DUODECIM

Clinical Decision Support

White Paper
2026

DUODECIM
Clinical Decision Support

DUODECIM
EBMEDS

THE FINNISH MEDICAL SOCIETY
DUODECIM
PUBLISHING COMPANY

The Finnish Medical Society Duodecim is Finland’s largest scientific association. It exists to develop the professional skills and clinical practice of doctors through continuing education, publications and research grants. Established in 1881, Duodecim’s membership today comprises more than 20,000 doctors and medical students.

Duodecim Publishing Company Ltd is the leading medical publishing company in the Nordic countries. Duodecim Publishing Company Ltd publishes information content for medical and healthcare professionals in the form of traditional printed products but also as electronic databases, solutions integrated into healthcare systems and an online learning environment. It is owned by the Finnish Medical Society Duodecim

Contents

EBMEDS Overview

EBMEDS combines patient data with current medical knowledge to deliver reliable, personalized guidance at every step.

Duodecim EBMEDS Is a Suite of Digital Services Designed to Guide Patient Care Throughout the Entire Care Pathway

By combining patient data with up-to-date medical knowledge, EBMEDS services delivers reliable, personalized guidance at every step. Our solutions integrate seamlessly with other healthcare systems, supporting both citizens and healthcare professionals. The result: safer care, better outcomes, and smarter decision-making for everyone involved — from the first signs of symptoms to effective treatment. .

Duodecim EBMEDS is a collection of digital services digital services designed to improve the quality of care:

- **Clinical Decision Support**: Patient-specific guidance for healthcare professionals to support clinical decision-making.
- **Health Benefit Analysis:** Population-level analytics to optimize care pathways, with a strong emphasis on prevention and long-term outcomes.
- **Duodecim Star**: Low-threshold digital health checks and online coaching that help citizens prevent and manage lifestyle-related diseases.
- **Duodecim Symptom Checkers**: Citizen-facing tools that help assess the need for treatment and the urgency of individual health problems or symptoms.

Healthcare environment

Addressing information overload is essential to improving patient safety in modern healthcare.

Information Overload and Its Impact in Healthcare

The healthcare environment is becoming increasingly complex as medical knowledge, diagnostic tools, and treatment options expand rapidly. While this growth offers opportunities to improve patient outcomes, it also creates challenges for clinicians, who must sift through vast amounts of data to make timely, accurate decisions. Electronic health records (EHRs), though essential, can make it difficult to quickly identify the most relevant clinical information, increasing the risk of delays or oversights.

A major patient safety concern is abnormal test results that go unnoticed or are not followed up. Adverse drug reactions also remain a frequent cause of emergency visits and hospital admissions. Many of these harms could be prevented through careful medication selection, monitoring, discontinuation of unnecessary drugs, and dose adjustments for factors such as renal function.

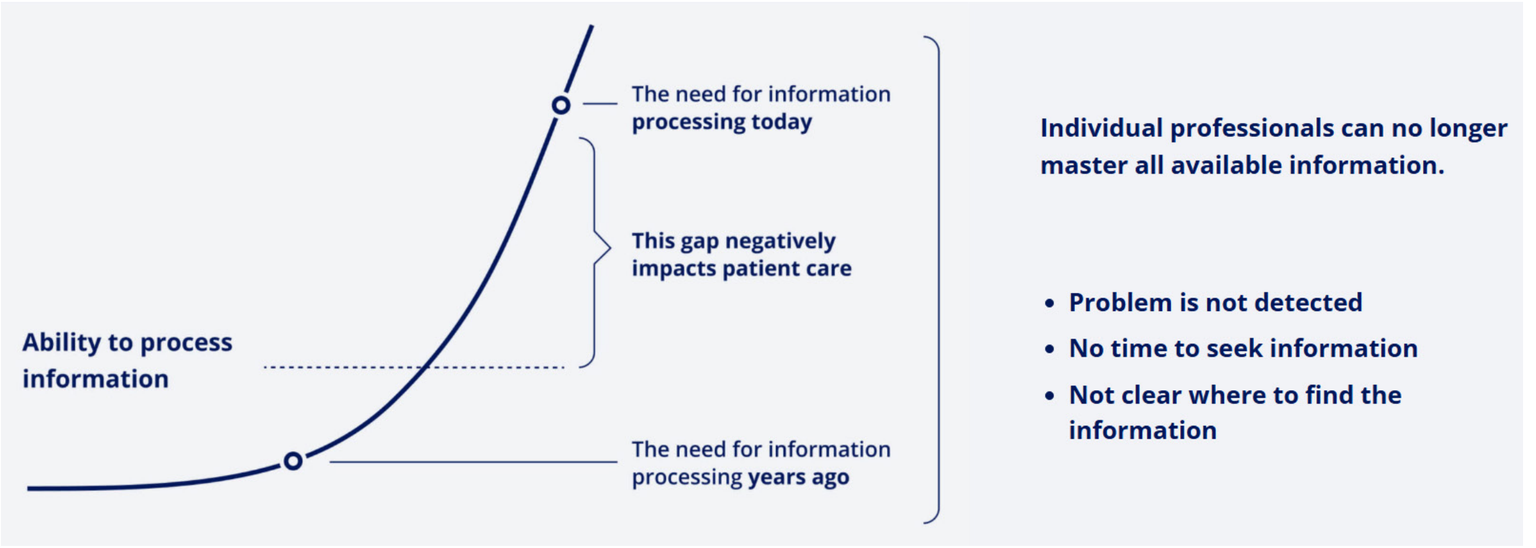
The impact of information overload is therefore significant and tangible. Clinicians face pressure to extract actionable insights efficiently within busy workflows. Without effective decision support, preventable harm increases, affecting patient safety and the overall quality of care.

Implementing tools that prioritize critical information, highlight potential risks, and support evidence-based decisions at the point of care can reduce cognitive burden and ensure important clinical signals are not missed, ultimately improving outcomes and patient safety.

Healthcare environment

With clinical decision support, healthcare organizations can turn data into decisions – and decisions into better care.

Information Overload and Its Impact in Healthcare



Clinical decision support integrated into electronic health records helps ensure that accurate information is available at the right time, in the right context, and in a useful format. This supports clinicians in following proper clinical processes and enables organizations to improve care quality, patient safety, efficiency, and cost-effectiveness.

Duodecim Clinical Decision Support

Duodecim Clinical Decision Support delivers the latest medical knowledge to clinicians exactly when it matters most.

Improving Care Quality Through Integrated Duodecim Clinical Decision Support

Duodecim Clinical Decision Support is seamlessly integrated into electronic health record (EHR) systems, delivering intelligent, patient-specific guidance directly into clinical workflows. By analyzing structured health data and combining it with trusted medical knowledge and best-practice guidelines from multiple reliable sources, it empowers healthcare professionals to make informed decisions with confidence.

Designed for use across all healthcare roles, Duodecim Clinical Decision Support delivers timely recommendations at the point of care. Guidance can be generated automatically or on demand, ensuring continuous availability whenever clinical insight is needed. Always up to date, the system brings the latest medical knowledge to clinicians exactly when it matters most.

By keeping the patient at the center of care, it supports individualized treatment through clinically relevant alerts and personalized recommendations—clearly explaining what actions to take and how care should be adjusted.

By filtering out unnecessary notifications, Duodecim Clinical Decision Support helps reduce alert fatigue and cognitive overload. The result is safer decision-making, more efficient workflows, and higher-quality care for every patient.

Duodecim Clinical Decision Support

Duodecim Clinical Decision Support provides multiple benefits for professionals and organizations

More time for patient encounters

Easy access to accurate information and auto-filled forms and calculators cuts down time spent on searching and documentation – freeing up more time for patient care.

Cost savings through early identification of care gaps

Improved information access and usability help identify care gaps early, enabling proactive action. This leads to higher-quality care and longterm cost savings.

Consistency of care

When all professionals in an organization share the same up-to-date information in the same user-friendly format, the quality of care becomes consistent.

Individual and organizational learning

Comprehensive, continuously updated databases support ongoing learning and the development of professional skills at both individual and organizational levels.

Duodecim Clinical Decision Support

Clinical notes should actively inform care decisions and improve patient outcomes, not just be archived after the visit.

Relevant Patient Data as the Foundation of Duodecim Clinical Decision Support

Duodecim Clinical Decision Support uses basic clinically relevant patient data as input. The query generated by the electronic health record system contains a concise set of patient data, with irrelevant or outdated information filtered out.

Demographic information
- Age
- Gender

Diagnoses
- ICD-10 and ICPC-2

Interventions
- Medication
- Vaccinations
- Procedures

Measurements
- Laboratory results
- Physiological measurement

Factors that affect health
- Smoking
- Pregnancy

Risk information
- e.g., drug allergies

Duodecim Clinical Decision Support accommodates multiple coding systems, which are mapped to an internal alias system to ensure consistent interpretation of clinical data. It also allows the use of multiple measurement units, enabling seamless integration with diverse healthcare systems and workflows.

Duodecim Clinical Decision Support

Modular structure enables flexible, adaptable, and tailored installation.

Decision Support Rules

Patient data are analysed using clinical decision support rules implemented in JavaScript. These rules are created, managed, and updated using the web-based EBMEDS rule editor application, enabling efficient maintenance and continuous improvement of the rule set.

Modular Structure of Duodecim Clinical Decision Support

Duodecim Clinical Decision Support is organized into several independent modules that can be activated or omitted as required. Module selection is based on factors such as the availability, completeness, and quality of data in the underlying data repository, as well as any overlapping or existing functionality already provided by the electronic health record (EHR) system. This modular approach allows flexible deployment tailored to local needs and system capabilities.

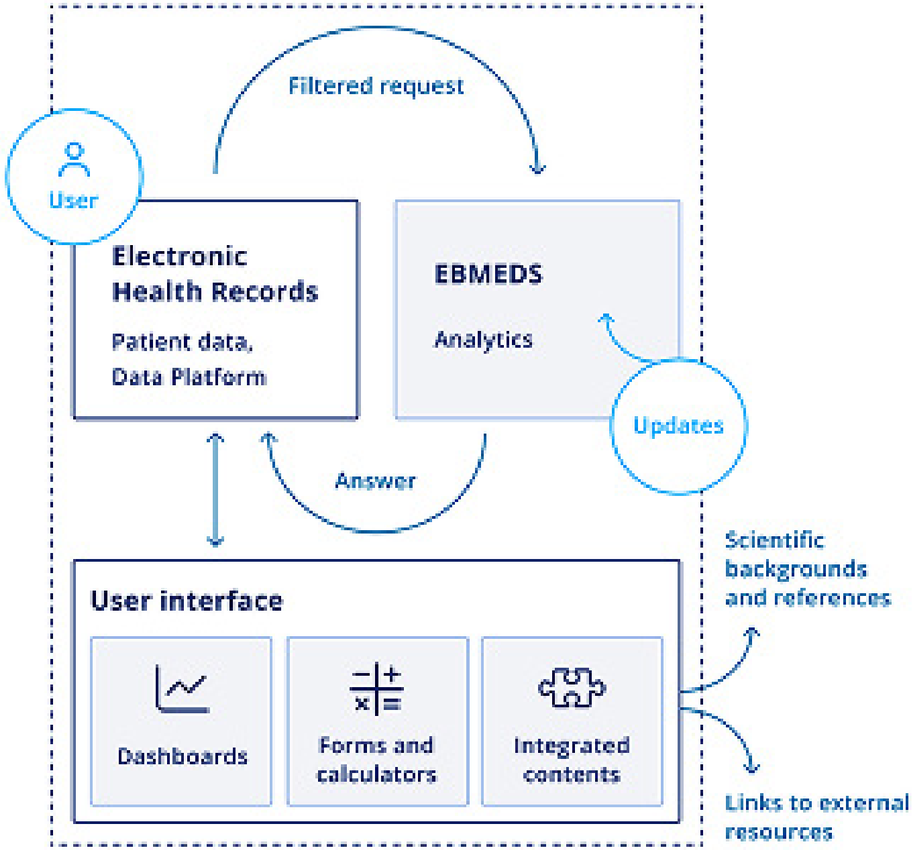
The modules primarily rely on data sources provided by Duodecim or approved third-party providers. When necessary, additional data sources can be introduced in collaboration with Duodecim, allowing the decision support functionality to be extended and adapted to specific clinical or organizational requirements.

Architecture and Integration

Duodecim Clinical Decision Support offers an API that works with any patient data repository containing structured patient data

API Integration and Data Sources

Duodecim Clinical Decision Support provides an API that can be consumed by any patient data repository that has access to structured patient data. The data repository is usually part of an EHR system, but it may also be an independent repository.



Architecture and Integration

The system has modest performance requirements and is fully horizontally scalable.

Data Transformation and Client Components

Before analysis, patient data must be converted into a format supported by the decision support engine. This is achieved through a lightweight adapter layer and client component developed by local IT teams familiar with the structure of the data repository.

The client component submits the data for analysis, receives and parses the response, and presents the resulting feedback within the EHR or data repository user interface. The decision support system itself has no user interface and returns only structured output for display by external systems.

Supported request message formats include native XML and JSON schemas, as well as initial support for FHIR STU3, with broader FHIR compatibility planned as the standard continues to evolve

Performance and Deployment models

The system has modest performance requirements, is fully horizontally scalable, and can handle high server loads. Most patient datasets are processed in under one second.

Deployment is flexible and can be implemented either as a local installation or as a centralized service serving multiple organizations.

Duodecim Clinical Decision Support Modules

Reminders highlights when an individual patient’s care requires attention

1. Clinical Reminders

Clinical reminders are prompts or notifications that help healthcare professionals remember important actions related to patient care. They can highlight recommended tests, necessary follow-ups, preventive measures, medication reviews, or other evidence-based interventions that support high-quality treatment. Typically, a triggered reminder signals a deviation from quality standards. All rules are linked to descriptions of the rules including the reminder texts and evidence data.

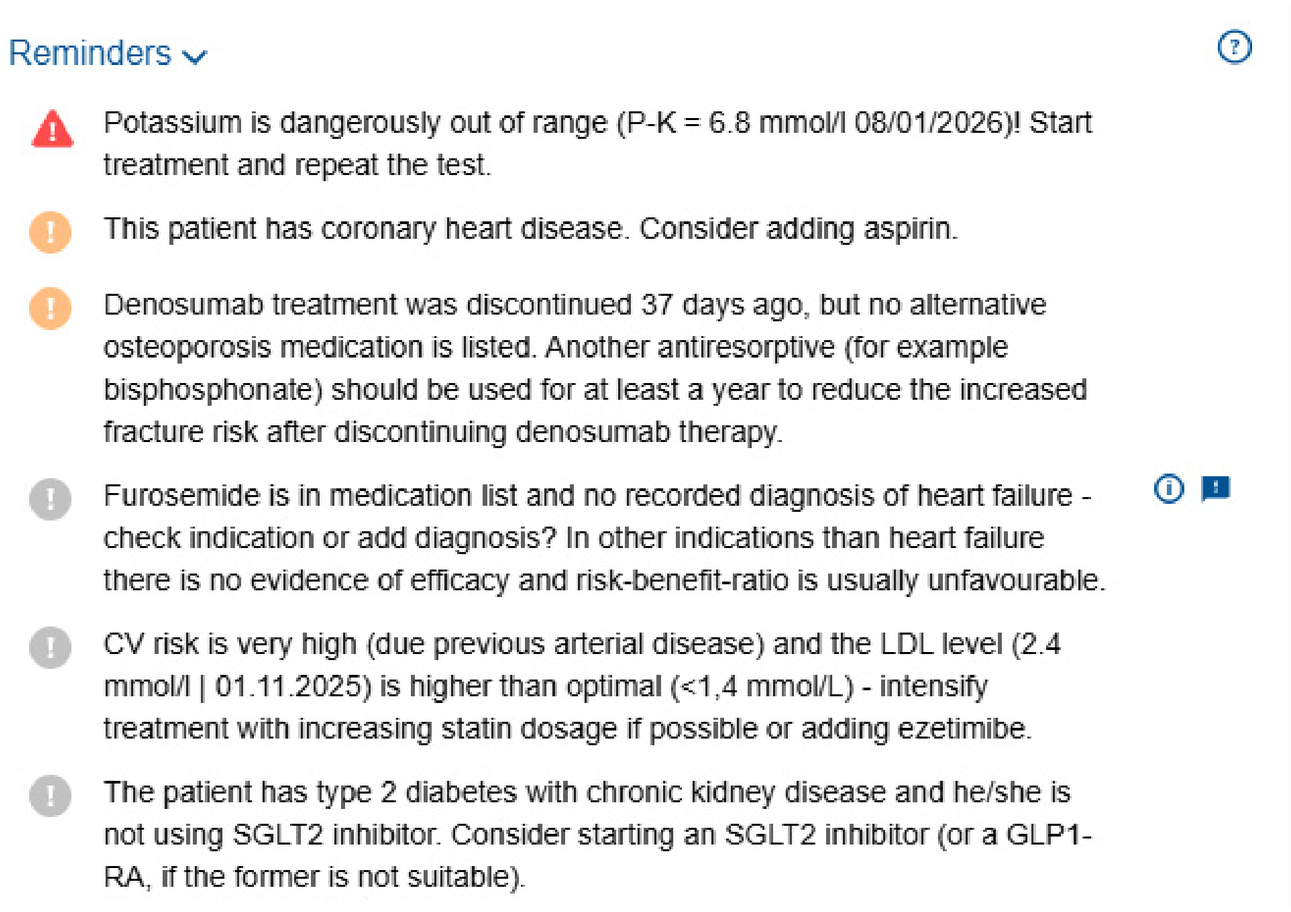
Patient-specific clinical reminders are tailored to an individual patient’s current health status, and care needs. Instead of generic notifications, these reminders focus on what is clinically important for that specific patient. By delivering only meaningful and personalized reminders, Clinical Decision Support systems help clinicians provide safer, more efficient, and more proactive care while minimizing unnecessary interruptions. Reminders are categorized into three groups based on their clinical significance:

The primary language of the Duodecim Clinical Decision Support is English. However, as the reminders are short they are easy to translate into other languages. Usually the translation is performed by healthcare professionals. At the moment, reminders are provided in several languages.

Duodecim Clinical Decision Support Modules

Reminders are prioritized based on clinical importance and urgency

1. Clinical Reminders



Duodecim Clinical Decision Support Modules

Clinical guidelines tailored to the needs of each individual patient

2. Links to Guidelines

Clinical guidelines play a vital role in modern healthcare by providing clear, evidence-based recommendations that support clinicians in delivering safe, consistent, and high-quality care across different clinical settings.

By grounding decision-making in the most current and reliable medical evidence, guidelines help reduce variation in care, improve patient outcomes, and support clinical confidence. They benefit not only patients—through safer and more effective treatment—but also healthcare professionals by offering trusted guidance in complex clinical situations. In addition, clinical guidelines promote continuous professional development by helping clinicians stay up to date with new research findings, best practices, and evolving standards of care.

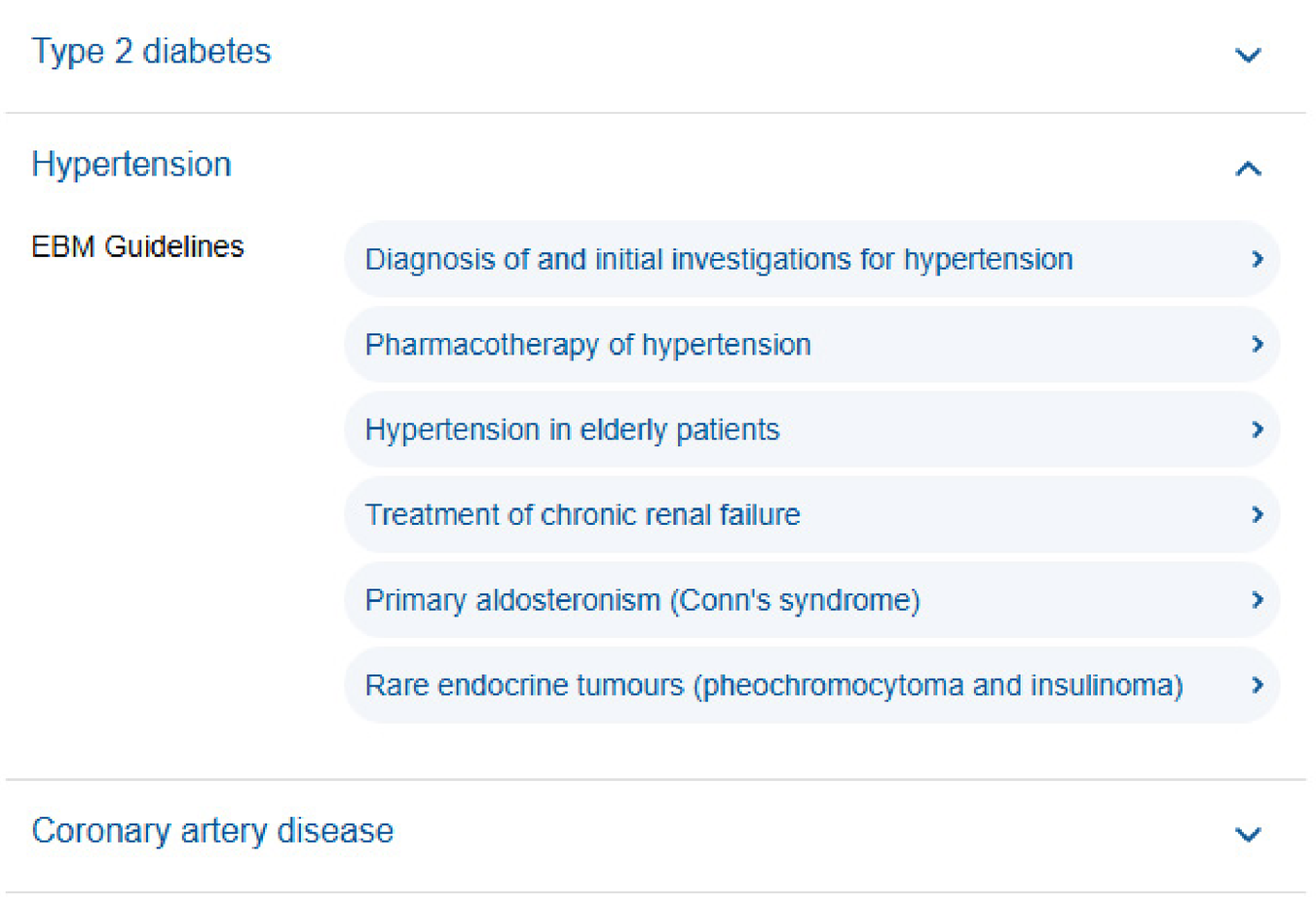
Duodecim Clinical Decision Support strengthens the use of clinical guidelines by generating a patient-specific list of guideline links based on each patient's diagnoses, making relevant information easily accessible at the point of care. The default guideline collection within Duodecim Clinical Decision Support is EBMG, and additional guideline collections can be incorporated by indexing them with diagnosis codes.

Looking ahead, Duodecim Clinical Decision Support aims to further enhance personalization and clinical insight through the responsible use of artificial intelligence, once regulatory frameworks clearly support and enable its safe application in healthcare.

Duodecim Clinical Decision Support Modules

Reliable guidelines support safe and consistent clinical decisions.

2. Links to Guidelines



Duodecim Clinical Decision Support Modules

Clinical calculators that automatically fill in patient data and use standard formulas to give results

3. Forms and Calculators

In healthcare, many calculators are used and completing them often takes a considerable amount of time. These calculators are intended, for example, for assessing disease risk and for clinical scoring.

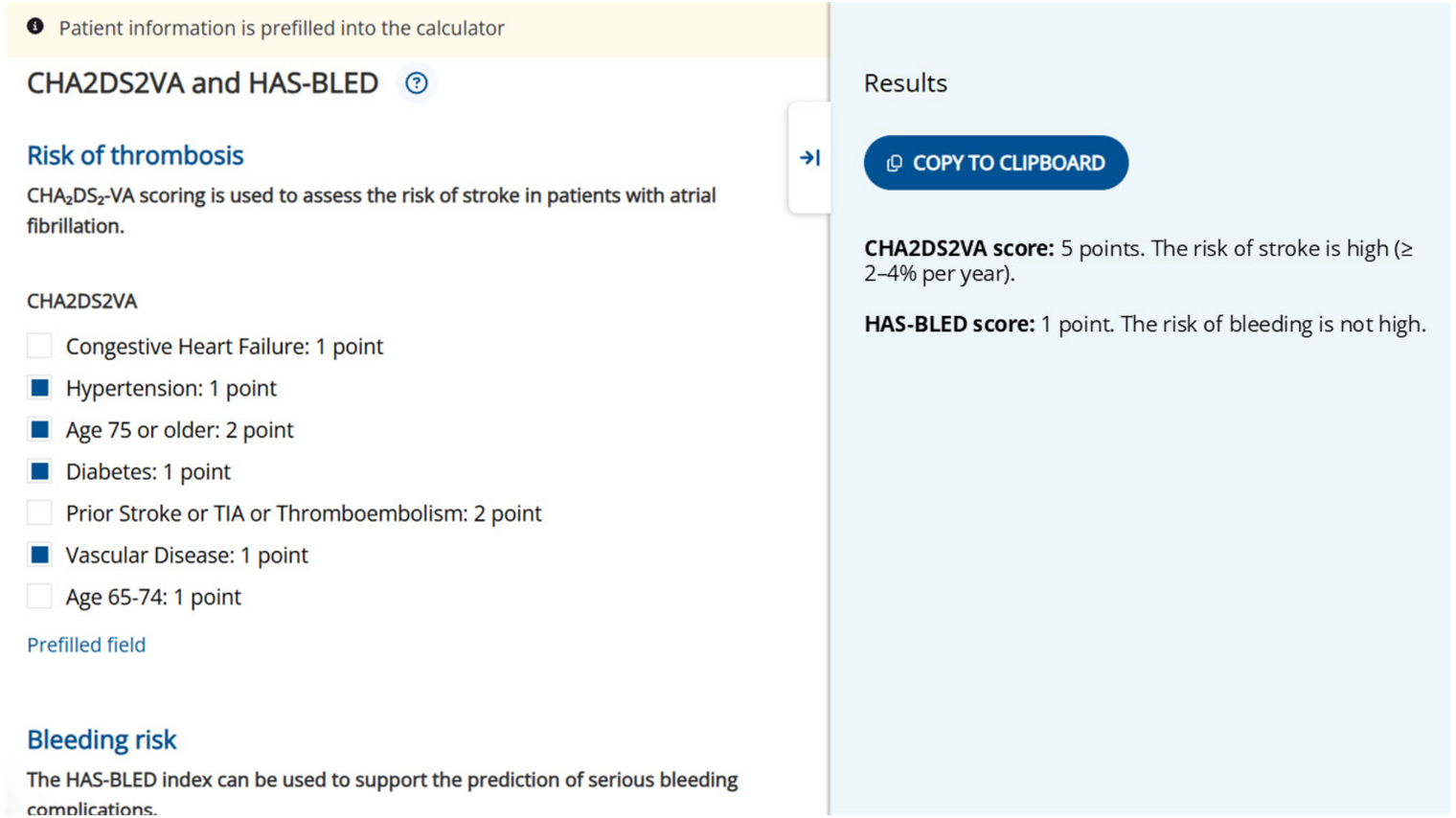
The information required for them is scattered across several different places. Duodecim Decision Support pre-populates the calculators with the patient's data, which significantly saves working time. The user can complete or modify the information manually.

Clinical calculators provide structured results—such as scores, estimates, or risk assessments—that help support clinical decision-making in everyday practice. Common examples include CHA2DS2VA and HAS-BLED scores for assessing stroke and bleeding risk, the eGFR calculator for evaluating kidney function, and the FINRISKI score for estimating cardiovascular risk, among many others. These tools help clinicians interpret complex clinical data more efficiently and consistently, supporting evidence-based care across different patient populations.

Duodecim Clinical Decision Support Modules

Duodecim Clinical Decision Support calculators are based on validated research and are commonly part of clinical guidelines

3. Forms and Calculators



Duodecim Clinical Decision Support Modules

Duodecim Clinical Decision Support analyzes medication data along with other patient information to deliver timely, patient-specific clinical insights.

4. Drug databases

Drug databases play a vital role in healthcare by offering structured, reliable, and continuously updated information about medications. They support clinicians and pharmacists in making informed decisions by providing clear insights into drug indications, dosing, and safety considerations.

In addition, drug databases significantly enhance patient safety and risk management by generating alerts for potential drug–drug interactions, contraindications, allergies, and duplicate therapies, helping to reduce medication errors and improve overall quality of care. When combined with a patient's genetic profile, this information can further support personalized drug and dose selection, leading to more effective and safer treatments.

Duodecim Clinical Decision Support builds on this foundation by analyzing not only medication data, but also diagnoses and laboratory results obtained from electronic health records. This information is then compared with multiple drug databases to deliver timely, patient-specific clinical insights. By integrating diverse data sources, Duodecim Clinical Decision Support helps healthcare professionals identify risks early, optimize therapy choices, and support safer, more personalized clinical decision-making at the point of care.

Duodecim Clinical Decision Support Modules

Drug databases reduce medication errors and enhance patient safety

4. Drug databases

Adverse drug reactions

Total risk	D Anticholinergic effect	D Constipation	C Orthostatism	C Sodium balance	A Potassiu balance
amitriptyline	+ 3	+ 2	+ 3	-2	0
bisoprolol	0	+ 1	0	0	+ 1
furosemide	0	+ 1	0	-2	-2
losartan	0	0	0	0	+ 2
metformin	0	0	0	0	0
rosuvastatin	0	+ 1	0	0	0

User Interface

Duodecim Clinical Decision Support brings evidence-based, patient-specific insights straight into clinical workflows

Structured Feedback

Electronic health record system can make use of the structured feedback provided by Clinical Decision Support. This means that the electronic health record system itself creates a user interface for the Duodecim Clinical Decision Support and displays the feedback it produces in a format suitable for the system. In principle electronic health record system may also choose to use only part of the Duodecim Clinical Decision Support feedback during different workflow stages.

Duodecim Clinical Decision Support summary page

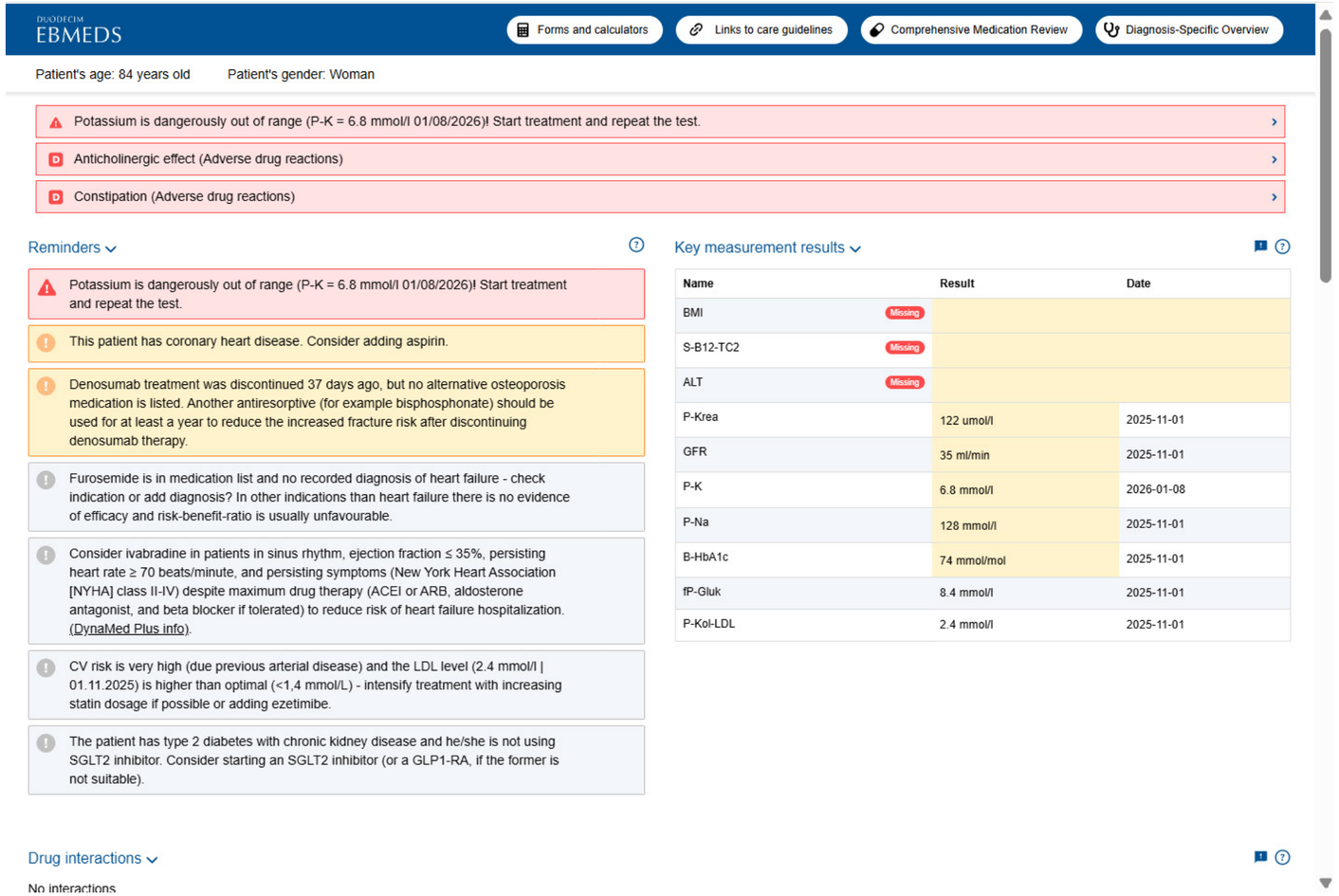
Summary page serves as a centralized patient overview, displaying essential information such as clinical reminders, drug-related alerts, and relevant laboratory results in one place. This reduces the need for healthcare professionals to navigate multiple sections of the EHR, saving time and improving workflow efficiency.

In addition to providing a clear snapshot of the patient's health status, the summary page supports clinical decision-making by enabling faster and more accurate treatment choices. It also offers quick access to additional resources provided by Duodecim Clinical Decision Support, which further enhances medication safety and ensures evidence-based care.

User Interface

A clear overview of key patien-spesific information with quick access to other Duodecim Clinical Decision Support tools and resources

Duodecim Clinical Decision Support summary page



User Interface

Duodecim Clinical Decision Support generates alerts to support safe medication use.

Duodecim Comprehensive Medication Review

Comprehensive Medication Review enables the evaluation of a patient's medication at a glance. Information that would otherwise need to be retrieved from several different sources is made quickly and easily accessible.

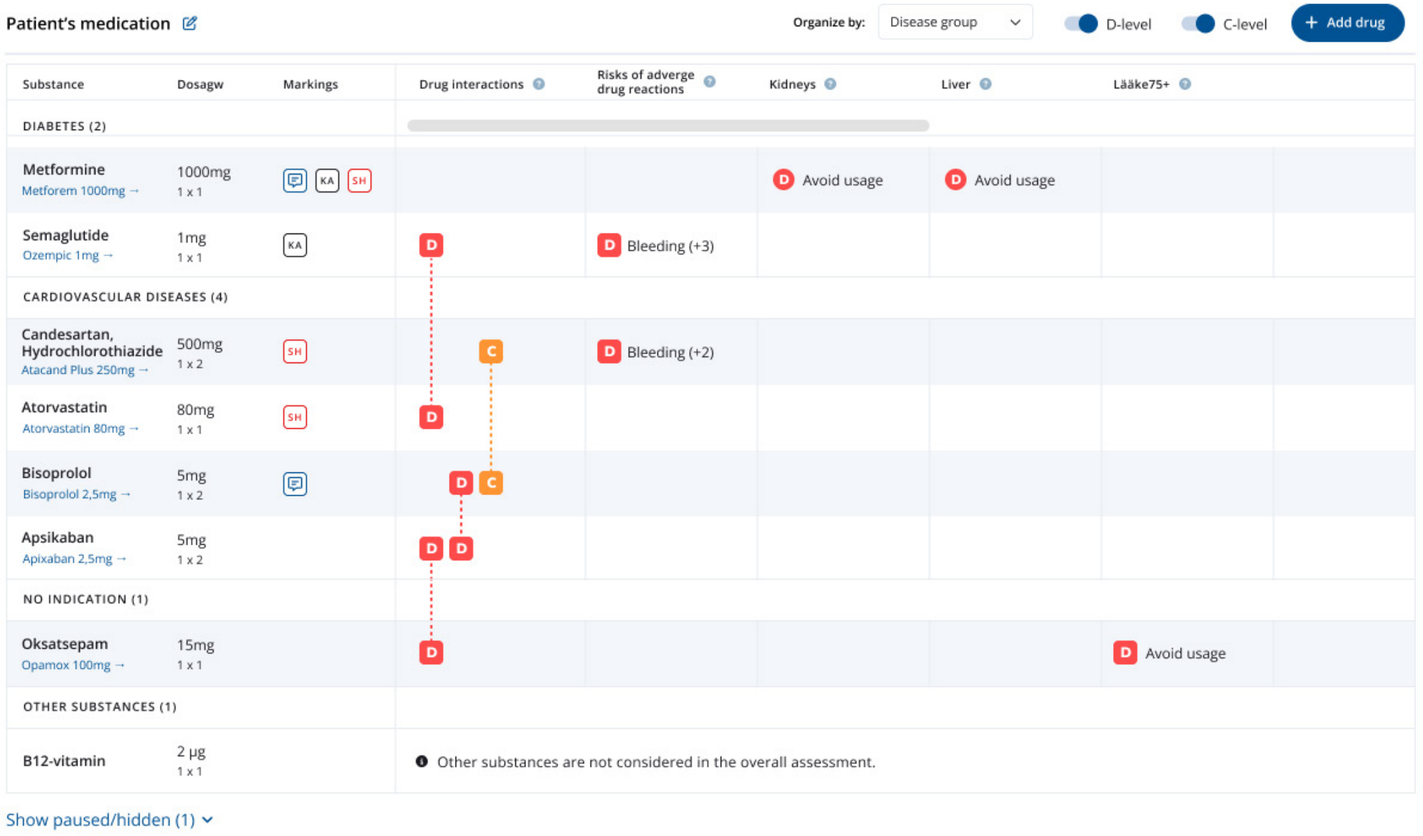
In addition to medication, the Comprehensive Medication Review also takes into account the patient's diagnoses and laboratory results, among other things. Medication can pose risks to a patient, but so can an untreated condition. Clinicians therefore need solutions tailored to the specific needs of each individual patient, not just a list of medication-related risks.

This helps identify medication-related problems and supports better decision-making in pharmacotherapy, improving medication safety while also saving the clinician's time.

User Interface

A clear Medication Overview presents essential medication information at a glance, enabling fast, informed clinical decisions.

Duodecim Comprehensive Medication Review



EBMEDS Quality Process

Reliable medical knowledge are at the core of our products clinicians can trust

Clinical Expertise Behind the Knowledge

All Duodecim EBMEDS contents is created, reviewed, and continuously maintained by medical professionals, ensuring it is scientifically sound, clinically relevant, and aligned with real-world medical practice. This expert-led approach allows users to rely on the information with confidence.

The EBMEDS editorial team consists of medical professionals from diverse clinical backgrounds. The team collaborates closely with the editorial teams of EBM Guidelines in Finland as well as with leading international partners. These include the Cochrane community, known for producing systematic literature reviews; the GRADE Working Group, which develops methods for assessing the quality of evidence and strength of recommendations; and the Guidelines International Network (GIN), a global organization dedicated to advancing clinical guidelines.

We are committed to delivering clinically meaningful and actionable information that supports healthcare professionals in making informed decisions. Our focus is on providing clear, concise, and relevant insights that can be directly applied in everyday clinical practice.□□Whenever customers have needs for new content or wants to accommodate existing content to local needs, our expert team is ready to assist

EBMEDS
Quality Process

Quality and seamless usability come together to create a user experience clinicians can trust

Quality drives everything we do

Quality is the foundation of everything we do. From the way we develop our products to how we support our customers, quality and continuous improvement guide every decision and every process. We are deeply committed to maintaining the highest standards to ensure reliability, safety, and trust in all our solutions.

Seamless and Intuitive User Experience

By combining modern technology with clear, user-friendly information, we create a seamless and efficient user experience. This enables our customers to work faster, with greater confidence and accuracy, leading to high levels of satisfaction and long-term partnerships.

EBMEDS Quality Process

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The device is produced by Duodecim Publishing Company Ltd.

The quality management system is certified in accordance with the requirements of ISO 13485:2016

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Summary of Intended Use

Duodecim Clinical Decision Support is a medical clinical decision support system that analyses structured patient data related to an individual's health and illnesses. It combines patient data with medical knowledge and practices from multiple sources. The purpose of the clinical decision support is to improve the quality of care and compliance with clinical guidelines, prevent treatment errors, improve patient safety and save the user's time.

Duodecim Clinical Decision Support is designed to provide clinical decision support such as treatment suggestions and diagnostic assistance for healthcare professionals. Typically, Duodecim Clinical Decision Support is connected to another information system that can produce the required structured patient information. Duodecim Clinical Decision Support is designed to be always available to the end user and to generate suggestions both automatically and upon the user's request. The software can be used for all types of patients regardless of age, gender or status of health.

Certified as a medical device

EBMEDS® Clinical Decision Support, hereinafter referred to as Duodecim Clinical Decision Support, is a Class IIa medical device in accordance with the EU Medical Device Regulation 2017/745.

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