

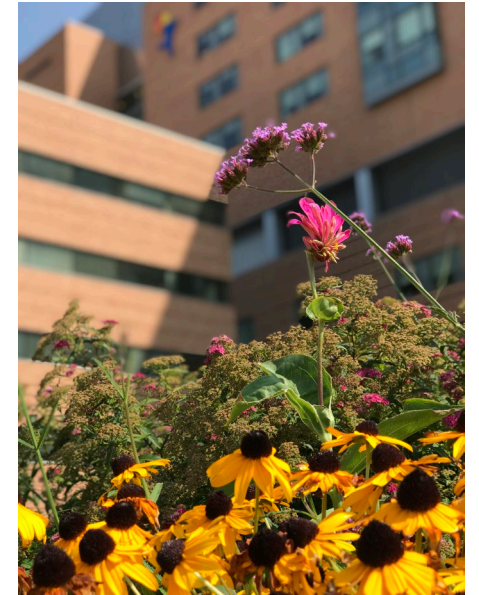
The Colorado Program for Integrated Research in Child-Maternal Health (CO-CMH)

An Early Life Exposures Research Program (ELEP) Update



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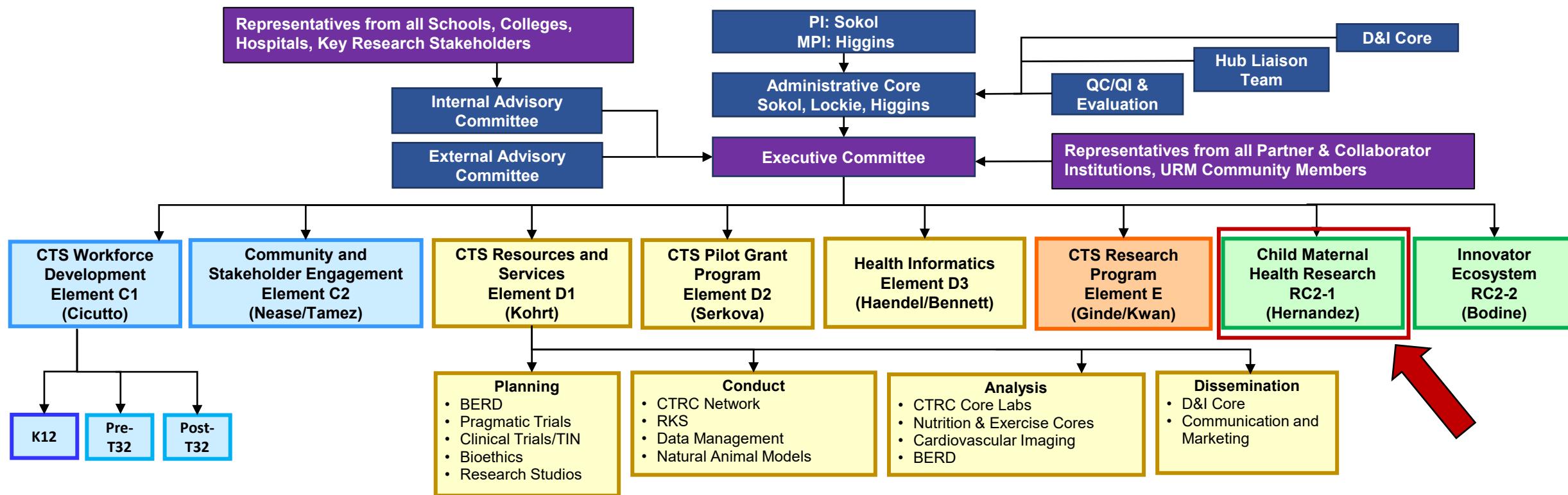
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Colorado Clinical and Translational
Sciences Institute (CCTSI)

UNIVERSITY OF COLORADO DENVER | ANSCHUTZ MEDICAL CAMPUS

The Colorado Program for Integrated Research in Child-Maternal Health



The CO-CMH: Moving the Needle for Child-Maternal Health

Knowledge gaps in the field:

- High adolescent suicide rates, pediatric major depression and obesity, maternal opioid and substance use, and HIV infection continue to undermine gains in CMH in Colorado
- Poor understanding of **life course development** within an interactional context—with SDoH, relationships, time, genetics, and environment
- 83% of rare diseases affect children
 - Poorly understood, inaccurately identified
 - Inform our understanding of common chronic diseases



These gaps may be overcome through data linkage studies



Life Course Health Development and an Intersectional Lens

- Health inequities threaten to undermine the substantial advancements made in CMH, demanding that conventional approaches to their study be challenged
- Recognizing that SDoH are rooted in long-standing inequities, intersectionality is a framework that allows for examination of health disparities in the context of social forces, power, and oppression that shape health capacity
- Testing for moderation (interaction) in this context allows for generation of new knowledge beyond the current state to illuminate *why* health inequities exist in a framework for action

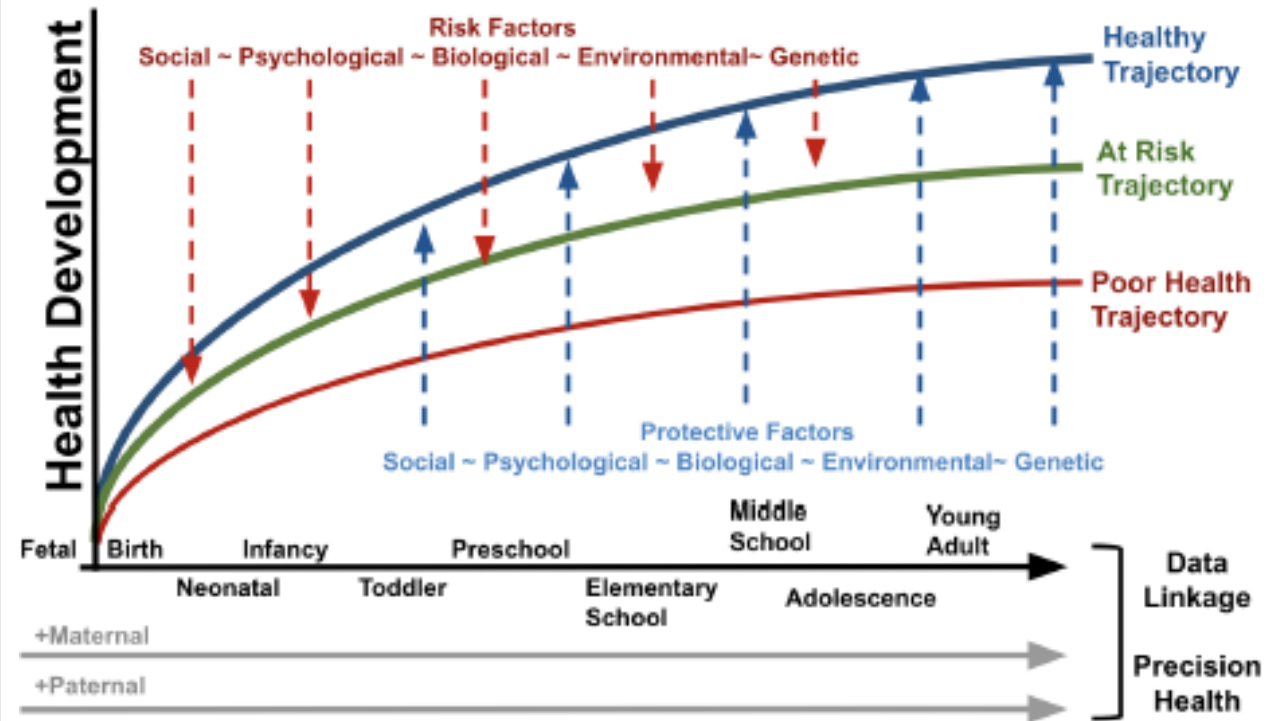


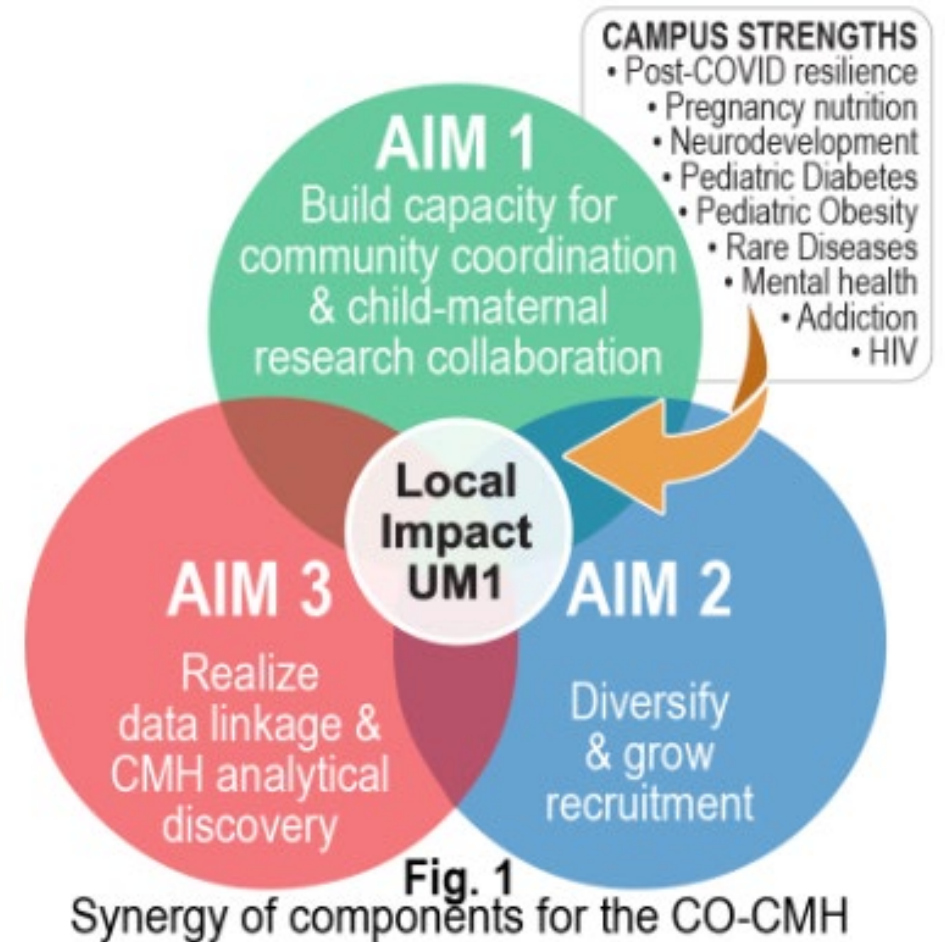
Figure 3. Health trajectory optimization. Using the LCHD model, identification of endophenotypes, precursory conditions to fully manifested phenotypes associated with chronic disease, may generate new knowledge that allows for health optimization through a shift from poor (red line) or at-risk (green line) trajectory to a healthy trajectory (blue line) moving into adulthood.

Approach and Innovation

Challenge: Increased need for coordinated research in *child and maternal* health—**inclusive of pediatrics.**

Aim 1: Build capacity for community coordination and child-maternal research collaboration.

We will expand our perinatal research infrastructure broadly to include maternal through neonatal, infant, child, adolescent, and young adult populations, and coordinate collaborative research campus-wide—identifying CMH research studies and connecting investigators with comprehensive clinical translational resources.

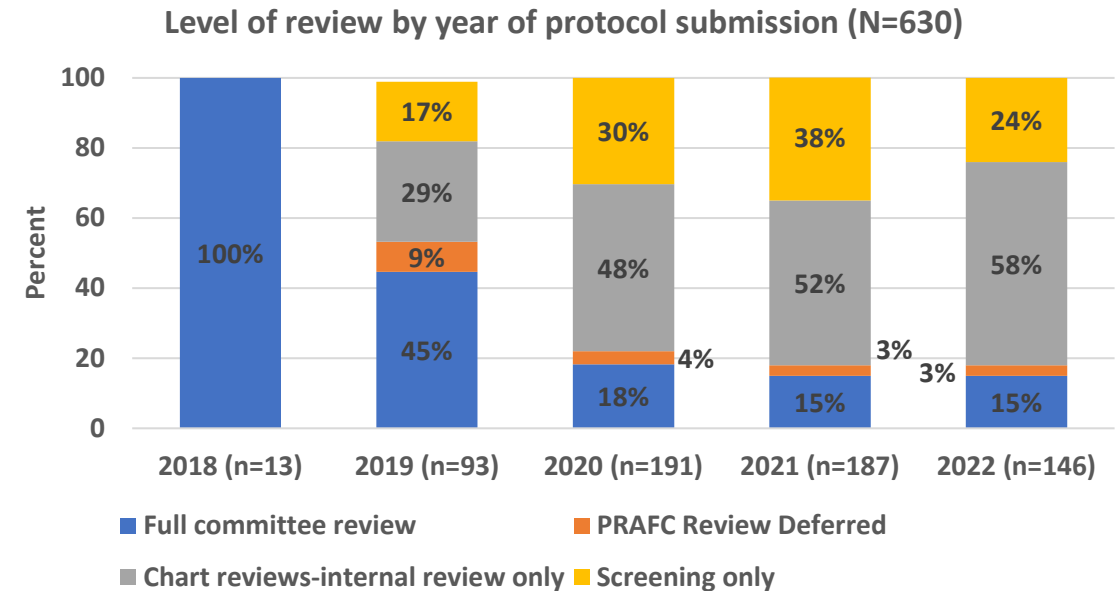


Approach and Innovation

Innovation

Team-science innovations

- **Novel incentives and processes to realize collaborations across key lifespan domains.**
 - Using our demonstrated team science strategies we will foster expertise matching, cross-domain and cross-sectoral collaboration training, and novel informatics methods to promote and support effective lifespan research across a diversity of domain areas and institutional units and their constituent investigators.



Approach and Innovation

Challenge: Underrepresentation of diverse and high-risk populations in CMH research threatens public trust.

Aim 2: Diversify and grow recruitment.

In partnership with UCHealth, CHCO, and Colorado State University, we will develop processes to expand and diversify CMH recruitment state-wide through hospital networks. We will intentionally form new relationships with communities beyond CU-Anschutz using community engagement strategies so that benefits of research participation are extended and optimized.

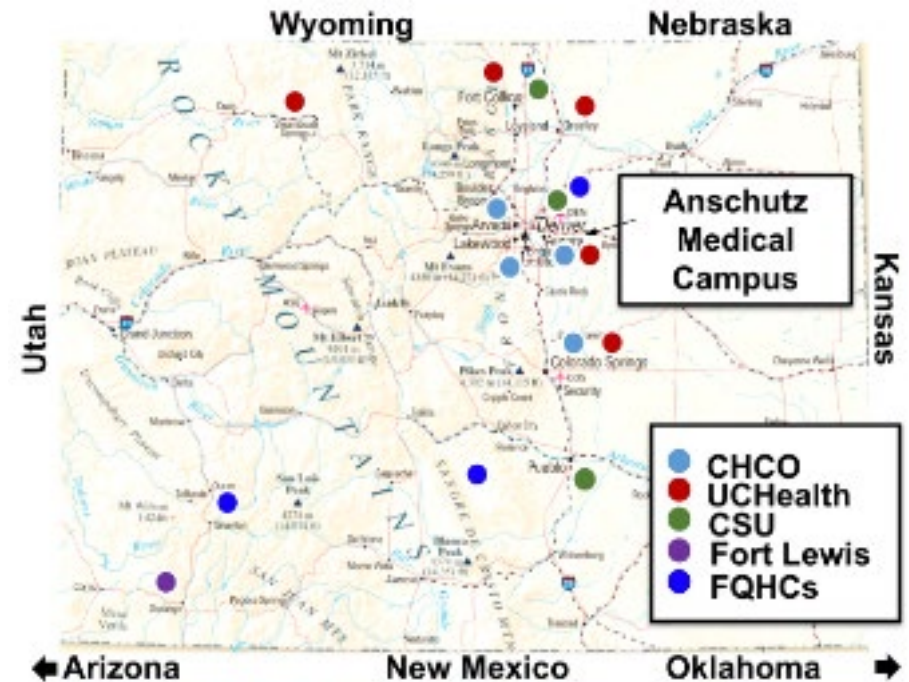


Figure 7. Actual and expansion of recruitment outreach. Through our collaborators, we have identified opportunities for future expansion of the recruitment network to include:

- 1) A research clinic site at UCHealth Memorial Hospital (Colorado Springs, South), UCHealth Greeley Hospital (North), and UCHealth Yampa Valley Hospital (Steamboat Springs, Western Frontier);
- 2) Colorado State University's satellite sites (Pueblo Campus, Denver Spur campus);
- 3) Federally qualified health centers (FQHCs; Statewide) and through the Nurse Family Partnership home visitation program; and
- 4) Fort Lewis College (Durango, Southwest).

Approach and Innovation

Innovation

Operational and care delivery innovations

- **Maximally inclusive recruitment process.** Our multi-pronged approach to connect with diverse populations through UCHHealth, CHCO, Colorado State University and across our region will support larger and more representative populations to enable more types of intersectional CMH life course research.
- **Expansion of our pioneering multidisciplinary perinatal infrastructure.** We will target and facilitate CMH research campus-wide, particularly within primary pediatric care - an identified need and opportunity.



Approach and Innovation

Challenge: Local and National CMH priorities may be addressed through life course research, leveraging clinical information from rare diseases, and using an intersectionality approach.

Aim 3: Realize data linkage and CMH analytical discovery.

We will leverage our cloud-based clinical data warehouse to generate fully integrated, user-friendly bidirectional (Maternal→Child; Child→Maternal; Child→Child) CMH datasets across organizations. These data will be made securely available for collaborative analytics and self-services.

In collaboration with pediatric and adult precision medicine, we propose specific initiatives in pediatric obesity and major depression, maternal pregnancy complications, and acquired versus inherited diseases.

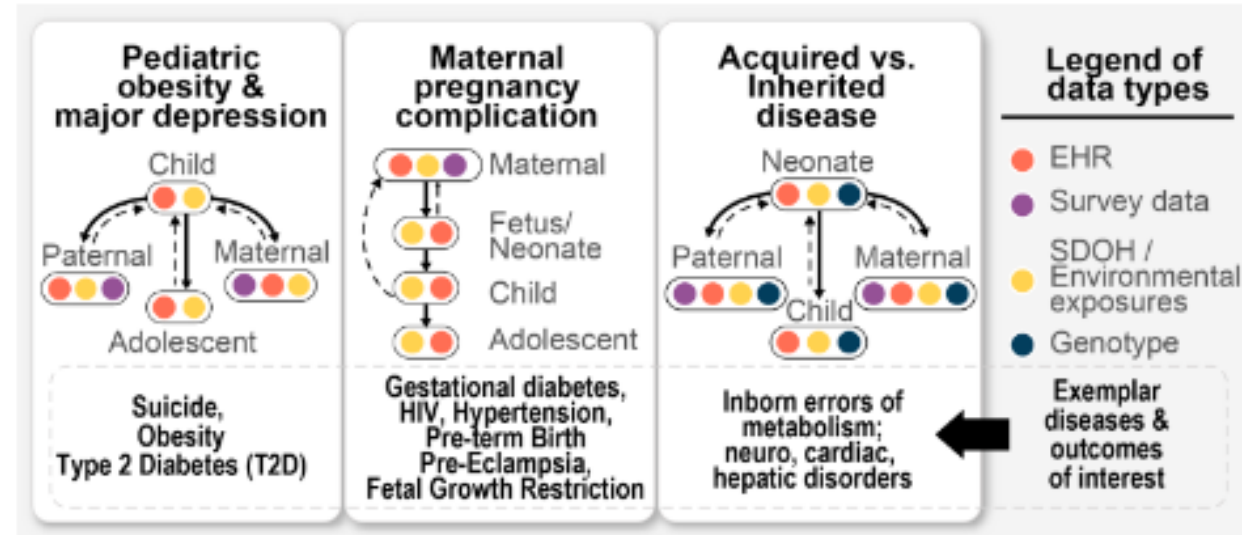


Figure 10. Exemplar data linkages representing LHIs that may be addressed by expertise in CMH research at CU-Anschutz. Beginning with the infant/child or maternal condition, child-parent data can be linked bidirectionally (forward or backward) to study dyads in a LCHD framework with an intersectional lens. Patient-level (e.g. EHR and survey) data will be associated with community-level (e.g. SDOH, Environmental).

Approach and Innovation

Innovation

Implementation of a truly learning healthcare system. The proposed processes and infrastructure will set the stage for care decision making artifacts that can integrate translational science at the early stages of life to attain population health improvements throughout the lifespan.

Translational informatics innovations

- **State-of-the-art processes for data linkage.** We will create user-friendly research data sets that integrate maternal-neonatal-child data, overcoming the current challenge of labor intensive, inefficient, and expensive data cleaning. We will provision EHR data linkage for mother-infant/child pairs within and across UCHHealth and CHCO Epic implementations.
- **Advanced data comprehensiveness and deep phenotyping.** We will combine bidirectional maternal-child data linkage with clinical, genetic, social, and environmental information to phenotype cohorts that mirror ethnic and racial distributions in our community.
- **Cutting-edge digital health technologies (DHT).** We will advance tools and platforms to collect, validate, and link digital data across life stages and hospitals, creating a collaborative analytical environment.

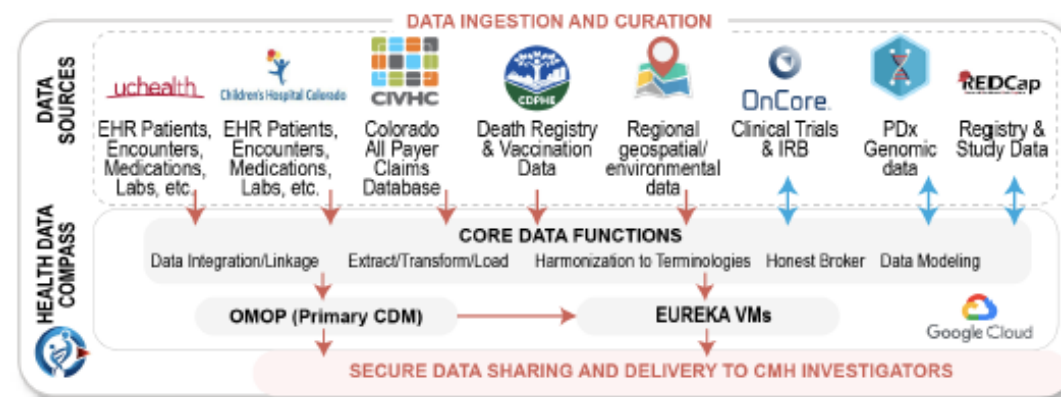


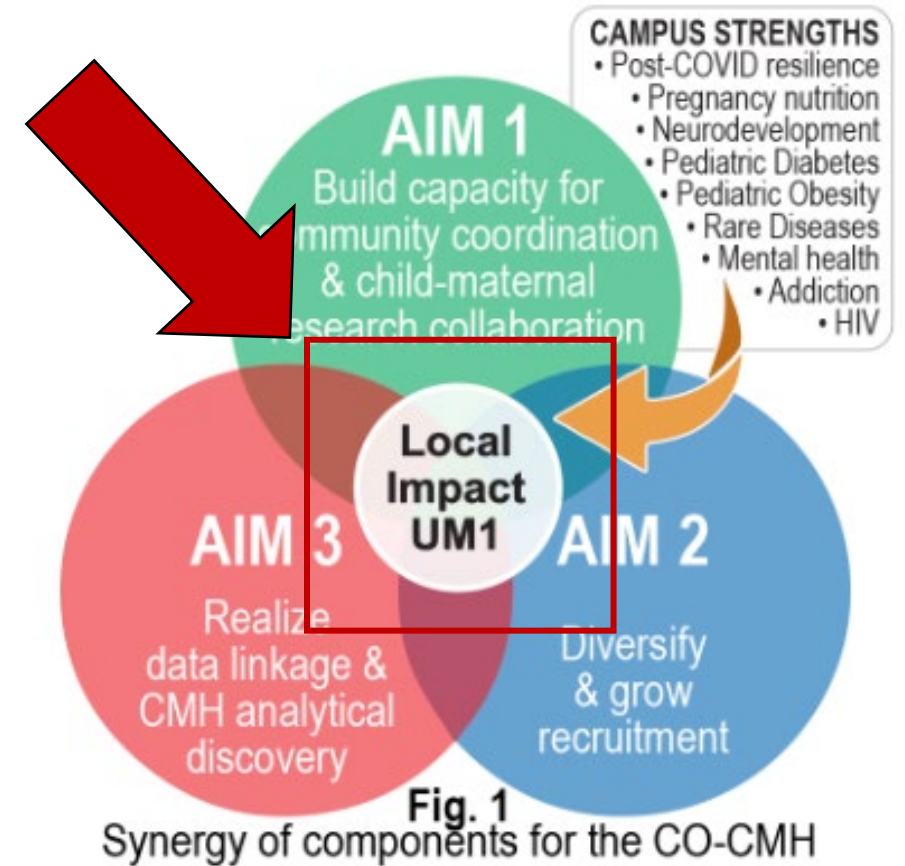
Figure 8. HDC cloud data integration platform. Sources include EHR data from UCHHealth and CHCO, the CDPHE death registry, vaccination, all-payer claims, state and national environmental data sources, and PDx genomics resources. EUREKA provides an analytical environment and custom data extracts are delivered to approved investigators using HIPAA-compliant tools.

Approach and Innovation

Innovation

Scientific innovations

- **Advance understanding of genetic, social, and environmental influences on child-maternal health and across the lifespan.**
- In the context of key cross-cutting areas such as nutrition and metabolism, rare disease and genetics, neurodevelopment and mental health, and public health/SDoH, we will address key knowledge gaps in generational and family environmental effects at all life stages.



Expected Outcomes and Impact

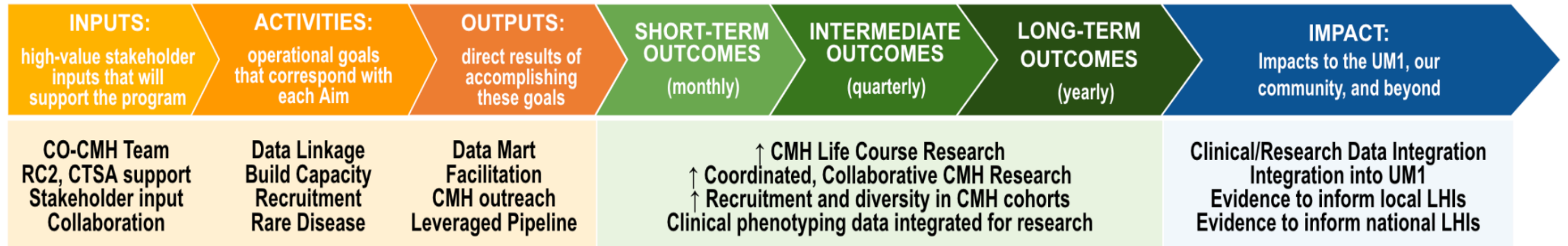
- **Impact:** Our CO-CMH will address major gaps in the field by facilitating innovative life course research integrated with UM1 hub activities, poised for discoveries to inform local, state, and national CMH priorities.

Program Milestones

	MILESTONES	Date	MILESTONE CRITERIA FOR SUCCESS	Evaluation
AIM 1 Goals	CMH studies are captured in Human Subjects portal	8/1/23	# Protocols tracked, continuous assessment	Monthly
	CMH facilitation committee has been established and ongoing review/support processes are evaluated	8/1/23	Multidisciplinary membership across CMH units and clinics # Protocols reviewed, continuous assessment # Days from portal submission to investigator feedback Investigator satisfaction with CMH facilitation process # Funded CCTSI pilot studies supported (mentored/Jr. faculty)	Monthly Monthly Monthly Quarterly Annually
	Team science and collaboration is fostered among CMH investigators	8/1/23	# Investigators who give permission for data sharing # Investigators with consultations for CMH research # New collaborations fostered by CO-CMH	Monthly Quarterly Annually
	CMH nuclei are formed across CU-Anschutz	ongoing	# New CMH-focused nuclear groups formed	Annually
	CMH investigators are connected to clinical translational science (CTS) resources**	8/1/23	# Investigators connected to a CTS resource # and type of CTS resource to which investigators are referred # Investigators who engage with a CTS resource after referral	Quarterly Quarterly Quarterly
AIM 2 Goals	EHR-based recruitment resources are made available through UCHHealth, CHCO	1/1/24	# Investigators who utilize the recruitment resource # Investigators meeting recruitment targets	Quarterly Annually
	Processes exist for uncomplicated research visits at CSU	8/1/23	# CMH Studies and # of visits in the Human Performance Lab	Monthly
	Quarterly meetings established with Community Engagement Core and with CSU Extension Agents	1/1/24	New relationships w/ CMH communities beyond CUAMC # and description of community touchpoints for CMH research	Quarterly Quarterly
	Diversity in CMH study cohorts is increased	ongoing	Increased racial & ethnic distributions among study cohorts	Annually
AIM 3 Goals	New labs for uncomplicated research visits are identified statewide	5/1/24	Database of new labs exists # CMH Studies, # visits	Annually Quarterly
	Data mart is established for linked data sets	8/1/23	Data mart for CMH investigators established, available	Quarterly
	User-friendly bidirectional data sets are integrated and available	ongoing	# Investigators who obtain a data set # and Type of life course research studies # Studies/Publications that inform a local/state LHI for CMH # Studies/Publications that inform a national LHI for CMH	Quarterly Annually Annually Annually
	Rare diseases are identified for inclusion in linked data	1/1/24	# and type of rare diseases identified and included	Annually
	Genomic data are included in linked data	1/1/24	# Linked data sets with genomic data included	Annually
	Establish exemplar linked data sets:	1/1/24	# Data sets available for Pediatric Obesity, Major Depression, Maternal Complications, Neonatal Acquired, Inherited Dis.	Annually
	Identify CU expertise to use exemplar data sets	ongoing	Investigators identified	Annually



Metrics and Evaluation



Centers for Disease Control, 1999

Dissemination and National CTSA Involvement

- Teri Hernandez is a newly elected member of the *CTSA Integration Across the Lifespan Executive Committee*
 - Service begins January, 2023



Questions for EAC

- Our plan moving forward is to secure sustainability of the current perinatal research infrastructure
- We will resubmit this grant after revisions
- **Questions for the EAC:**
 - **Impressions of the proposed program?**
 - **Do you have advice on how the program might be structured differently to increase its impact?**

