Dedalus

HEALTHCARE PLATFORM SOLUTION(S)

BUILDING CONNECTED
HEALTH AND CARE SYSTEMS

DC4H® - DIGITAL CONNECT 4 HEALTH ®

INTEGRATING PROCESSES
WITH ACTIONABLE DATA

The management and delivery of care is increasingly moving beyond the walls of individual institutions towards integrated and coordinated care built around the needs and preferences of the patient.

This patient-first approach responds to both the broader aspirations of Triple Aim for healthcare and a commitment to enabling patient engagement. Digital-first tools and services are increasingly becoming part of the landscape of care, and the patient expects a single, integrated and coordinated experience.

To meet the needs of their patients, healthcare organisations need real-time visibility of how their services are being used and of the wider health system. The challenge for healthcare providers will be to effectively connect to this new integrated healthcare ecosystem, given that the data required to make this a reality is often not easily accessible.

However, these challenges can be addressed with the right approach — including the ability to integrate and ingest data across disparate applications, link data sets, gain evidence-based insights about populations, and support clinical workflows across organisations.

HEALTHCARE PLATFORM SERVICES

DEDALUS DC4H®
SIX PILLARS OF VALUE:
MEETING HEALTHCARE
DATA NEEDS

Dedalus DC4H® platform comprises six pillars that together provide a comprehensive platform ecosystem for innovation and modernisation to support an integrated health system that connects providers, patients and other caregivers across organisational and geographic boundaries **(See Figure 1)**.

Dedalus DC4H® enables healthcare organisations to access, cleanse, integrate, ingest and semantically tag data held across multiple clinical and operational systems. As a result, this platform delivers contextual and actionable insights for informed and timely decision-making.

Dedalus DC4H® is an open platform ecosystem offering the building blocks to leverage machine learning (ML) models from third-party artificial intelligence (AI) partners and carry out predictive analytics. Furthermore, the platform offers out-of-the-box self-service analytics dashboards for data investigation, as well as the ability to close the loop by triggering events based on clinical/operational decision support, providing a notification or alert to the clinician to act in a timely manner.

Meeting healthcare data needs pillar in practice

While each of the six pillars is connected to and builds on the capabilities delivered by one another, each is also independent — enabling organisations to start where maximum value can be delivered.
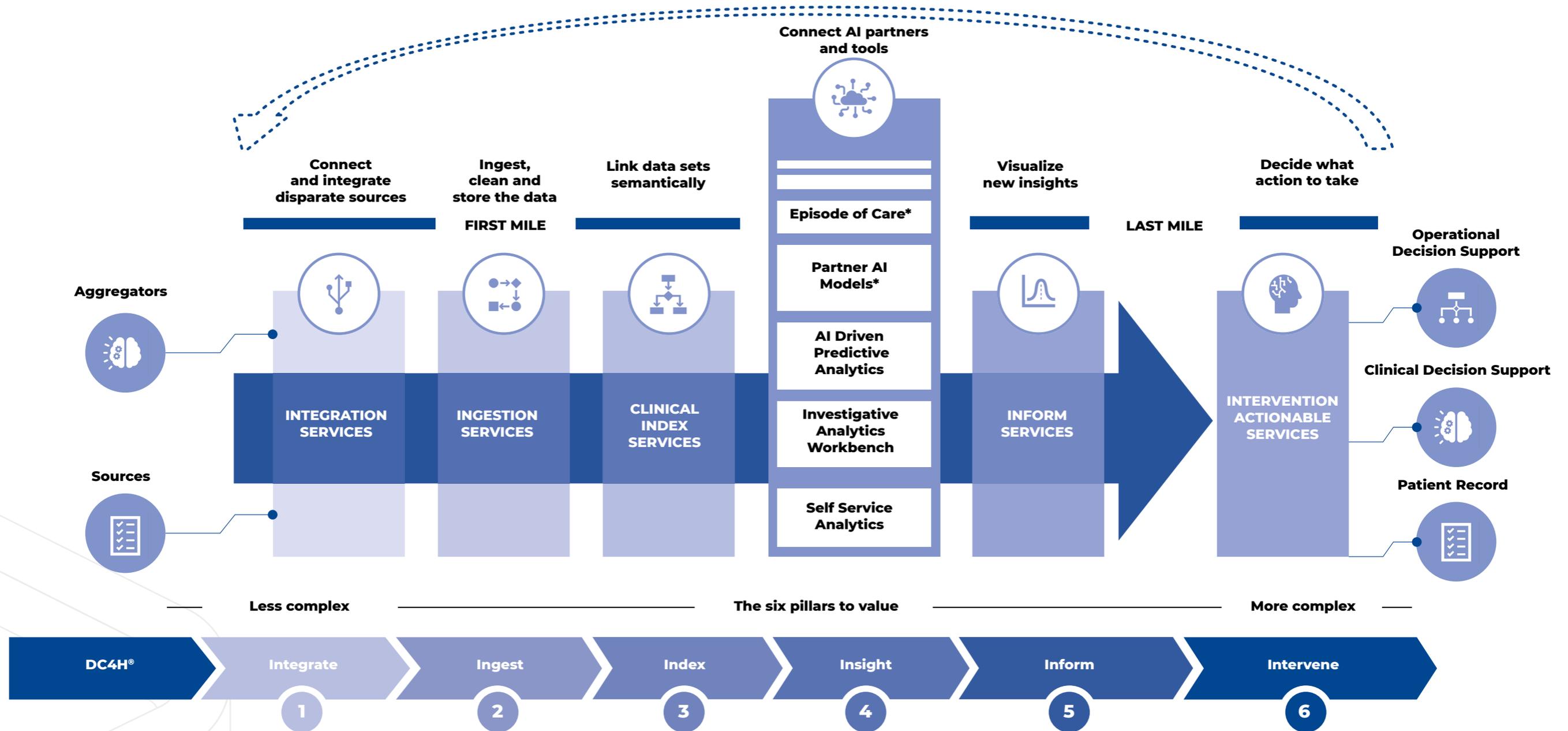
Figure 1. Dedalus DC4H® Digital Connect 4 HealthPlatform

DEDALUS DC4H®
PILLAR ONE: INTEGRATE

Dedalus DC4H® enables the flow of complex and fragmented data across disparate applications and organisations. This makes it easier to manage high volumes of complex data with its robust scalable and flexible integration services.

A key challenge all healthcare organisations face is connecting the multitude of different systems containing patient and operational data across their health and care ecosystems. Dedalus DC4H® connects maps data items using industry standards, such as Health Level Seven - including Clinical Document Architecture (CDA) and Fast Healthcare Interoperability Resources (FHIR) - and Integrating the Healthcare Enterprise (IHE), to allow users to integrate multiple systems and different data sources. The integration pillar has the flexibility to connect through many protocols and can process proprietary formats.

This component serves as an accelerator for integration. Dedalus DC4H® has proven integration to most of the major electronic medical record (EMR) vendors across primary, secondary and social care as well as to laboratory and imaging.

Dedalus DC4H® can augment existing integration capabilities, helping to accelerate the deployment of healthcare applications by leveraging common integrations with the platform.

Aggregators

Connect and integrate disparate sources

INTEGRATION SERVICES

Sources

DC4H® — **Integrate**

1
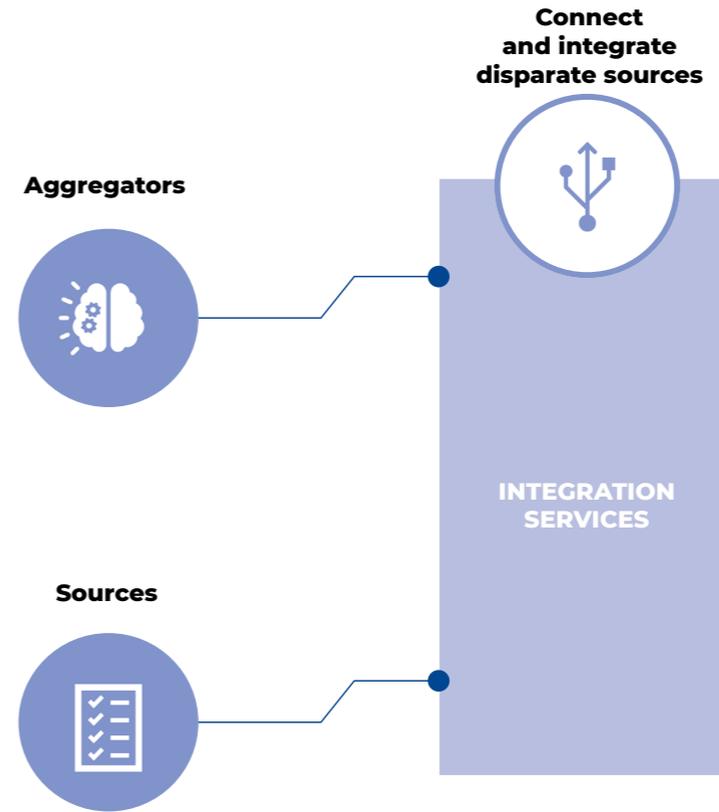
Integrate pillar in practice

Dedalus DC4H® is helping to support the modernisation of legacy applications for several organisations. At one large U.S. healthcare system, Dedalus DC4H® 's Integrate Pillar is being used to open up the organisation's three EMRs to enhance access to data as well as integrate over 60 different healthcare applications. Dedalus DC4H® processes over 15 million transactions per day.

HEALTHCARE PLATFORM SERVICES
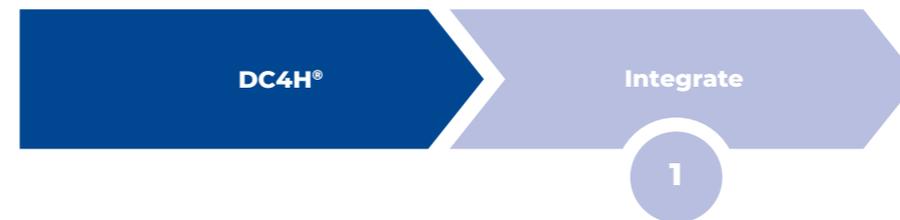
DEDALUS DC4H®
PILLAR TWO: INGEST

Through its integrated care record, Dedalus DC4H® provides a single store to hold data that has been ingested from data aggregated across multiple source systems (such as provider, payer and internet of things [IoT]-sourced data) and normalised to an industry standard. The integrated and coordinated care record provides a full picture of the patient's clinical and administrative data.

Dedalus DC4H® uses FHIR as the canonical data format and uses standardised terminology sets such as SNOMED-CT, ICD and LOINC for mapping.

The aggregated data can be securely shared with other internal and external systems, plus applications such as Apple Health, by using standard FHIR APIs.

To ensure semantic equivalence, Dedalus DC4H® utilises a terminology server that allows seamless transition between code systems, allowing all contributing applications to use their preferred nomenclature.

Dedalus DC4H® addresses the problem of patient identity by including a Master Patient Index that allows all of the records belonging to a single patient to be matched to their integrated care record, removing any duplication and potential missed clinical information.

To accelerate the ingestion of data from various source systems into an integrated care record, Dedalus DC4H® provides out-of-the box bidirectional mapping between the most popular data formats such HL7 v2.x, FHIR STU 3, FHIR R4 and others.

Ingest, clean and store the data

INGESTION SERVICES

Ingest

2

Ingest pillar in practice

Dedalus DC4H® is being leveraged by one hospital system to monitor actual patient demand by speciality. By gathering data from different sources, administrators can see bottlenecks in the system, such as longer-than-expected lengths of stay, an increase in the number of patients who left without treatment, staffing mismatches and more. This helps to determine the most critical areas on which to focus service-improvement efforts.
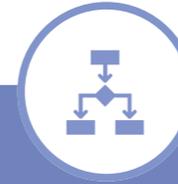
DEDALUS DC4H®
PILLAR THREE: INDEX

Once data has been normalised and stored into DC4H® Clinical Data Repository (structured on FHIR data model), healthcare providers need to determine the meaning of captured data through the "semantic linking" of the data sets. This enables clinicians to ask relevant questions and extract specific data. For example, users can find all the data on male patients over age 55 with both chronic obstructive pulmonary disease (COPD) and hypertension. This addresses the long-standing challenge for healthcare data analysts caused by data being organised and coded in different ways depending on the system from which it originated. For example, the hospital EMR may use SNOMED-CT to code a health condition, while a GP (General Practitioner) system may use an ICD-10 code.

Data tagging therefore must be able to understand multiple code sets in relation to the coding and classification of diseases, including ICD-9 codes, ICD-10 codes, SNOMED CT and others. Dedalus DC4H®'s clinically relevant semantic tagging services address these challenges by taking globally recognised taxonomy and ontology as reference points and drilling down to details about diseases, such as diabetes versus uncontrolled diabetes mellitus. This ensures the data is not only available and in an integrated record but is also semantically relevant to the end user.

Dedalus DC4H® provides out-of-the-box tagging for hundreds of health conditions, allowing clinicians and researchers to achieve objectives more rapidly and accelerate the development of analytics insights based on AI/ML approaches. It provides a classification system to perform disease staging, assigning each claim, encounter, procedure, medication and condition to a disease category and severity level.

Link data sets semantically

CLINICAL INDEX SERVICES

Index

3

Index pillar in practice

To make better healthcare decisions, organisations and providers need contextual data. Dedalus DC4H® helps clients by aggregating raw data within a category and tagging connected or similar data sets. For example, if clinicians or researchers are searching for data about infectious diseases, their workload is made simpler if all diseases within that category are identified.

To help hospitals and clinicians leverage information from health records for both real- time and retrospective insights, Dedalus DC4H®'s Tag pillar selects valid and standard clinical concepts from different terminology services — SNOMED CT, ICD-9 codes, ICD-10 codes — making these concepts available as an interoperable and comparable body of clinical terms. This brings structure to what would otherwise be subjective, amorphous records of clinical scenarios, allowing comparison with a global body of knowledge that is consolidated into standard and valid terminology services.

DEDALUS DC4H®
PILLAR FOUR: INSIGHT

Providing analytics and evidence-based insights about populations as well as the health of individuals underpins quality caregiving. The intelligence fabric components support visual investigative analysis of data for the generation of actionable insights and care planning.

The intelligence fabric, or analytics hub, enables organisations or third-party providers to deploy and execute their AI/ML models, while Dedalus DC4H® ensures that data is mapped from the FHIR integrated record format into the proprietary format usually used by third-party ML model vendors. The analytics hub also enables the results of multiple ML models to be integrated into a common data set for analysis.

Furthermore, Dedalus DC4H® provides a set of pre-defined functions that allow data scientists and engineers to interact with clinically tagged data from the

integrated care record directly from a data science notebook. These are a form of interactive computing, in which users write and execute code, visualise the results and share insights.

Connect AI partners and tools

- Episode of Care*
- Partner AI Models*
- AI Driven Predictive Analytics
- Investigative Analytics Workbench
- Self Service Analytics

Insight

4

Insight pillar in practice

To help a healthcare system better understand and monitor patient demand, Dedalus DC4H®'s Insights pillar, leveraging ML/AI, assesses not only internal bottlenecks but also external factors such as World Health Organisation disease migration, weather, holidays, local events and so on. This external data contributes to a deeper understanding about the flow of patients through the emergency department and any additional workload this may impose on the system.

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PILLAR FIVE: INFORM

The analytics workbench provides evidence-based insights about populations and individual health, enabling investigative intelligence on the data in the longitudinal patient record through navigable dashboards and visualisations. This pillar leverages the API manager used by the healthcare organisation to support the rapid creation of new, information-rich applications while governing and controlling access to patient data.

The inform pillar of DC4H® allows any healthcare professional to access and visualize a patient's clinical information via a powerful "optical layer" to display clinical information available on DC4H® either in the form of clinical documents or atomic, finer-grained clinical data sets from resources stored in the Clinical Data Repository (CDR).

Using a series of visualisation dashboards, the Dedalus DC4H® Inform pillar enables users to carry out investigative analytics, drilling down data by geography, gender, condition, age group and more — thereby getting an out-of-the-box view of the data.

Additionally, these predefined visualisations can be customised by the customer, or new dashboards can be created as required.

Visualize new insights

INFORM SERVICES

Inform

5

Inform pillar in practice

Dedalus DC4H® is being leveraged by one hospital system to monitor actual patient demand by speciality. By gathering data from different sources, administrators cansee bottlenecks in the system, such as longer-than-expected lengths of stay, an increase in the number of patients who left without treatment, staffing mismatches and more. This helps to determine the most critical areas on which to focus service-improvement efforts.

Dedalus DC4H® is being leveraged to forecast models of medical care based on analysis of applied protocols, clinical guidelines, and screening programmes. Success metrics/quality indicators identified by the protocol or screening programme can be monitored by the platform .

The metrics and indicators are calculated from the data within the FHIR repository and can be presented in reports, dashboards or as direct messages to highlight progress, compliance or results. The reports and dashboards can be aggregated on a national level or presented on a local level, depending on requirements.

Rules can also be configured. For example, if a cohort of patients is not compliant with the respective clinical guidelines, a message can be sent to the relevant recipient, including the patient and their care provider.
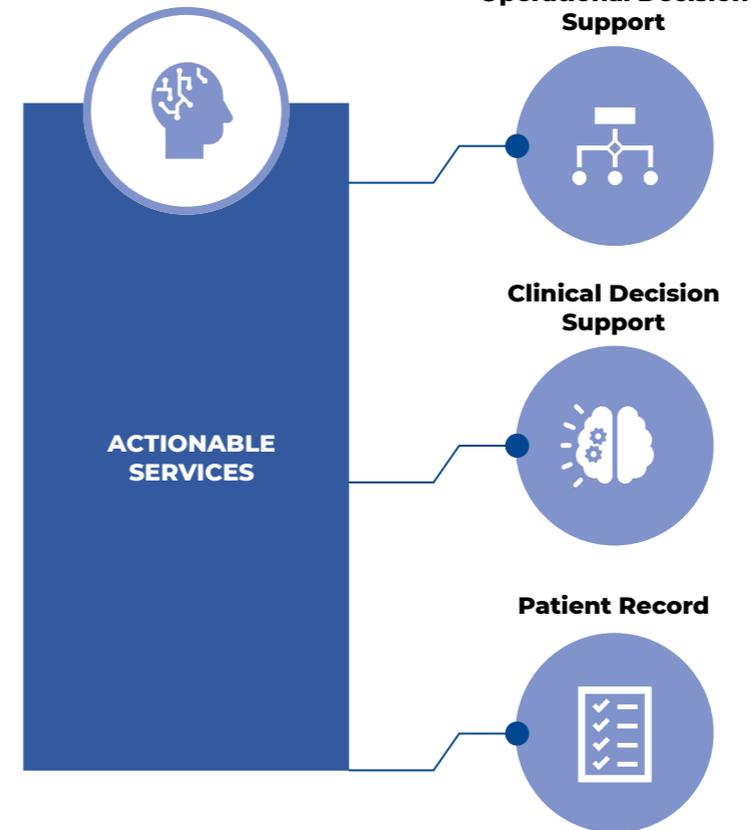
DEDALUS DC4H®
PILLAR SIX: INTERVENE

Once the information is generated, rather than using static dashboards that provide the data but don't provide contextual information to the clinician, the Intervene pillar uses a set of defined business rules and automated processes, through a notification or alert, to offer an action based on what is actually happening. Examples include a large influx of patients in the emergency department or a crisis with a heart patient in another ward. Automated workflows, carried out by the insights workbench, monitor real-time data coming into the integrated record and can alert or notify clinicians when interventions are required or overdue.

DC4H® Public API (based on HL7 FHIR) is also integral to enabling healthcare intervention. Leveraging this connected application ecosystem combined with automated workflows puts actionable and real-time insights   directly into the hands of the clinicians or hospital staff, notifying them to go and do something.

The Intervene pillar allows clinicians to visualise an event and provides them with an intervention based on clinical decision support best practices. The data enables healthcare organisations to optimise their productivity and support health outcomes.

For example, in the case of a patient with chronic heart failure, the Intervene pillar could be leveraged to monitor a patient's weight changes. If weight increases by more than a certain number of kilograms on the same day, a rule will trigger an alert to a clinician or care coordinator to act and prevent an unnecessary hospital admission.

Decide what action to take

Operational Decision Support

Clinical Decision Support

ACTIONABLE SERVICES

Patient Record

Intervene

6

Intervene pillar in practice

One healthcare organisation is using Dedalus DC4H®'s Intervene pillar to support capacity management and reduce process flow variance by monitoring
the actual time spent on activities in a given clinical pathway and track the process of each activity. The actual flow time is compared to international benchmark flow times; for example, how long an X-ray or nurse examination typically takes. An alert is created and sent to management as well as the unit where the patient is currently located if the time exceeds a pre-determined benchmark.
Generated management reports are created periodically
to determine where and when delays are happening. Intervention is further enabled by employing utilisation and scheduling data to predict future problems with clinical bottlenecks.
Rules can also be configured. For example, if a cohort of patients is not compliant with the respective clinical guidelines, a message can be sent to the relevant recipient, including the patient
and caregivers.

HEALTHCARE PLATFORM SERVICES

THE DEDALUS DC4H®
DIFFERENCE

As the healthcare industry looks to gain more real-time access to and insights from the vast stores of data and information about patient care, Dedalus DC4H® and its flexible, independent and connected pillars will make it easier to:

· Integrate data from a wide range of existing healthcare applications easily and quickly by using the library of existing integrations into Dedalus DC4H®.

· Aggregate data faster and create an open, interoperable, agile platform environment connecting existing and legacy assets.

· Better understand patients and how they interact with the hospital or other healthcare organisations using Dedalus DC4H®'s FHIR-based integrated care record. It's more than just a data lake; it is a repository of curated, standardised, normalised and semantically relevant data.

· Fill the gaps in the investments that businesses have already made in data integration and analytics and maximise the value by tapping into existing investments in data and systems.

Dedalus

· Enable collaboration with partners across the healthcare ecosystem by leveraging industry standards.

· Create an integrated digital-care record or a consolidated data lake that allows users to cross-link information and derive new insights using structured and unstructured information, internet of things, wearable medical devices and more.

· Securely integrate and share data across the healthcare ecosystem into an abstract longitudinal patient record, respecting patient consent to be applied.

· Deploy an omnichannel ecosystem of front-end solutions to support patients, providers and care coordinators via integrated and collaborative platform services.

· Apply vendor-neutral data acquisition and point-of-care automation, avoiding any "rip-and-replace" approach so that healthcare organizations can evolve their application landscape.

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www.dedalus.com

About Dedalus

Dedalus is the leading healthcare and diagnostic software provider in Europe and one of the largest in the world. With its innovative framework of comprehensive and process-oriented solutions, Dedalus enables a revolutionary digital transformation of country-wide Healthcare Systems fully supporting the patient digital journey. Dedalus serves more than 6,100 private and public hospitals across 40 countries, through more than 5,500 highly specialized resources, of which 2000 are dedicated to R&D activities. We aim to help caregivers and healthcare professionals to deliver better care to the communities they serve and for this reason we are very proud of doing a special job, working with healthcare organisations to improve healthcare outcomes for patients.

Life flows through our software.

For more information, visit www.dedalus.com