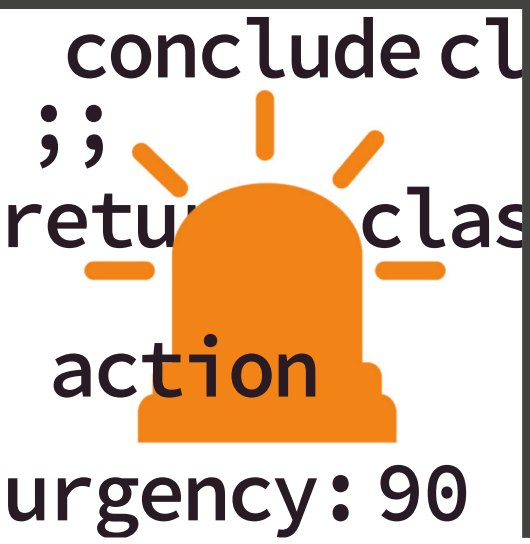


Clinical Alerts

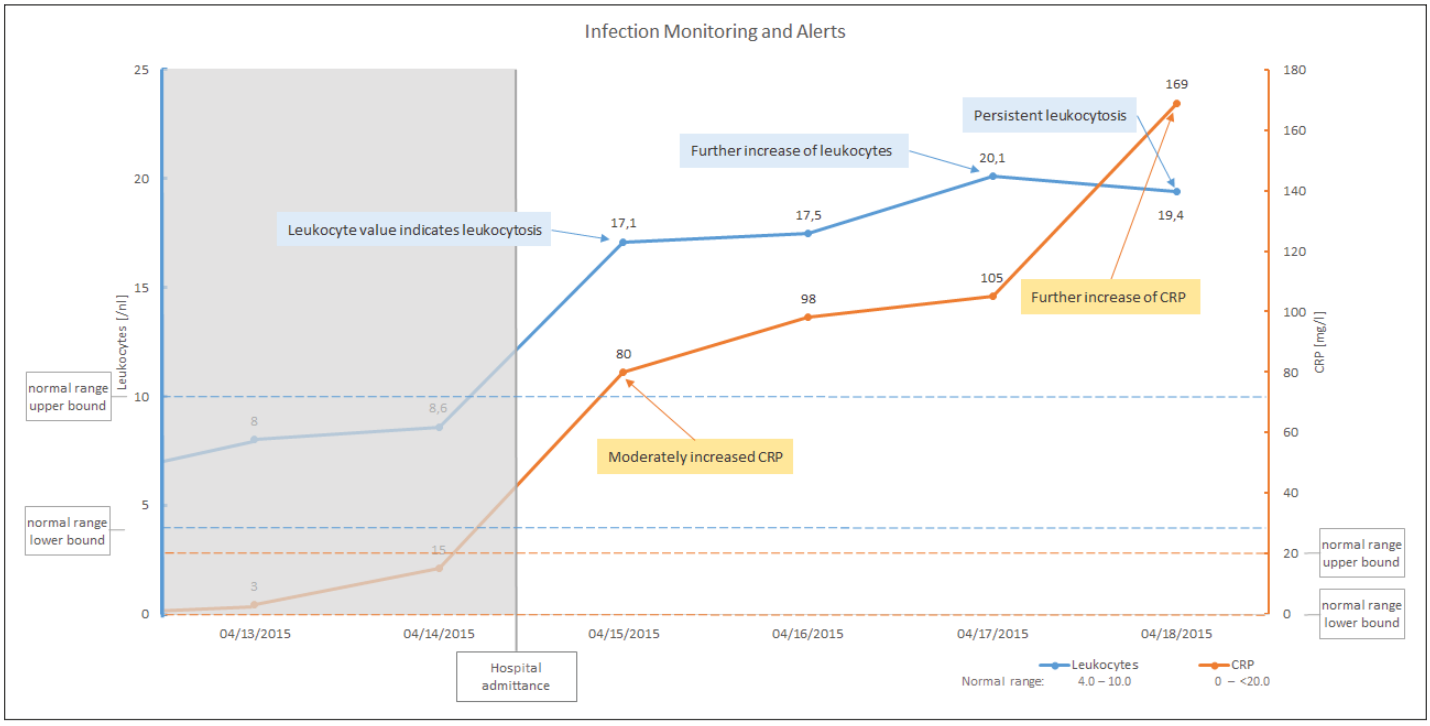
and customized medical content

ARDEN-SYNTAX-BASED MEDICAL CONTENT

Our medical content is written in Arden Syntax, an established medical knowledge representation and processing language that is an up-to-date HL7 International industry standard and approved by the American National Standards Institute (ANSI). We offer several application-ready medical knowledge packages for various clinical purposes as well as development of custom-built medical content for your hospital's unique medical tasks and requirements.

CLINICAL ALERT PACKAGES

The following medical knowledge packages for clinical alerts cover important clinical situations, offering to-dos and trends, supporting timeliness and completeness, and even monitoring life-threatening events. Errors—small or big—are prevented, patient safety increased, quality standards checked—for the benefit of the patient, the clinician, and the institution.



Clinical Alerts at the Right Point of Time

AVAILABLE CLINICAL ALERT PACKAGES

The following packages are available. They target different issues in clinical routine and are of varying scope.

TROPONIN MONITORING AND ALERTS

KIDNEY FUNCTION MONITORING AND ALERTS

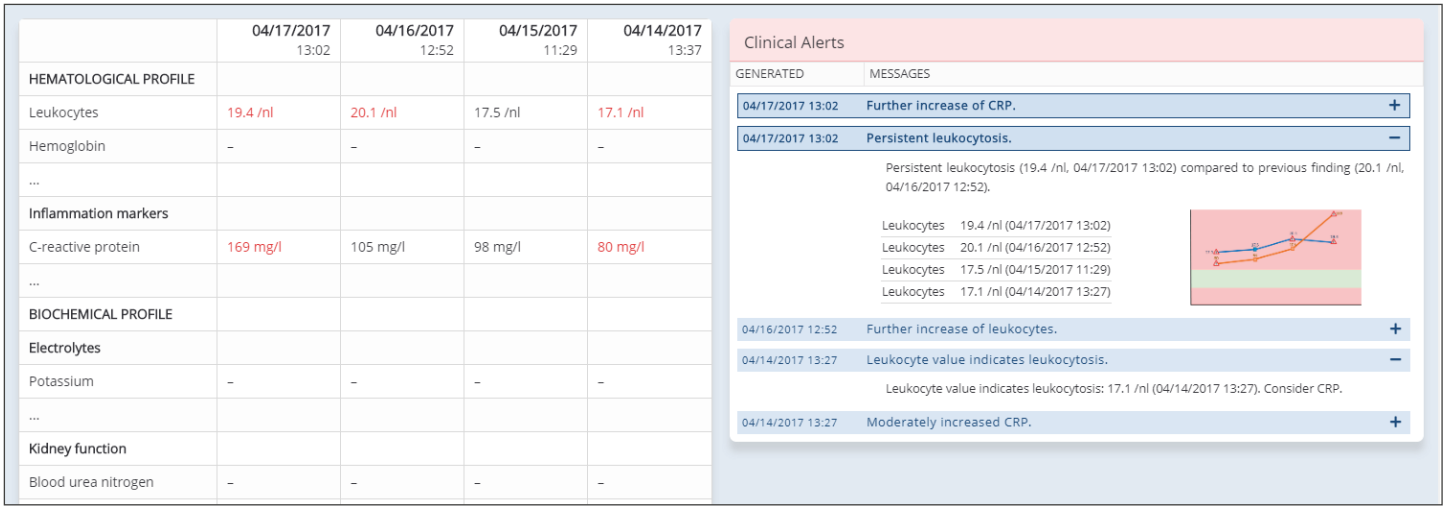
HEMOGLOBIN AND INFECTION MONITORING AND ALERTS

POTASSIUM MONITORING AND ALERTS

TSH MONITORING AND ALERTS

APPLICATION POSSIBILITIES

These packages can be—for example—connected to the hospital's EMR system. The alert messages can be displayed in an area of the EMR's user interface—as shown in the example below. However, the application of these packages is completely flexible and can be implemented according to customer requirements.



Clinical Alerts Displayed in an EMR's Patient Overview

CONFIGURATION

The Clinical Alert packages can be configured to your institutional requirements, e.g., in terms of

- critical value limits
- prevention of overalerting (i.e., specify latent time to next alert)
- new-value- or fixed-time-(e.g., change of shift)-triggering of alerts

PACKAGE DETAILS

Troponin Monitoring and Alerts

This package checks and monitors a patient's troponin levels during the hospital stay. The alerts are designed for close surveillance during and after acute myocardial infarction. As institution or laboratory preferences differ in troponin testing, the package works with high sensitive troponin, troponin I, as well as troponin T, or a combination—it interprets every available troponin test result. In patients with increased troponin levels, the system alerts physicians to a (beginning) myocardial infarction. Starting from the maximum troponin value during an infarction, additional alerts are generated if there is a further troponin increase, if the troponin levels do not drop after the initial infarction, or if new troponin test results fail to appear regularly. If a patient is about to be discharged with pathological troponin levels, an alert is generated.

Kidney Function Monitoring and Alerts

This package monitors a patient's kidney function during the hospital stay based on the glomerular filtration rate (GFR) as well as creatinine, urea, blood-urea-nitrogen (BUN), and potassium levels. Alerts are generated, if the GFR indicates reduced kidney function (in 5 steps from possible reduction to kidney failure). If there is no GFR available, the package works with creatinine instead. The system alerts if creatinine levels are increased and/or have risen considerably. If the last known GFR or creatinine value was pathological, a notification to request new tests is issued after 7 days with no new incoming test results or upon discharge. The package also notifies of severely increased BUN or urea levels, pointing out a possible indication for dialysis. Furthermore, if potassium levels haven't been in the normal range, the package checks for creatinine levels or suggests a creatinine test. Creatinine level progression is then monitored and a trend prediction calculated. There is an alert if the creatinine levels are expected to rise pathologically within three days.

Hemoglobin and Infection Monitoring and Alerts

This package checks and closely monitors a patient's leukocyte, CRP, and hemoglobin levels during the hospital stay. Changes in these levels are considered clinically significant as they may indicate possible life-threatening episodes. Alerts are generated for pathological leukocyte, CRP, and hemoglobin levels. In case of an already present inflammation or if the patient suffers from leukemia, alerts are adjusted respectively. Dependencies between CRP and leukocyte levels are also taken into account. Hemoglobin level limits are defined gender-specific. Alerts are generated if hemoglobin levels indicate an anemic state or if there are significant drops of hemoglobin levels. Drops across one or several critical value limits are distinguished and accounted for.

Potassium Monitoring and Alerts

This package monitors a patient's potassium levels during the hospital stay. Especially in patients who suffer from multiple conditions and take a variety of different medications, pathological increases or decreases of potassium levels resulting in hyper- or hypokalemia are not uncommon. This package checks for pathologically increased or decreased potassium. Suggestions are given to indicate what medications or conditions could be responsible for pathological levels. Specific checks are advised (especially useful for doctors in training). If the last known value was not within normal range, an alert for further testing is generated upon the patient's discharge or after a specified amount of time has passed. Previously measured potassium levels are considered in order to notice adverse trends.

TSH Monitoring and Alerts

This package checks and monitors a patient's TSH levels during the hospital stay and issues a notification if a patient whose TSH levels need further attention is about to be discharged from the hospital. In case of moderately increased TSH levels, there is no immediate alert but the system constantly checks if new TSH levels have come in. After 4 weeks without new TSH levels, an alert is generated to request another test. Significantly increased or decreased TSH levels produce an immediate alert (especially useful in respect to contrast agents). Additionally, an alert requesting new TSH testing is generated after 2 weeks without new TSH values. If a patient is about to be discharged, the alert package checks for any outstanding future alerts. In this case, the alert is generated before the patient's discharge. The physician can then request new TSH test results; automatically including a recommendation for TSH level testing in the discharge letter is also a possibility.

If you are interested in other medical content options, we offer the following services to create customized medical content tailored to your hospital's needs:

CUSTOMIZED MEDICAL CONTENT BY MEDEXTER

Medexter's team of knowledge engineers works in close cooperation with experienced clinicians. We offer development of custom-built MLMs suited for your hospital's unique medical tasks and requirements with full support every step of the way.

ON-SITE CUSTOMIZED MEDICAL CONTENT DEVELOPMENT

Our ARDENSUITE represents an excellent and easy-to-use tool for you to write and test MLMs. In-house MLM development may have the benefit of a close cooperation between your skilled hospital IT department and the clinical staff for whose patient care routine MLMs are written. This setup works excellently in many of our ARDENSUITE installations.

For those who choose this option, we additionally offer an introductory training session for MLM development as well as support by Medexter's development team.

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SELECTED REFERENCES

Zeckl, J., Adlassnig, K., Fossler, R., Blacky, A., de Bruin, J.S., Koller, W., Rappelsberger, A. & Adlassnig, K.-P. (2017) *Context-Sensitive Clinical Alert Packages Written in Arden Syntax.* In Gundlapalli, A.V., Jaulent, M.-C. & Zhao, D. (Eds.) MEDINFO 2017: Precision Healthcare through Informatics, Proceedings of the 16th World Congress on Medical and Health Informatics, Studies in Health Technology and Informatics 245, IOS Press, Amsterdam, 1190–1194.