates to optimize other purchasing-related tasks, such as for contracting, contract and performance monitoring, provider payment method setting or automated controls. Estonia’s digitalization process started more than 20 years ago, reflecting the available technology of that time. Countries starting digitalization today can begin right away with the development of an advanced digital claims submission channel. There is thus potential for leapfrogging, whereby it is essential to choose the right entry point and level of digitalization.

2. Sequencing

Each country must explore its capacity and needs for digitalization as well as a package of reforms. This process will normally start with the digitalization of claims forms and the digital submission of claims. Once this is established, more functions can follow – such as automated controls for the optimization of claims management, post-submission controls for fraud detection, quality review and outlier identification. A clear plan for sequencing is important to build synergies along these processes and to maximise the potential for introducing advanced purchasing instruments.
3. Capacity strengthening and enabling learning through a gradual approach

It is important to build up organizational and analytical capacity within the purchasing agency in order to be able to collect the (claims) data needed, to assure quality data and to analyse and use the collected data. This is the basis for making purchasing increasingly strategic. In fact, sequencing reform measures and a gradual approach allow for a learning process that is critical for building capacity and for identifying and addressing challenges.

For example, in relation to data and templates, it is useful not to start too big but to begin with a limited/defined number of data fields and templates and with a built-in process of continuous learning. This will help to clarify what should be on the template and what is useful for analysis, rather than collecting large amounts of granular data that may never be used and make process heavy.

4. Using the available windows of opportunity

The phases within a reform process may sometimes be slower, and then again gain pace. It is important to seize windows of opportunity to initiate the next step in the reform. As skills improve and as the system’s capacities are progressively enhanced, these windows of opportunity can occur more regularly – institutional competencies are built at all levels, providers enhance their skills, the purchaser builds its skills etc. As the system matures, this may also make it easier to identify which new digital technology is needed.

5. Setting the right level of standardization and putting focus on data governance

It is important to avoid a fragmented software solution as this can create enormous transaction costs, even though hospitals should still be able to maintain their existing software set-up. There are arguments for and against standardization to consider in an environment of market competition. The question must be asked as to whether there is need to operate a standard and uniform model across all hospitals or whether to aim for harmonization of different approaches. Technical and cost issues of creating and ensuring interoperability need to be considered.

Finally, digitalization of claims management requires adequate data governance. This involves a range of domains, foremost ensuring privacy and data protection. Moreover, when artificial intelligence and machine learning approaches come into play, it is important to install an effective regulatory framework to guarantee equity and non-discrimination in order to receive trusted algorithmic outcomes (24).
References


Annex 1: Organigram of the EHIF

### Annex 2: Overview of the information submitted on claims (selected fields)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Comments/examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General information:</strong></td>
<td></td>
</tr>
<tr>
<td>– Claim identification</td>
<td></td>
</tr>
<tr>
<td>– Date of admission/appointment</td>
<td></td>
</tr>
<tr>
<td><strong>Service provision-related information</strong></td>
<td>Yes/No</td>
</tr>
<tr>
<td>– Emergency care</td>
<td>Yes/No</td>
</tr>
<tr>
<td>– Certificate of incapacity to work</td>
<td>Inpatient, outpatient, dental care, family physician etc.</td>
</tr>
<tr>
<td>– Setting of care</td>
<td></td>
</tr>
<tr>
<td><strong>Type of arrival</strong></td>
<td>E.g. with ambulance or police, referred, on own</td>
</tr>
<tr>
<td><strong>Patient information:</strong></td>
<td></td>
</tr>
<tr>
<td>– Name</td>
<td></td>
</tr>
<tr>
<td>– Identification number</td>
<td></td>
</tr>
<tr>
<td>– Date of birth</td>
<td></td>
</tr>
<tr>
<td>– Gender</td>
<td></td>
</tr>
<tr>
<td><strong>Diagnosis:</strong></td>
<td>According to ICD-10(^9)</td>
</tr>
<tr>
<td>– Main diagnosis according to ICD-10</td>
<td>According to ICD-10</td>
</tr>
<tr>
<td>– Comorbidity/complication</td>
<td>According to ICD-10</td>
</tr>
<tr>
<td>– External cause</td>
<td>According to ICD-10, in case of trauma</td>
</tr>
<tr>
<td>– Clinical severity, stage of disease</td>
<td>Based on agreement with medical associations</td>
</tr>
<tr>
<td><strong>End of treatment</strong></td>
<td>E.g. referred to other hospital, discharge home, death</td>
</tr>
<tr>
<td>– Date of discharge</td>
<td></td>
</tr>
<tr>
<td>– Discharge status</td>
<td></td>
</tr>
<tr>
<td><strong>Health-care services</strong></td>
<td>As indicated in benefit package</td>
</tr>
<tr>
<td>– Name of the service</td>
<td>E.g. hours, units, litres</td>
</tr>
<tr>
<td>– Code of the service</td>
<td>Hours (1, 2, 3, …, 18, more than 18 hours)</td>
</tr>
<tr>
<td>– Quantity</td>
<td></td>
</tr>
<tr>
<td>– Duration of intensive care</td>
<td>In case of dental care, according to EVS-EN ISO 3950</td>
</tr>
<tr>
<td>– Date of service provision</td>
<td></td>
</tr>
<tr>
<td>– Dental formula</td>
<td>In case of dental care, according to EVS-EN ISO 3950</td>
</tr>
<tr>
<td>– DMFT index</td>
<td></td>
</tr>
<tr>
<td><strong>DRG information</strong></td>
<td>In case relevant</td>
</tr>
<tr>
<td>– Code of diagnostic-related group (DRG)</td>
<td>According to NCSP(^10)</td>
</tr>
<tr>
<td>– Tariff</td>
<td></td>
</tr>
<tr>
<td><strong>Coefficients applied to service tariffs</strong></td>
<td>Yes/No</td>
</tr>
<tr>
<td><strong>Code of surgical procedure</strong></td>
<td>According to NCSP(^10)</td>
</tr>
<tr>
<td><strong>Follow-up care</strong></td>
<td>Yes/No</td>
</tr>
<tr>
<td><strong>Total cost of the claim</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total cost of the claim in case DRG tariff is applied</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Provider information:</strong></td>
<td>As indicated in the contract</td>
</tr>
<tr>
<td>– Code in Business Register</td>
<td></td>
</tr>
<tr>
<td>– Name of physician/nurse</td>
<td></td>
</tr>
<tr>
<td>– Registration code of physician/nurse</td>
<td></td>
</tr>
<tr>
<td>– Address of service provision</td>
<td></td>
</tr>
<tr>
<td><strong>Medical specialty</strong></td>
<td>Yes/No – Referring to work which exceeds the volume of agreed contract and is paid based on reduced tariff(s)</td>
</tr>
<tr>
<td><strong>“Overprovided services”</strong></td>
<td>Yes/No</td>
</tr>
<tr>
<td><strong>Test-claim</strong></td>
<td>Yes/No</td>
</tr>
<tr>
<td><strong>Type of the contract</strong></td>
<td></td>
</tr>
<tr>
<td>– Primary care</td>
<td></td>
</tr>
<tr>
<td>– Specialized care</td>
<td></td>
</tr>
<tr>
<td>– Disease prevention</td>
<td></td>
</tr>
<tr>
<td>– Dental care</td>
<td></td>
</tr>
<tr>
<td>– Nursing care</td>
<td></td>
</tr>
<tr>
<td>– School health care</td>
<td></td>
</tr>
</tbody>
</table>


Annex 3: Desirable attributes relevant to purchasing

- There is transparent, financial and non-financial accountability in relation to public spending on health.
- The flow of public (and external) funds is stable and budget execution is high.
- The pooling structure and mechanisms across the health system enhance the potential to redistribute available prepaid funds – i.e. equitable distribution of resources across the country.
- Resource allocation to providers reflects population health needs, provider performance, or a combination of both.
- Purchasing arrangements incorporate mechanisms to ensure budgetary control.
- Purchasing arrangements are tailored to support service delivery objectives.
- Providers can receive revenues directly, manage them flexibly, and report on spending and outputs.
