

Point-of-Care Technologies

Multiparametric profiling of diabetes at the point-of-care

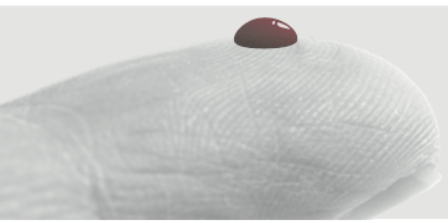
Fawaz Alzaid

DDI Senior scientist, Head of Department
INSERM Associate Researcher, Group Leader



معهد دسمان للسكري
Dasman Diabetes Institute

No conflict of interest to disclose



DIABETES

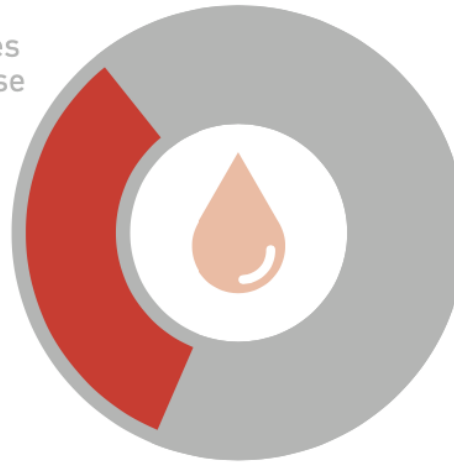
DIABETES IS
ON THE RISE



422 MILLION
adults have diabetes

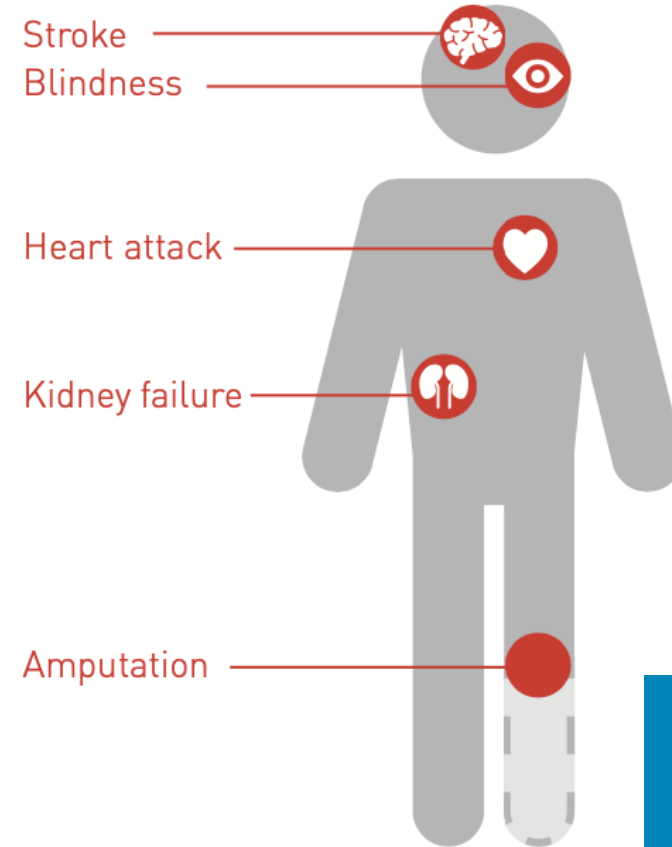
3.7 MILLION
deaths due to diabetes
and high blood glucose

1.5 MILLION
deaths caused
by diabetes



Consequences

Diabetes can lead to complications in many parts of the body and increase the risk of dying prematurely.

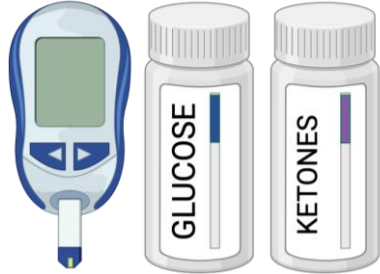


THAT'S **1** PERSON IN **11**

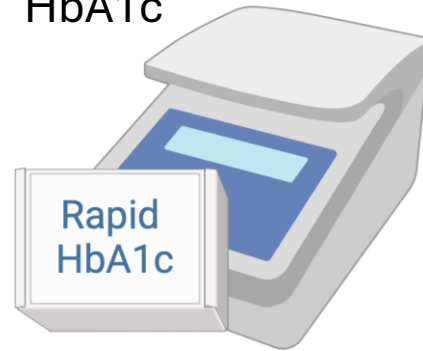


POC in Diabetes Care

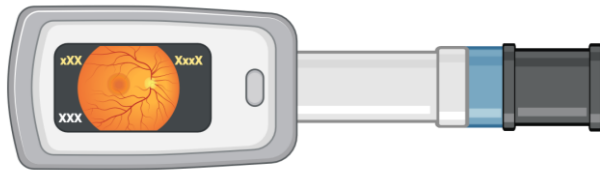
Glycemia, ketonemia



HbA1c



Retina imaging

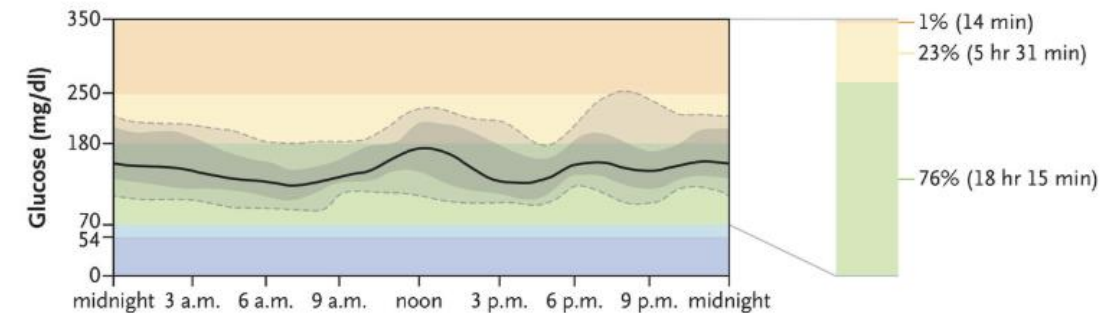
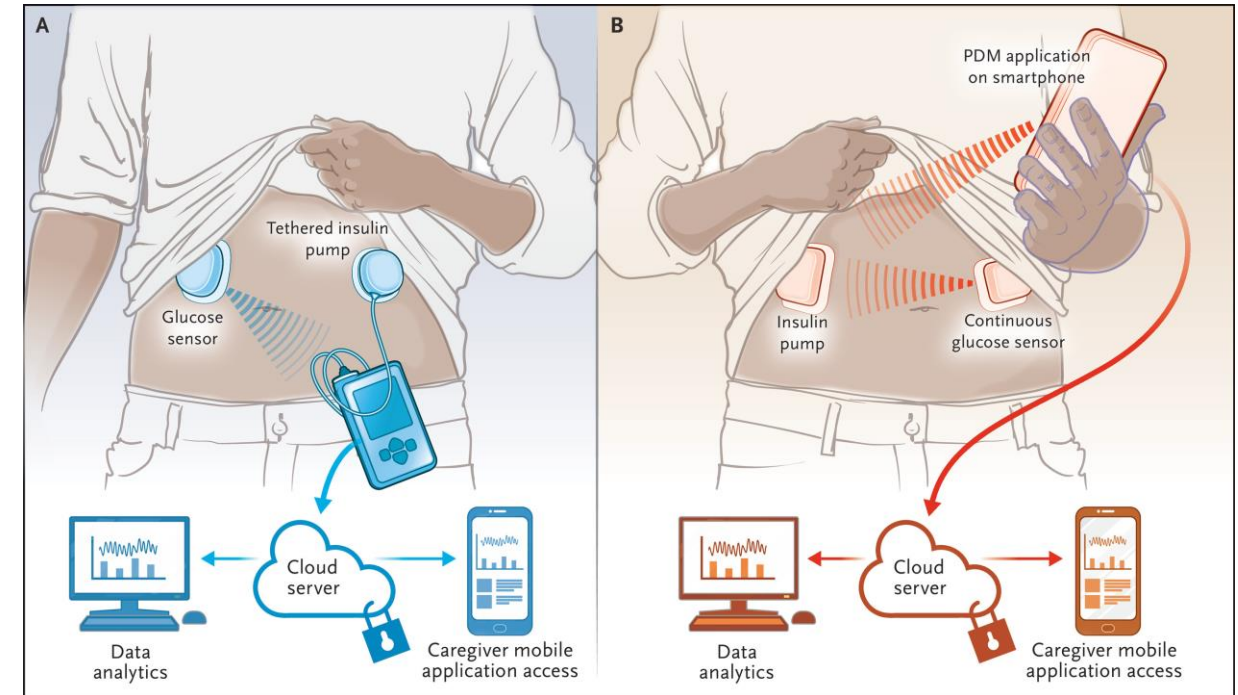


Monofilament

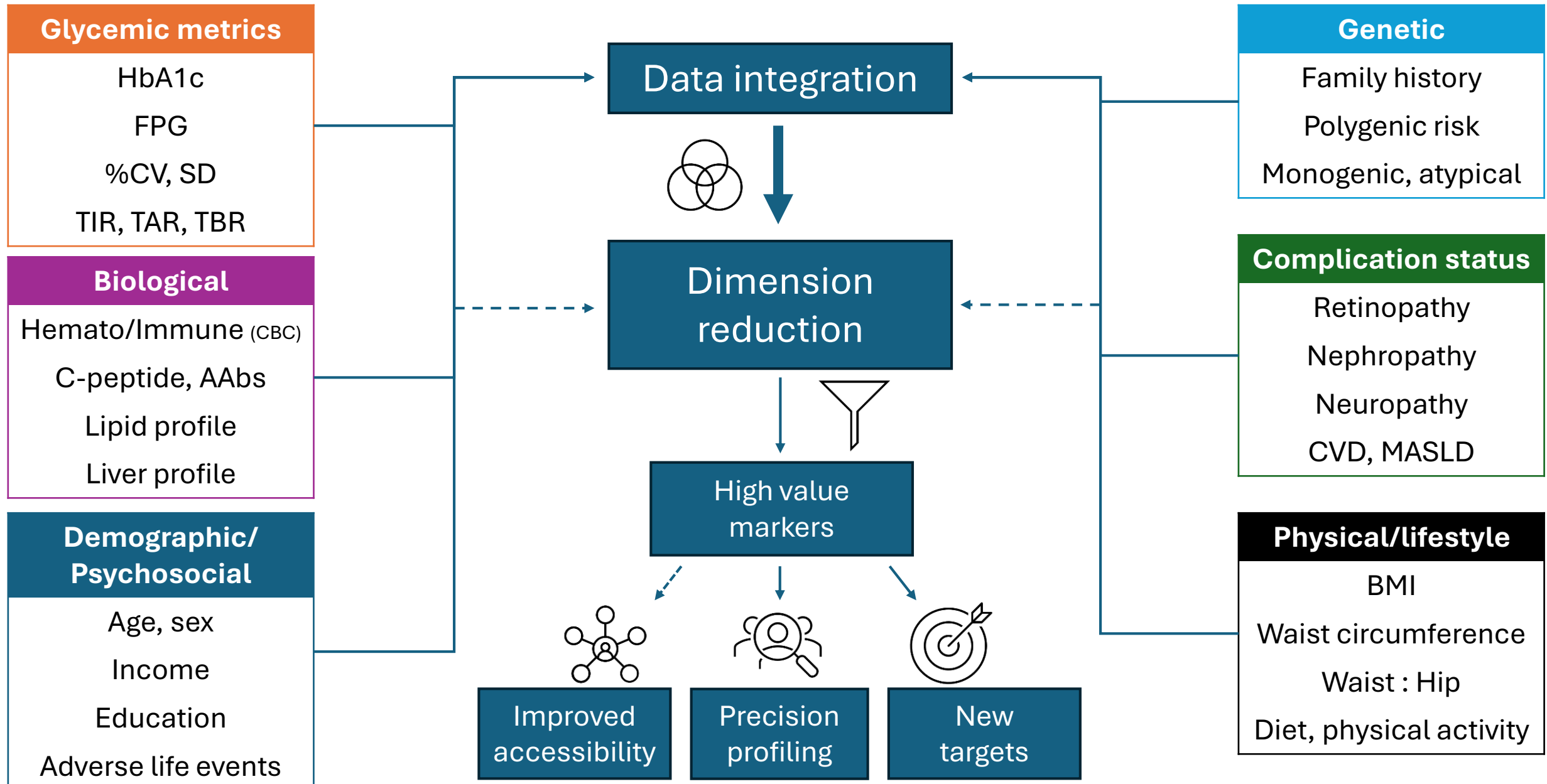


Questionnaires/scores
/EHR: Self-management,
compliance, risk, history...

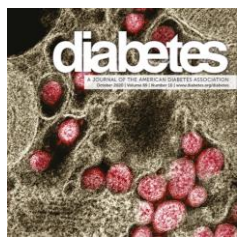
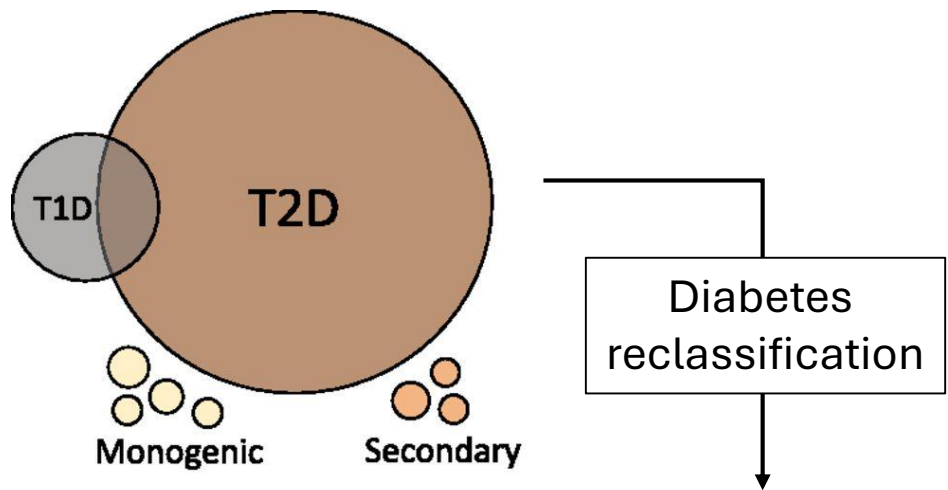
Diabetes technology (CGM, AID)



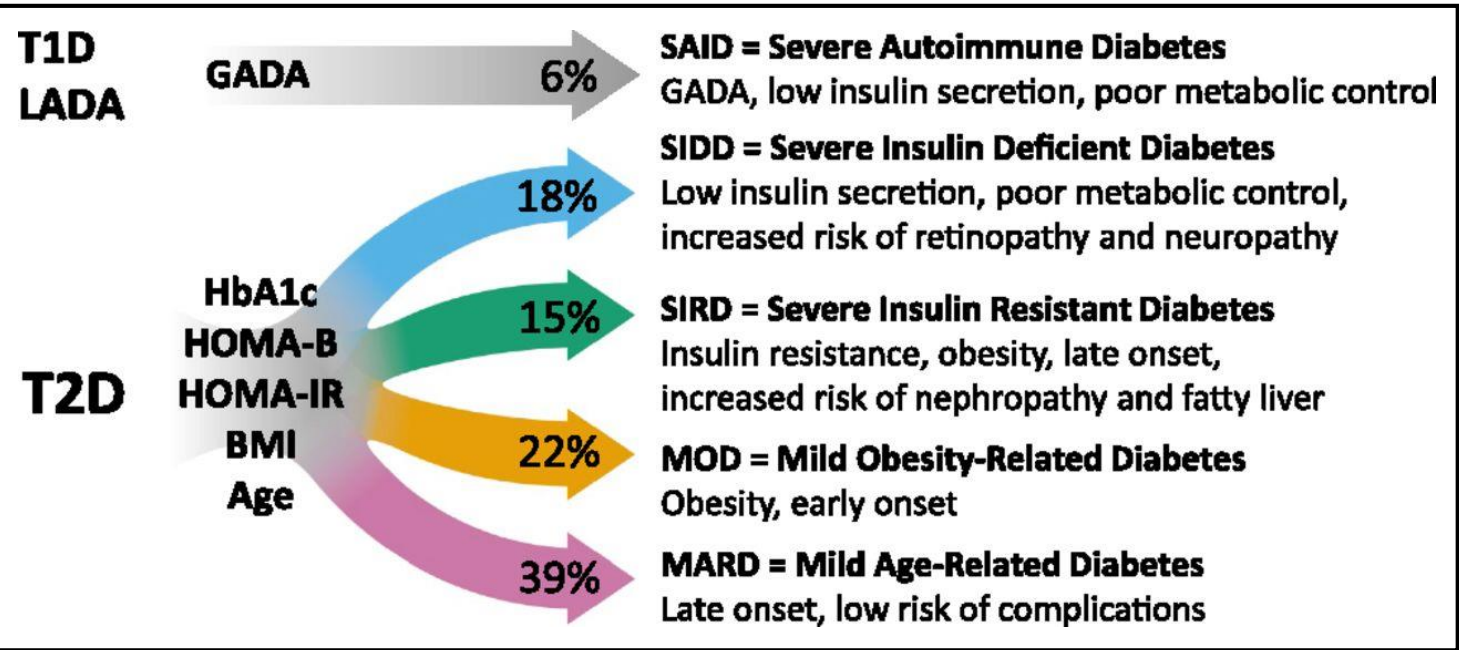
Data-driven optimization at PoC



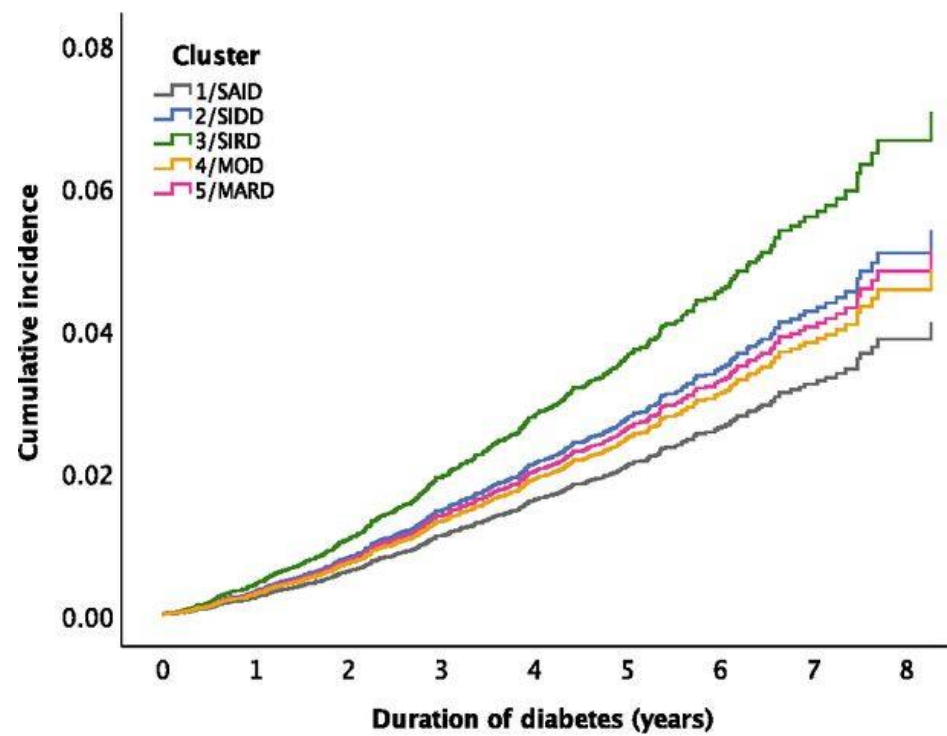
Subtypes of type 2 diabetes determined from clinical parameters



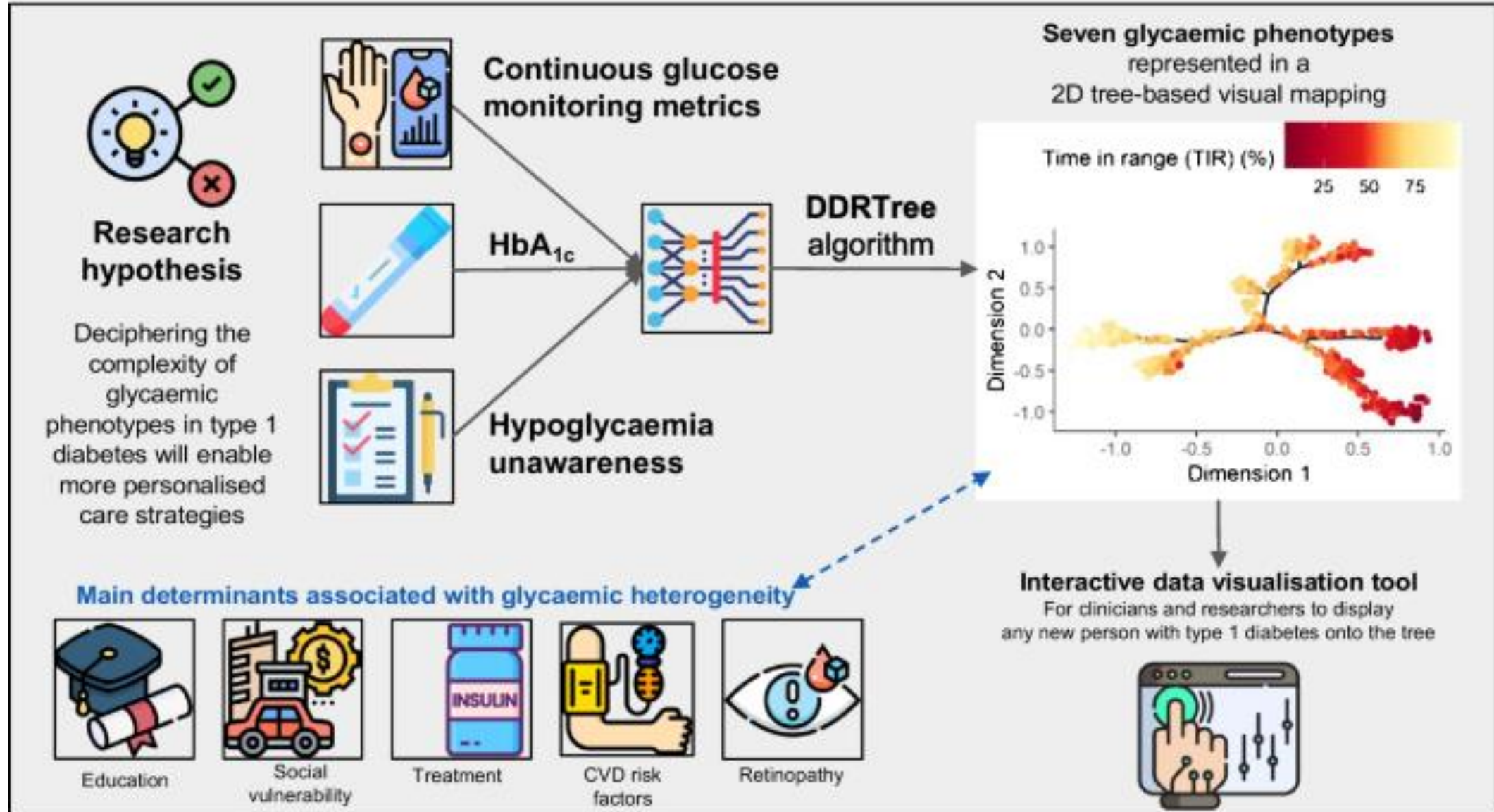
Ahlqvist et al 2020 Diabetes
Subtypes of type 2 diabetes determined from clinical parameters



Cumulative incidence of CKD



Heterogeneity of glycaemic phenotypes in type 1 diabetes



Heterogeneity of glycemic phenotypes in type 1 diabetes

6 variables for glycemic phenotype:

HbA1c

TBR: Time below range

TIR: Time in range

CV: Coefficient of variation

GRI: Glycemic risk index

Gold score (hypo awareness)

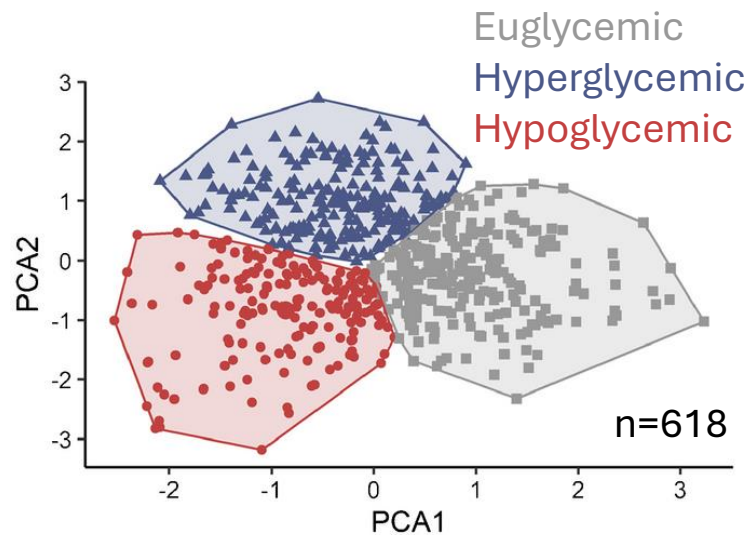


SFDT1 cohort: French National Cohort for Persons with Type 1 Diabetes (n=4583)

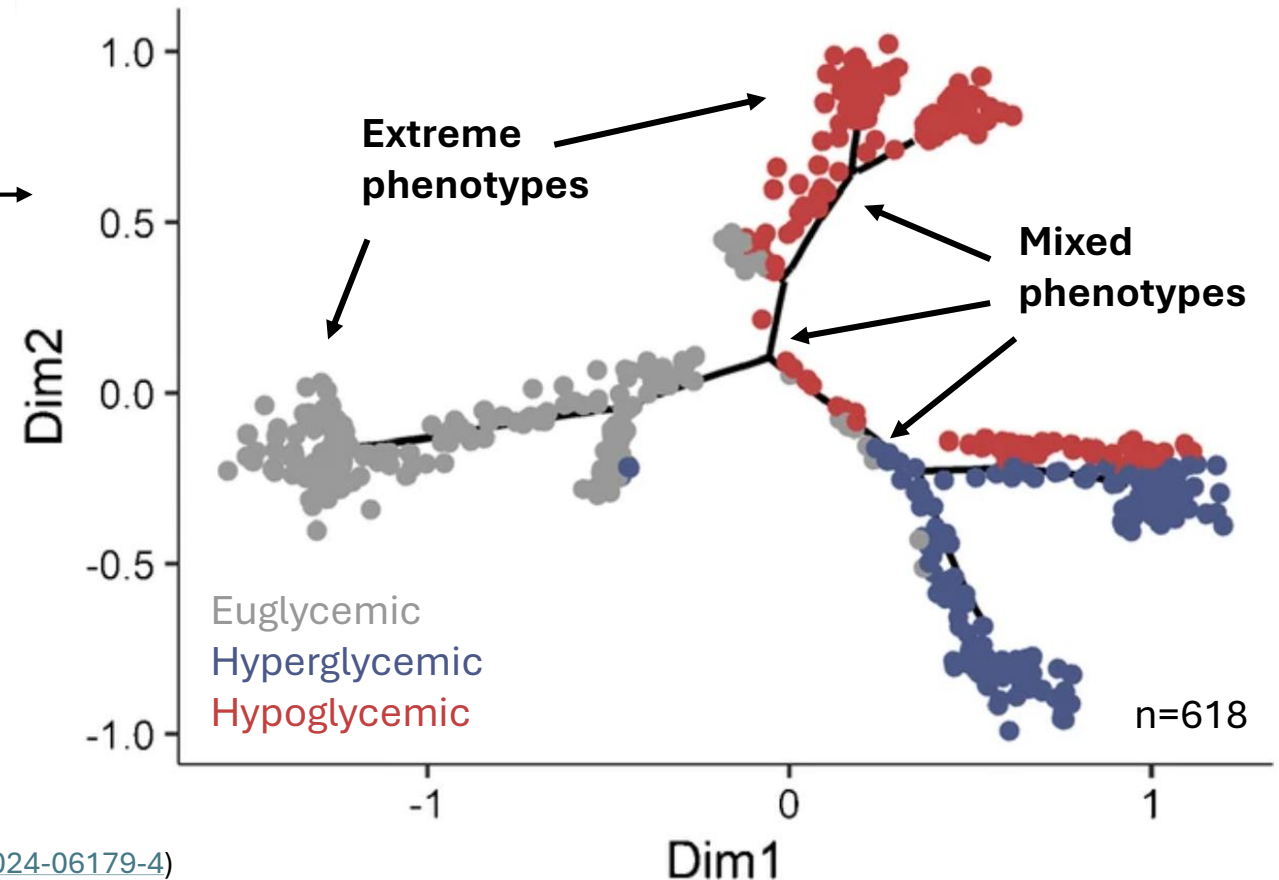


Dimension
reduction

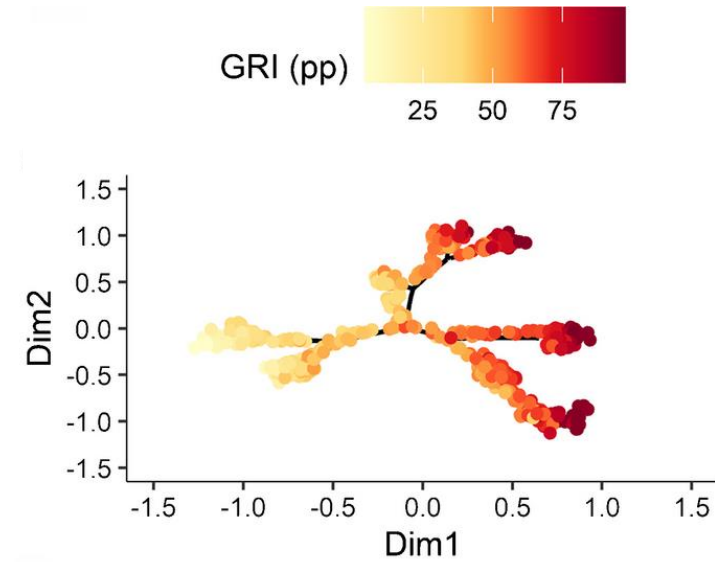
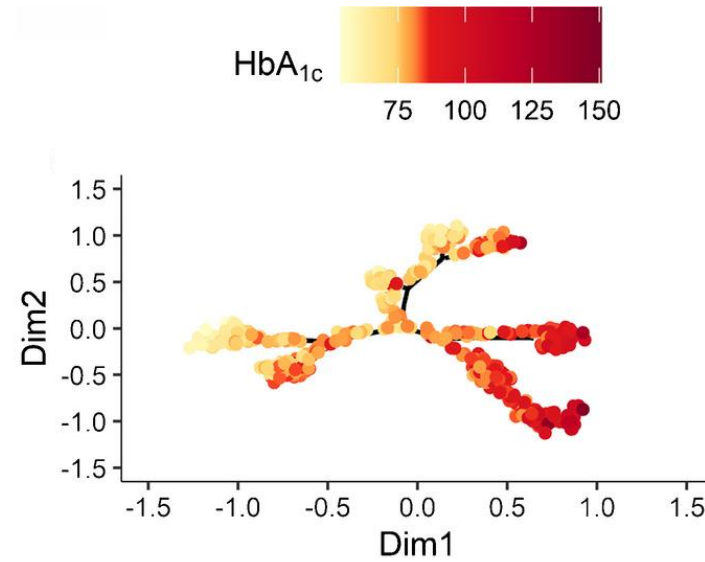
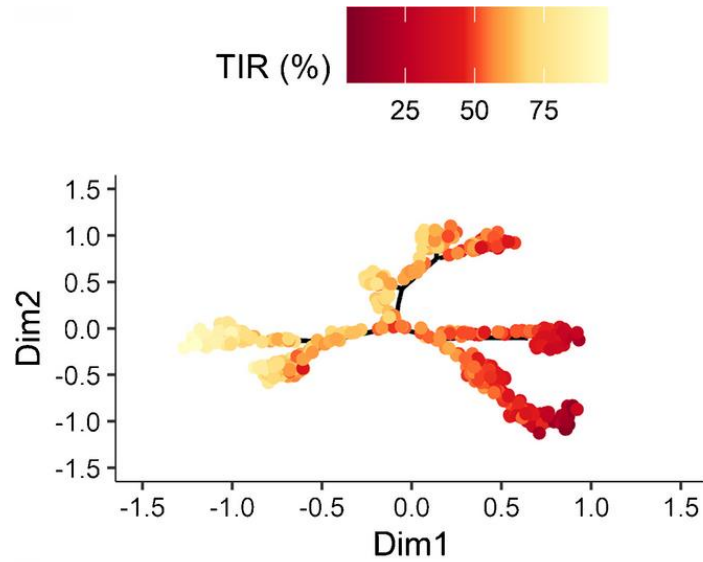
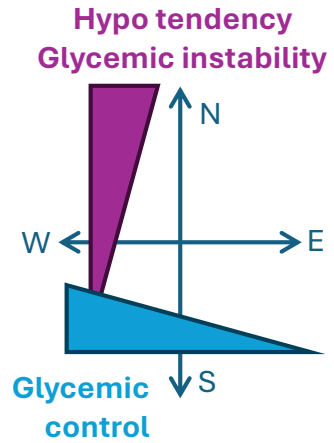
K-means: 3 glycemic
phenotypes



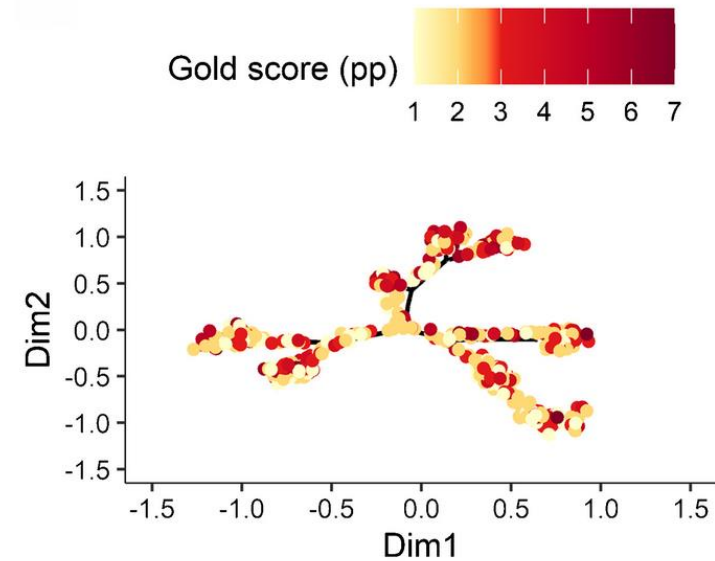
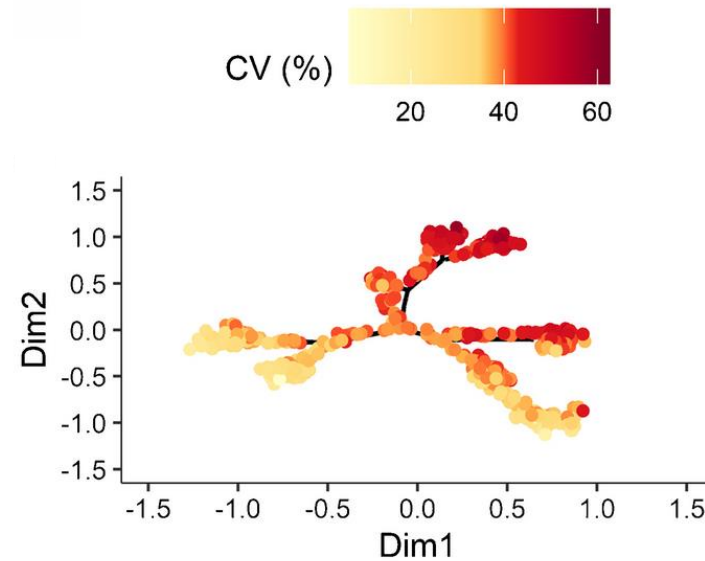
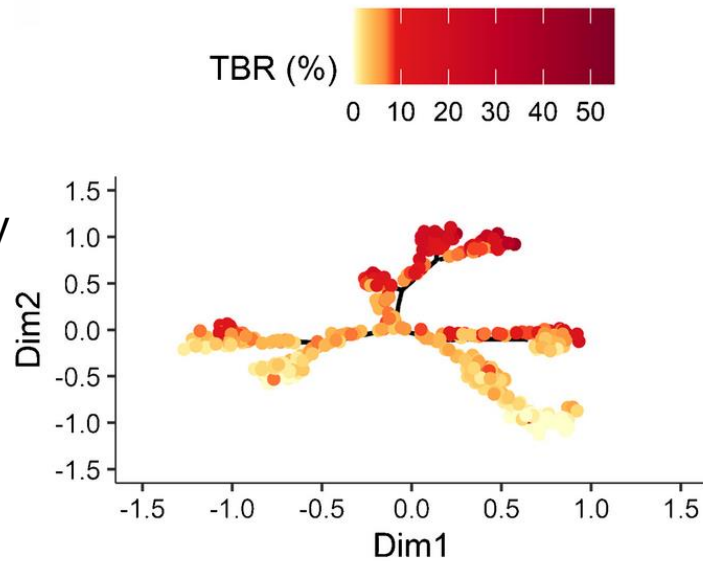
DDRTree: 7 glycemic phenotypes



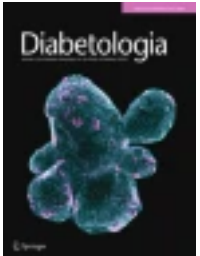
Heterogeneity of glycemic phenotypes in type 1 diabetes



Associations
CV risk factors
Retinopathy
Treatment
Education
Social vulnerability



Heterogeneity of glycemic phenotypes in type 1 diabetes



Heterogeneity of glycaemic phenotypes in type 1 diabetes

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Volume 67, pages 1567–1581, (2024) [Cite this article](#)

Online tool for glycemic phenotypic tree



Input glycemic variables

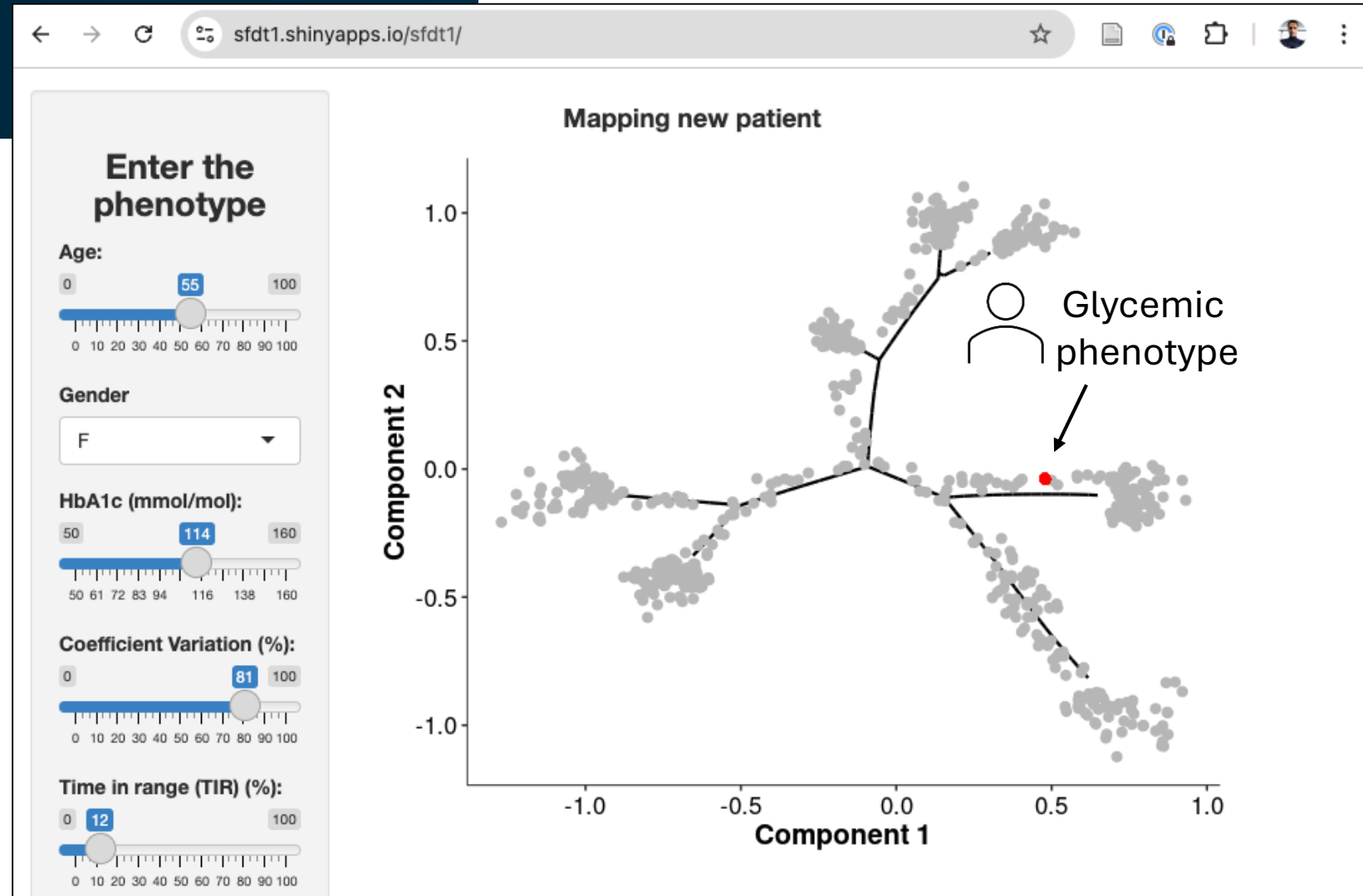
<https://sfdt1.shinyapps.io/sfdt1/>



DDRTree-resolved
glycemic phenotypes



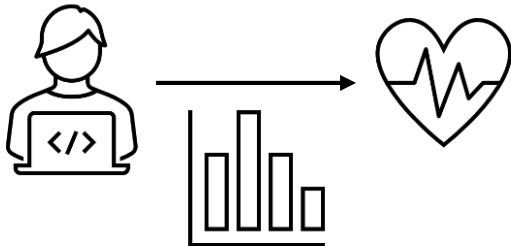
Phenotype associated
complications



The Steno T1 Risk Engine: Screening for CVD in T1D



CV risk in T1D



steno.shinyapps.io/T1RiskEngine/

Steno Diabetes Center Copenhagen T1 Risk Engines Calculator Research About Contact

Individualised interactive CVD & ESKD risk calculator

This risk calculator applies to adult type 1 diabetes patients.

Please select patient characteristics

Previous CVD
No

If the patient has had a previous CVD event, only ESKD risk can be assessed.

Age (years)
52

Sex
Male

Diabetes duration (years)
30

HbA1c
7,2

Enter unit
%

Systolic blood pressure (mmHg)
139

Current smoker
Yes

Albuminuria¹
Normal

eGFR (ml/min/1.73m²)
98

The following risk factors are only used for CVD risk calculation:

LDL cholesterol
5

Enter unit
mmol/l

Regular exercise (≥3.5 hours/week)
No

Calculate risk

CVD **ESKD**

Risk profile

Only applies to patients without previous CVD.

Patient's 10-year CVD risk is:

HIGH

Categorisation of risk based on NICE guidelines:

- low: <10%
- medium: 10-20%
- high: ≥ 20%

See European guidelines for CVD prevention.

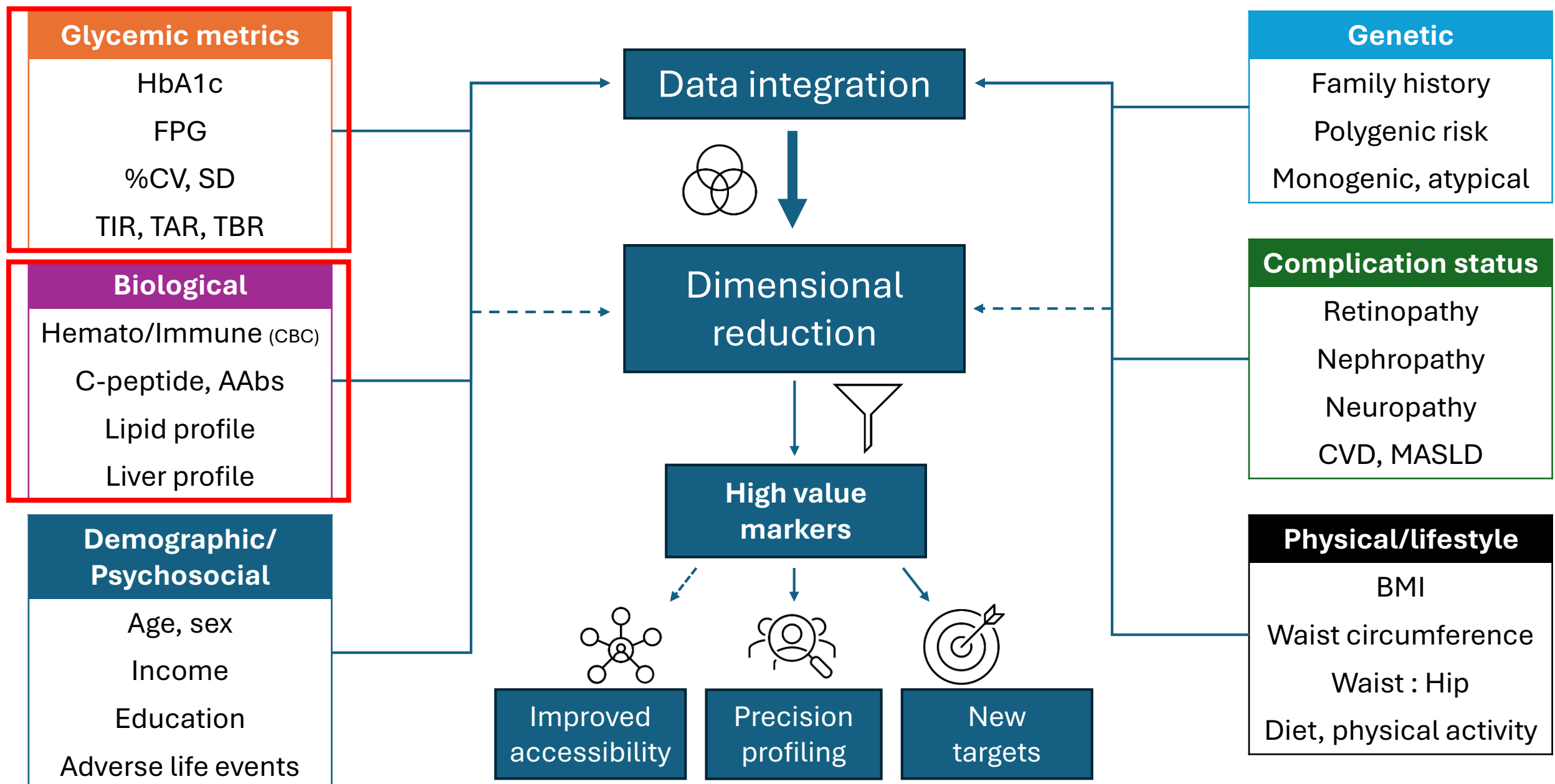
Estimated risk (%)

■ Your patient
■ Comparison group²

5-year 10-year

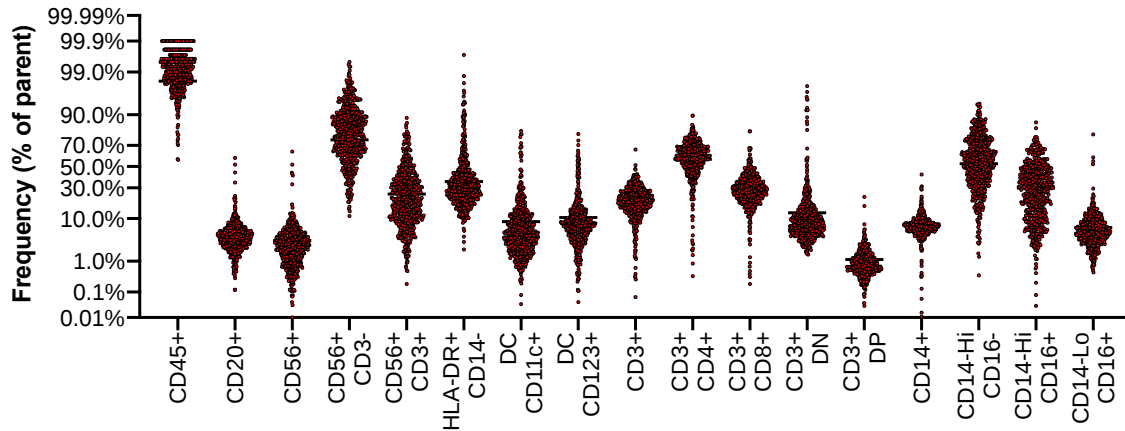
Time Period	Your patient (%)	Comparison group ² (%)
5-year	14	5.5
10-year	26.1	10.7

Data-driven optimization at PoC

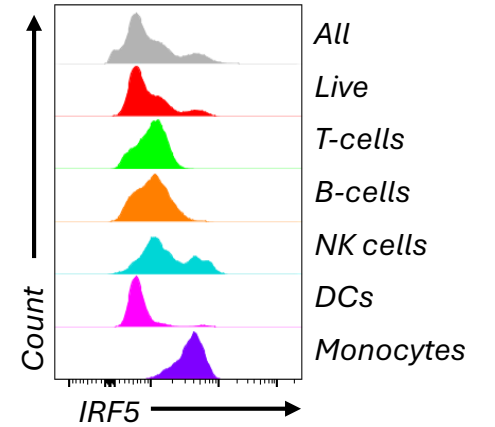


Immune correlates of diabetes status and complications

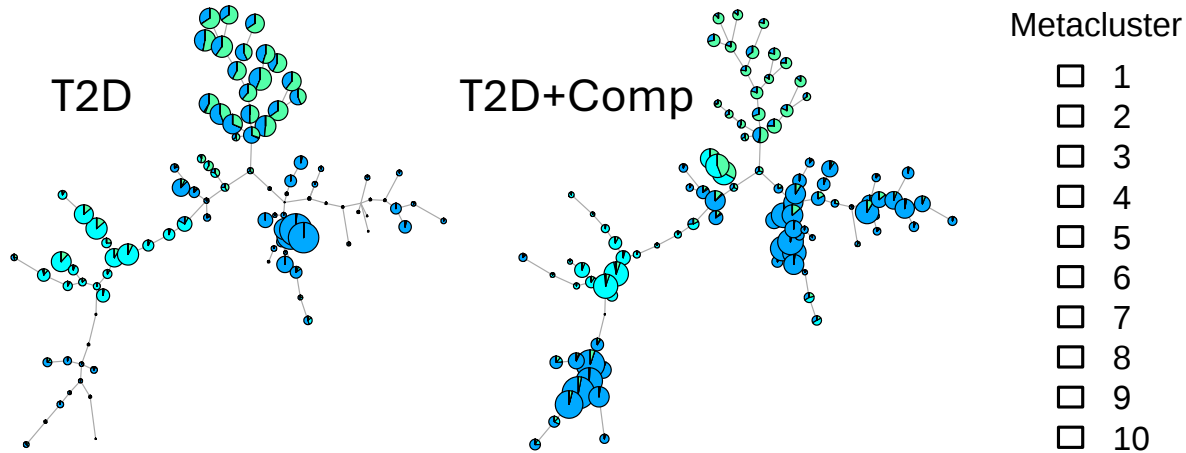
15 leukocyte populations in peripheral circulation



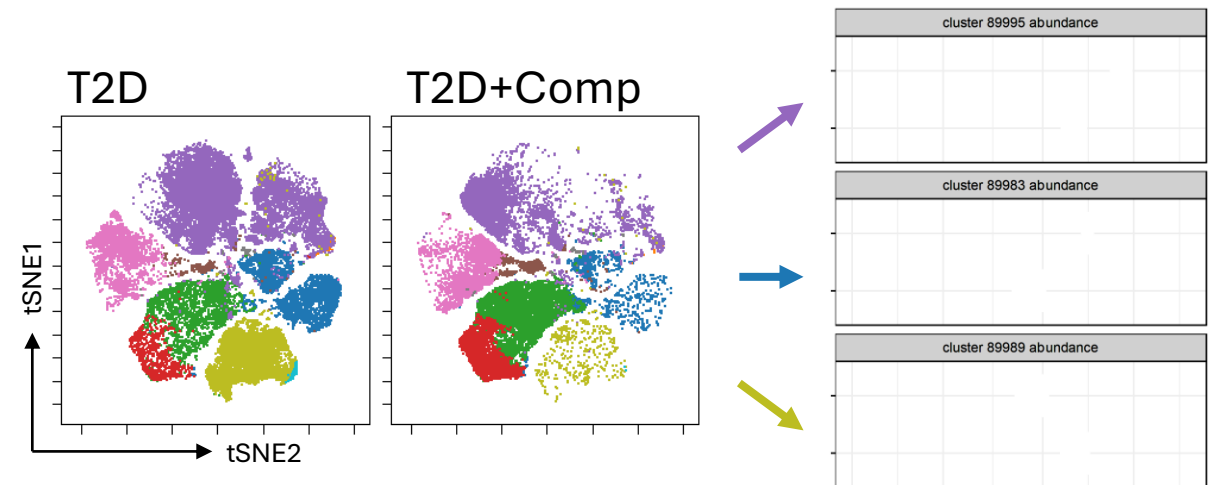
IRF5 nuclear stain



Unsupervised analyses & dimension reduction



Discriminant features





Non-diabetic

Healthy
National
bloodbank

Type 1 Diabetes

Glycemic
instability +
CV comp.

Diabetes
distress,
cognition

Type 2 Diabetes

Risk

Hist.
Gestational
diabetes

Obesity (+/-
Metabolic
syndrome)

Complications/Comorbidities

MASLD/
MASH

Vascular
complications

+

Lariboisière hospital



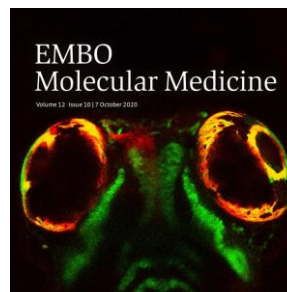
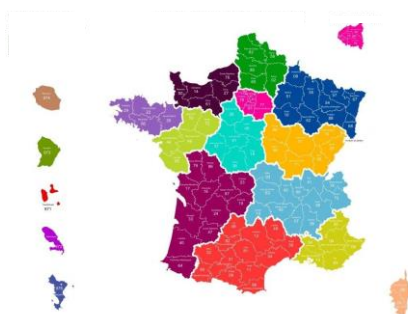
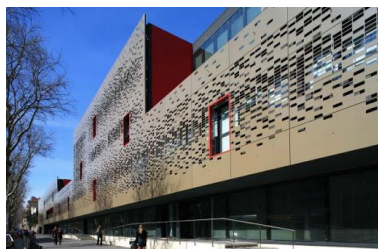
Bichat-Claude Bernard hospital



Geoffroy Saint-Hilaire Clinic

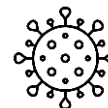


Hôpital de la Conception, Marseille



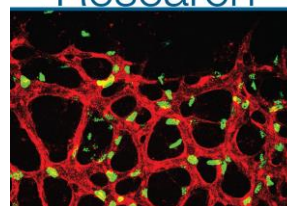
Alzaid et al 2020 EMBO Mol Med.

Monocytopenia, monocyte morphological anomalies and hyperinflammation characterize severe COVID-19 in type 2 diabetes



Alzaid et al 2020 EMBO Mol Med (<https://www.embopress.org/doi/full/10.15252/emmm.202013038>)

Circulation
Research



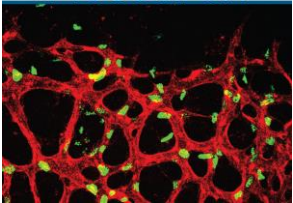
Julla et al 2024 Circ Res.

Blood monocyte phenotype is a marker of cardiovascular risk in type 2 diabetes



Julla et al 2024 Circ Res (<https://www.ahajournals.org/doi/10.1161/CIRCRESAHA.123.322757>)

Immune correlates of diabetes status and complications



Julla *et al* 2024 *Circ Res*.

Blood monocyte phenotype is a marker of cardiovascular risk in type 2 diabetes

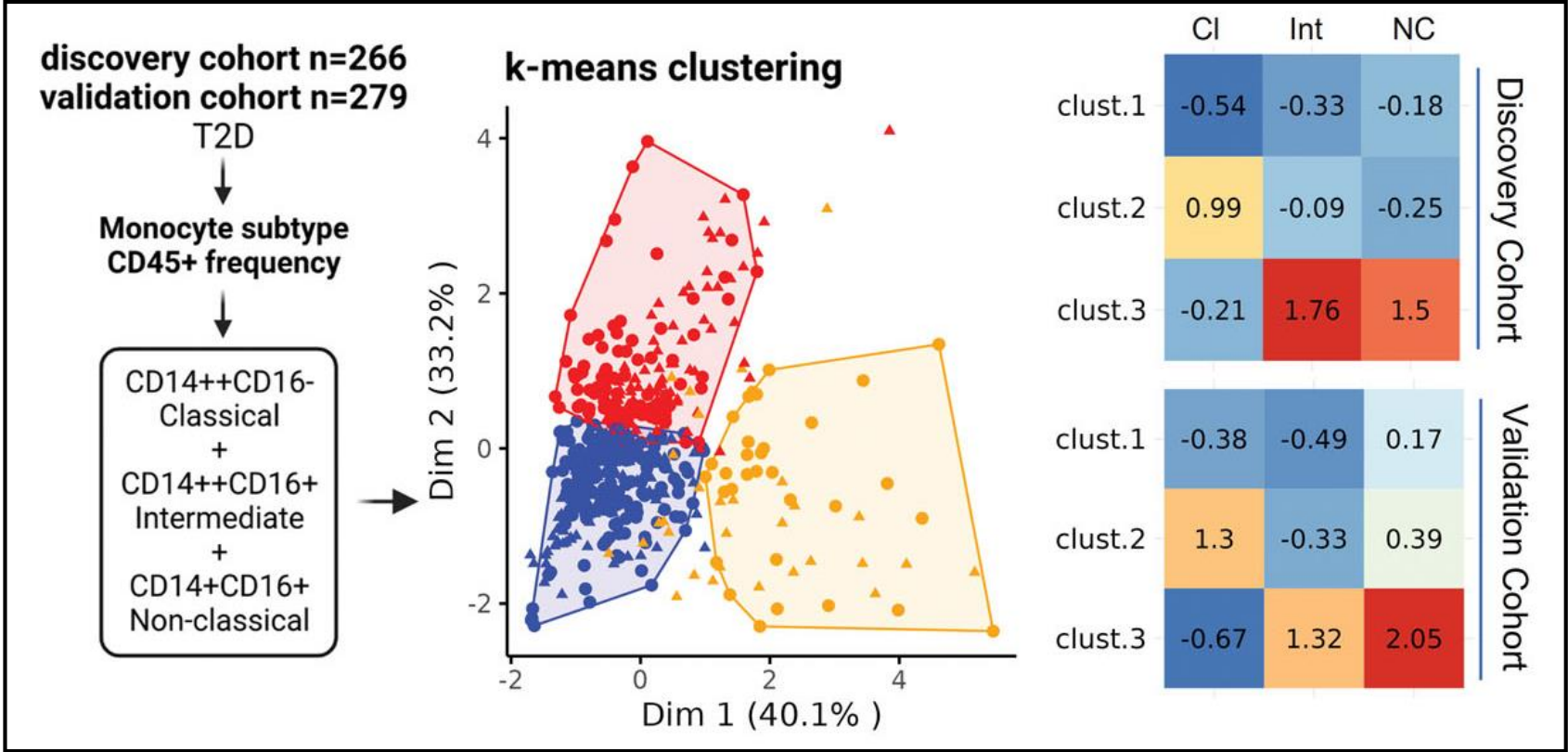
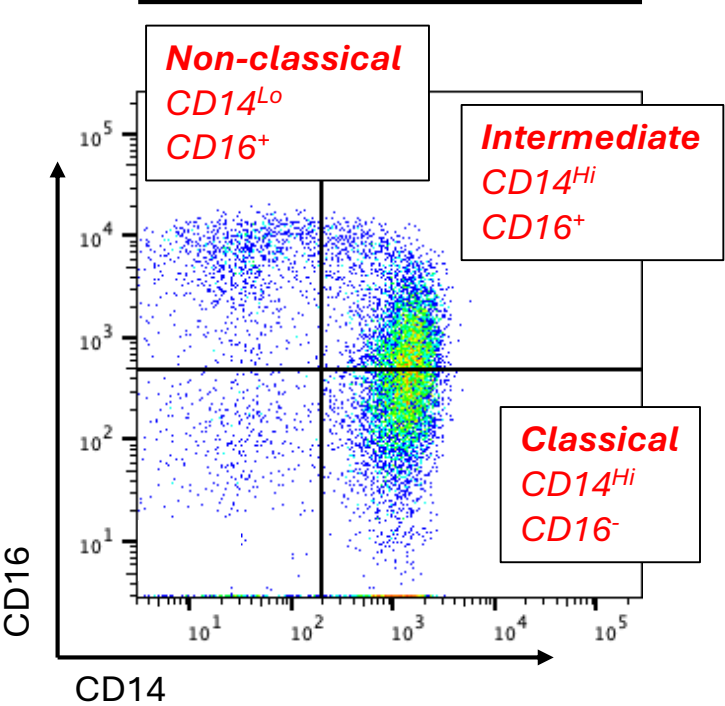


ANGIOSAFE-2 cohort: Role of GLP-1RA in angiogenesis (n=3154/n=266)



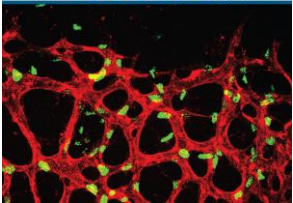
GLUTADIAB cohort: Amino acid metabolism in diabetic cardiovascular complications (n=279)

Monocytes



Immune correlates of diabetes status and complications

Circulation Research



Julla *et al* 2024 Circ Res.

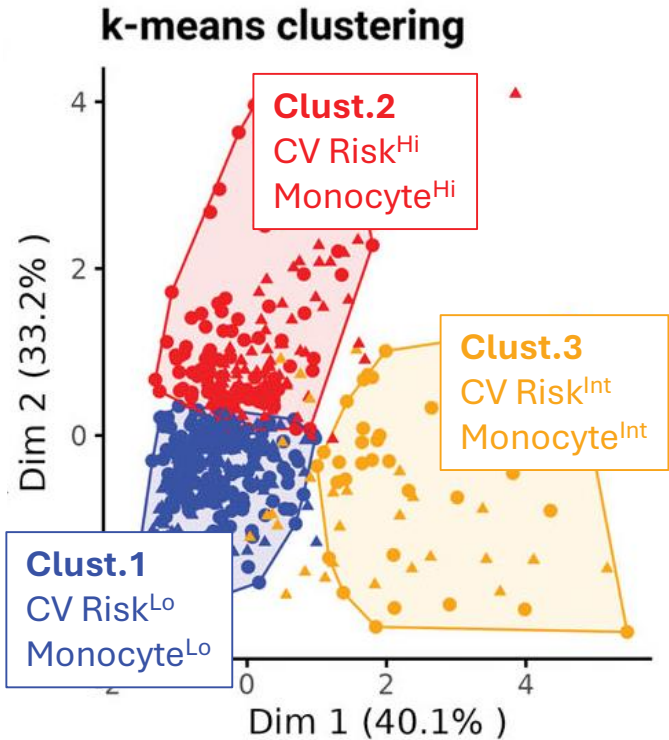
Blood monocyte phenotype is a marker of cardiovascular risk in type 2 diabetes



ANGIOSAFE-2 cohort: Role of GLP-1RA in angiogenesis (n=3154/n=266)



GLUTADIAB cohort: Amino acid metabolism in diabetic cardiovascular complications (n=279)



	Clust.1 (55%; n=147)	Clust.2 (33%; n=87)	Clust.3 (12%; n=32)	P value
Age, y	60 (55–67)	65 (58–69)	61 (53–69)	0.013*
BMI, kg/m ²	28.3 (25.3–31.7)	26.9 (25.4–30.5)	29.6 (25.4–33.3)	0.26
Dyslipidemia	106 (72%)	61 (70%)	23 (72%)	0.95
Coronary calcium score	8 (0–131)	97 (3325)	52 (0–134)	0.004*
HbA1c, %	7.70 (7.00–8.60)	7.60 (6.75–8.30)	7.45 (6.97–8.33)	0.34
Diabetes duration, y	13 (8–20)	15 (9–20)	12 (7–18)	0.30
CRP, mg/L	1.47 (0.78–3.44)	0.95 (0.54–2.49)	1.81 (0.64–2.86)	0.028*
Monocytes, /mL	0.45 (0.37–0.56)	0.60 (0.46–0.69)	0.57 (0.43–0.68)	<0.001*

Immune correlates of diabetes status and complications

Circulation
Research

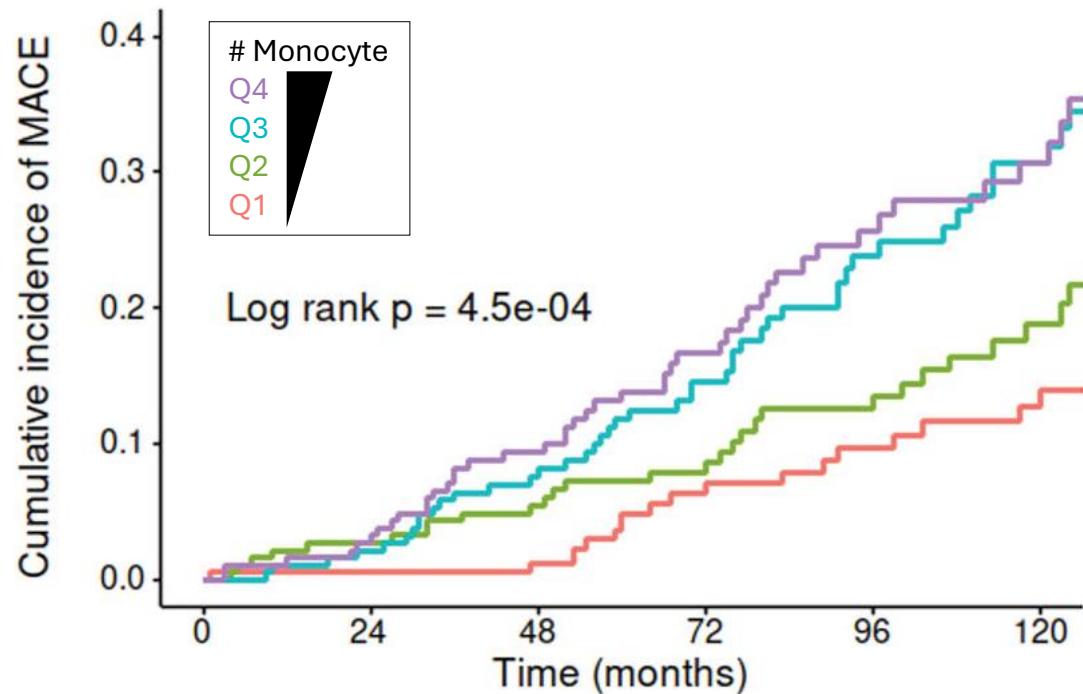
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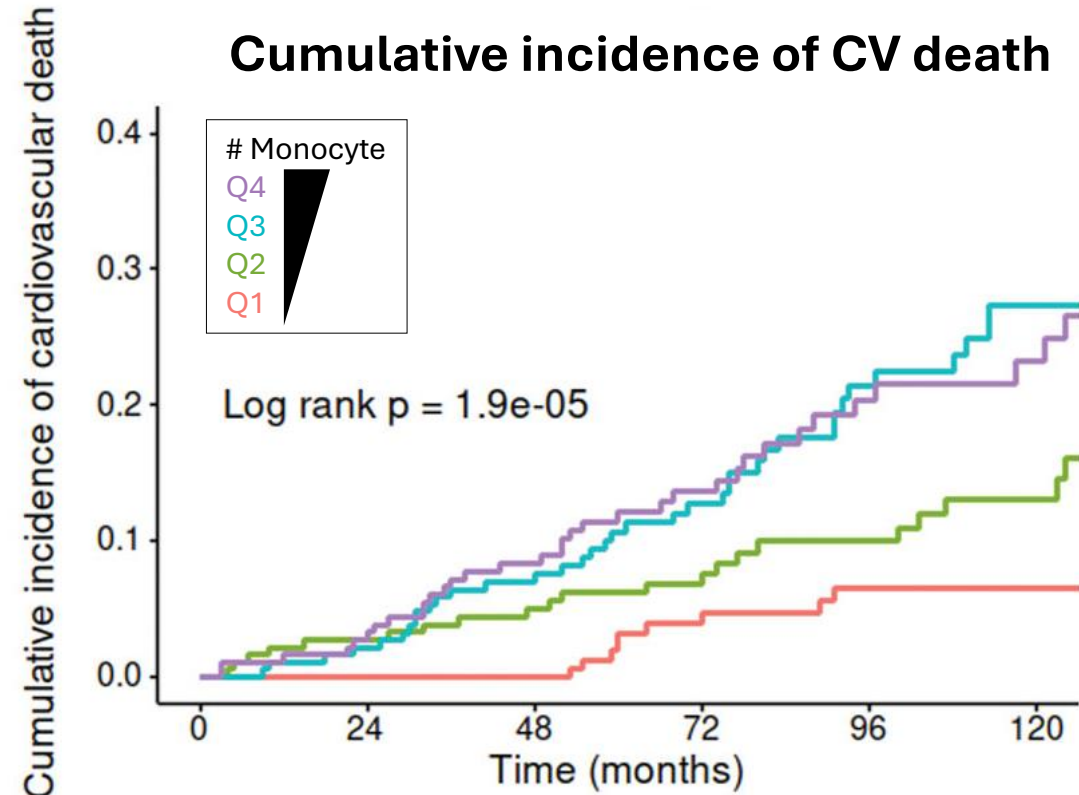


SURDIAGENE cohort: Survival
Diabetes and Genetics (n=1042)

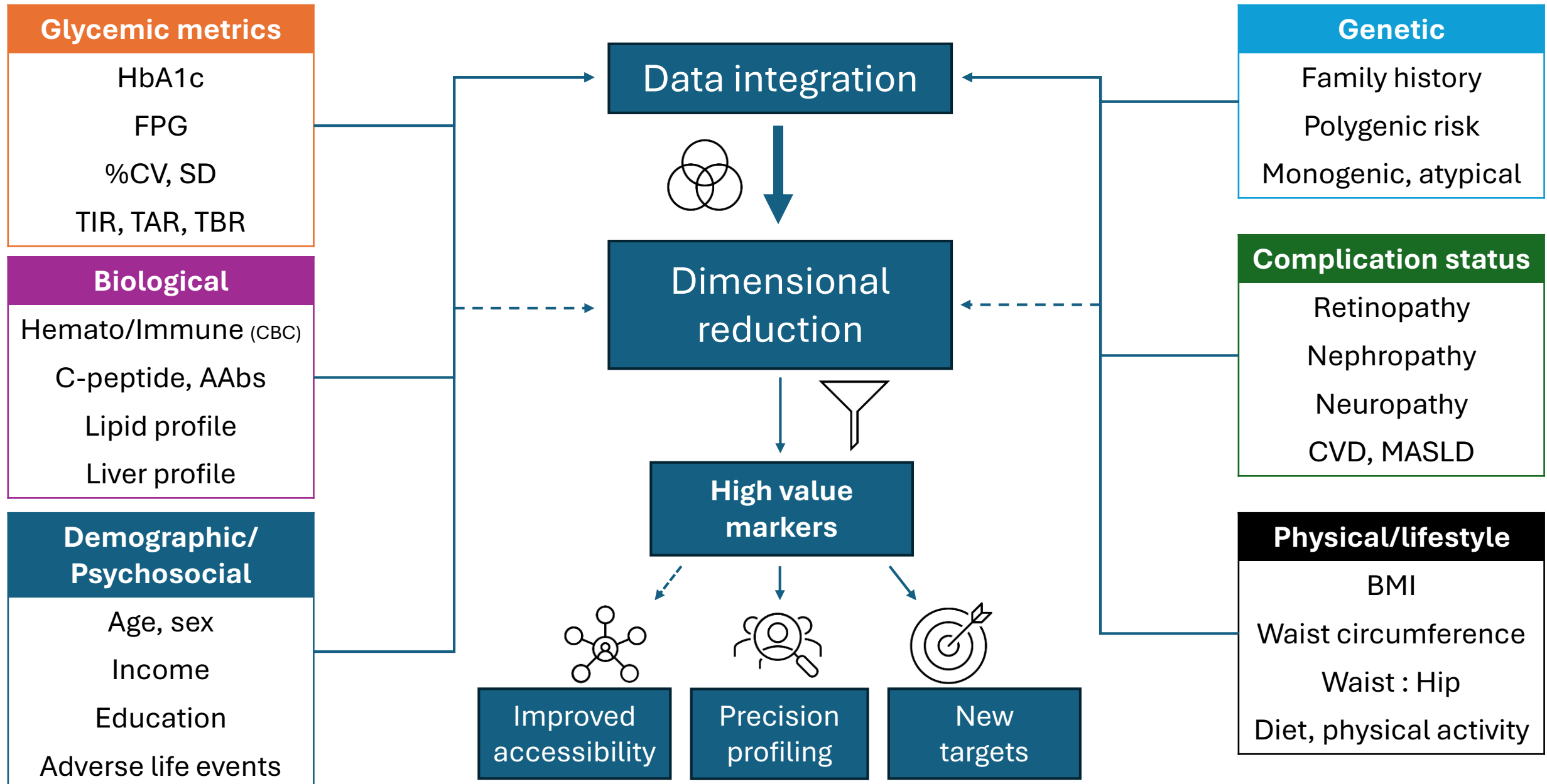
Cumulative incidence of MACE



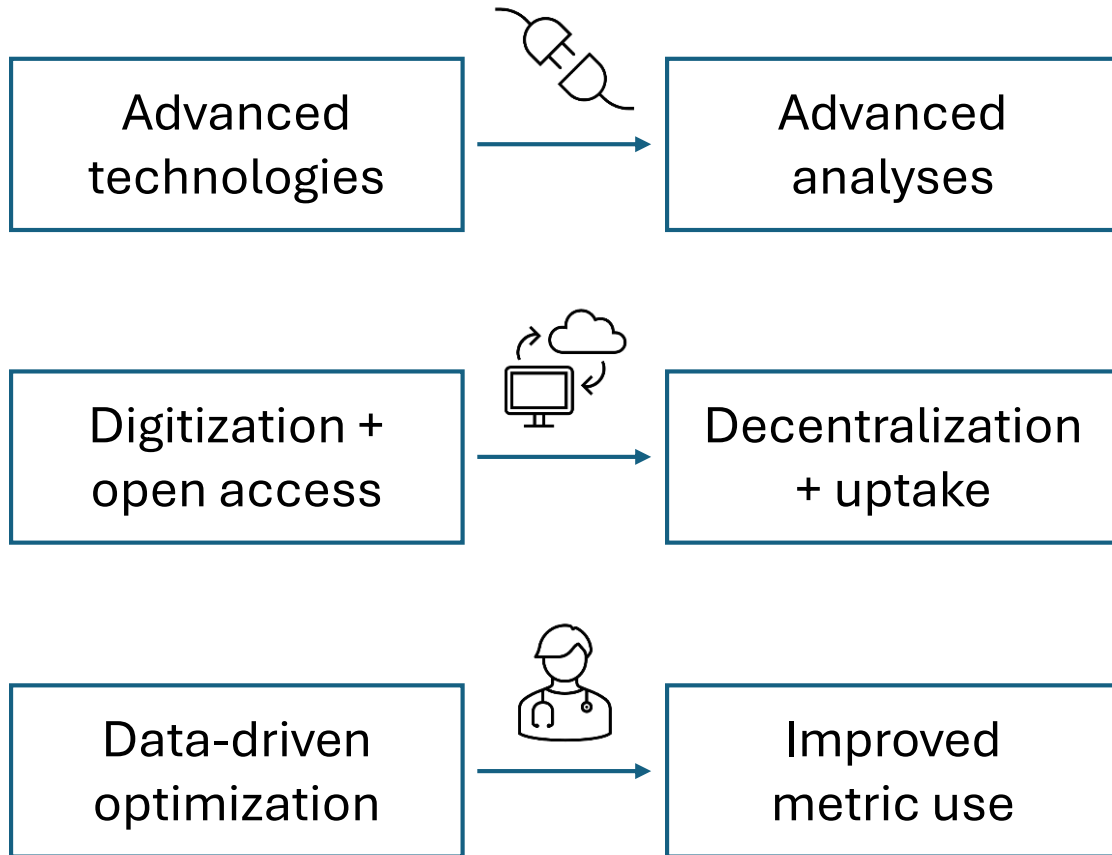
Cumulative incidence of CV death



Data-driven optimization at PoC



Take home message and thank yous



US-Kuwait Precision Medicine Workshop



**NATIONAL
ACADEMIES** *Sciences
Engineering
Medicine*

Dasman Diabetes Institute



أحد مراكز
Center

INSERM



Cohorts



SFDT1
ANGIOSAFE-2
GLUTADIAB
SURDIAGEN

