A Few Housekeeping Notes

• Q&A time will follow presentation

• During the presentation, use the chat box in WebEx to ask questions

• Please remain muted unless you need to speak. This minimizes background noise.

• When you speak, please identify yourself by name and work area to help others recognize you.

• This WebEx is being recorded and will be posted on the CTSI website
Welcome to the Duke CTSI Virtual Town Hall

January 19, 2018
Moderated by Ebony Boulware, MD, MPH
Director, Duke CTSI
Vice Dean for Translational Sciences
Associate Vice Chancellor for Translational Research

Please note that you have been muted upon entry to this WebEx. Click the microphone by your name in the participant list to unmute as needed.

This presentation is being recorded.
CTSI Virtual Town Hall

TransPop Update: Resources & Opportunities in Kannapolis

L. Kristin Newby, MD, MHS
Julie Eckstrand, RPh
January 19, 2018
Where in the world is Kannapolis?

Duke-Kannapolis is located two hours southwest of Durham and 30 minutes northeast of Charlotte at the North Carolina Research Campus.
**Brief History of Duke in Kannapolis**

- **2007**
  - Duke receives financial gift from the Murdock Foundation for Business & Culture

- **2008**
  - Duke opens its first office on the NC Research Campus, establishing a presence in Kannapolis, NC

- **2009**
  - MURDOCK Study enrolls its first participant
  - Nature publishes Duke MURDOCK Study research on the IL28B polymorphism in hep C virus

- **2010**
  - MURDOCK MS cohort enrolls its first participant

- **2011**
  - 5000th participant enrolled in MURDOCK Study

- **2012**
  - New studies, cohorts, publications, collaborators, industry-sponsored studies, growing number of participants, expanded catchment region, growth in operations and capabilities, new clinical operations space

- **PRESENT DAY**
  - 5000th participant enrolled in MURDOCK Study
Our Operations Team

Kristin Newby, MD, MHS
Faculty Director

Leah Bouk, CCRC, MBA
Research Practice Manager
Clinical Operations

Doug Wixted, MMCi
Research Project Leader
Biobanking and Informatics

Perla Nunes
Research Project Leader
Community Engagement

Brooke Heidenfelder, PhD
Research Project Leader
Clinical Operations (Durham)

Karen O. Johnson
Opportunity Development

Julie Eckstrand, RPh
Director of Operations

Kristin Newby, MD, MHS
Faculty Director

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Community Engagement

Brooke Heidenfelder, PhD
Research Project Leader
Clinical Operations (Durham)

Karen O. Johnson
Opportunity Development
Our Kannapolis Space

- Medical Office Building
- 5050 square feet
- Lab processing, 4 exam rooms, reception, offices, conference room
A full-service hub for translational population health research

<table>
<thead>
<tr>
<th>#</th>
<th>Type of Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Director of Operations</td>
</tr>
<tr>
<td>17</td>
<td>Clinical (Includes 1 ANP)</td>
</tr>
<tr>
<td>3.5</td>
<td>Data/Informatics</td>
</tr>
<tr>
<td>3</td>
<td>Community Engagement</td>
</tr>
<tr>
<td>2</td>
<td>Laboratory Processing</td>
</tr>
<tr>
<td>2</td>
<td>Staff Assistants</td>
</tr>
<tr>
<td>1</td>
<td>Communications</td>
</tr>
<tr>
<td>0.5</td>
<td>Biobanking</td>
</tr>
</tbody>
</table>
What is the MURDOCK Study?

Measurement to Understand the Reclassification of Disease Of Cabarrus / Kannapolis

• Overarching goal
  – Integrate population data (participant-reported, clinical, and molecular) as well as publicly available data sources in a geospatial framework to:
    • characterize health and disease, risk for clinical events, and response to treatment;
    • measure and predict population health outcomes;
    • provide a platform to conduct clinical and health services research.
MURDOCK Study Inclusion Criteria and Consent

Inclusion criteria:
• Age 18 or older and reside in qualifying zip code
• Residential zip code requirement waived for:
  • Those who qualify for COPD cohort
  • All first responders who work in catchment area
  • Male healthcare workers who work in catchment area
  • People who work at the North Carolina Research Campus

Participants consented to:
• Health questionnaire (illness, PROs, activity, diet, lifestyle, meds and demographics)
• Brief exam (HR, BP, waist circumference)
• Blood and urine samples for unspecified future research
• Contact for annual follow-up
• Contact up to 4x/year for participation in other research studies
• Ongoing access to medical record
• Geospatial mapping
• Participation indefinite or until consent withdrawn
## The MURDOCK Study Cohort: A Snapshot

<table>
<thead>
<tr>
<th>Demographics</th>
<th>N</th>
<th>%</th>
<th>Cabarrus County¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>8,168</td>
<td>66%</td>
<td>51%</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White/Caucasian</td>
<td>9,236</td>
<td>75%</td>
<td>76%</td>
</tr>
<tr>
<td>Black or African American</td>
<td>1,755</td>
<td>14%</td>
<td>18%</td>
</tr>
<tr>
<td>American Indian and Alaska Native</td>
<td>223</td>
<td>2%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Asian</td>
<td>115</td>
<td>1%</td>
<td>4%</td>
</tr>
<tr>
<td>Native Hawaiian and Pacific Islander</td>
<td>19</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Other Race</td>
<td>1,162</td>
<td>9%</td>
<td>NA</td>
</tr>
<tr>
<td>Don’t know/Not sure/Prefer no answer</td>
<td>120</td>
<td>1%</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>1,536</td>
<td>12%</td>
<td>10%</td>
</tr>
<tr>
<td>Spanish language preferred</td>
<td>1,225</td>
<td>10%</td>
<td>NA</td>
</tr>
</tbody>
</table>

¹ United States Census Bureau, 2016.

### Categorical Age Distribution

<table>
<thead>
<tr>
<th>Age at Enrollment</th>
<th>Current Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(10-19)</td>
<td>Age(20-29)</td>
</tr>
<tr>
<td>Age(30-39)</td>
<td>Age(40-49)</td>
</tr>
<tr>
<td>Age(50-59)</td>
<td>Age(60-69)</td>
</tr>
<tr>
<td>Age(70-79)</td>
<td>Age(80-89)</td>
</tr>
<tr>
<td>Age(90+)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Counts and percentages exclude withdrawn participants without permission to use data or samples (n=104). [Left] Participants can report multiple races and are counted for each race reported. [Above] For deceased participants, age at death is used for current age.
### The MURDOCK Study Self-reported Medical Conditions

<table>
<thead>
<tr>
<th>Cancer</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>449</td>
<td>4%</td>
</tr>
<tr>
<td>Colon</td>
<td>134</td>
<td>1%</td>
</tr>
<tr>
<td>Lung</td>
<td>89</td>
<td>1%</td>
</tr>
<tr>
<td>Prostate</td>
<td>271</td>
<td>2%</td>
</tr>
<tr>
<td>Cervical</td>
<td>178</td>
<td>1%</td>
</tr>
<tr>
<td>Melanoma</td>
<td>473</td>
<td>4%</td>
</tr>
<tr>
<td>Other skin cancer</td>
<td>1,815</td>
<td>15%</td>
</tr>
<tr>
<td>Oral</td>
<td>31</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Other cancer</td>
<td>536</td>
<td>4%</td>
</tr>
</tbody>
</table>

Counts and percentages exclude withdrawn participants without permission to use data or samples (n=104), and include reported history at baseline and new incidence during follow up.

<table>
<thead>
<tr>
<th>Heart</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrial fibrillation</td>
<td>811</td>
<td>7%</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>456</td>
<td>4%</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>943</td>
<td>8%</td>
</tr>
<tr>
<td>Heart attack</td>
<td>844</td>
<td>7%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>3,572</td>
<td>29%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2,260</td>
<td>19%</td>
</tr>
<tr>
<td>High cholesterol</td>
<td>5,610</td>
<td>45%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>5,374</td>
<td>43%</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>3,071</td>
<td>25%</td>
</tr>
<tr>
<td>Kidney disease</td>
<td>505</td>
<td>4%</td>
</tr>
<tr>
<td>Gout</td>
<td>759</td>
<td>6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Obesity</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported, n (%)</td>
<td>3,816 (31%)</td>
</tr>
<tr>
<td>BMI at baseline, median (25%, 75%)</td>
<td>27.8 (24.3, 32.3)</td>
</tr>
<tr>
<td>BMI at latest follow up, median (25%, 75%)</td>
<td>27.3 (23.4, 31.8)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COPD &amp; Smoking history</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported COPD, n (%)</td>
<td>807 (7%)</td>
</tr>
<tr>
<td>Current smokers at baseline, n (%)</td>
<td>1,459 (12%)</td>
</tr>
<tr>
<td>History of smoking at baseline, n (%)</td>
<td>3,616 (29%)</td>
</tr>
</tbody>
</table>

Data as of: 09 January 2017
The MURDOCK Study: Socioeconomic Status (SES)

<table>
<thead>
<tr>
<th>Household income</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under $10,000</td>
<td>804</td>
<td>6%</td>
</tr>
<tr>
<td>$10,000 - $29,999</td>
<td>2,141</td>
<td>17%</td>
</tr>
<tr>
<td>$30,000 - $49,999</td>
<td>2,040</td>
<td>16%</td>
</tr>
<tr>
<td>$50,000 - $69,999</td>
<td>1,695</td>
<td>14%</td>
</tr>
<tr>
<td>$70,000 - $89,999</td>
<td>1,302</td>
<td>11%</td>
</tr>
<tr>
<td>$90,000 or more</td>
<td>2,565</td>
<td>21%</td>
</tr>
<tr>
<td>Don't know or not answered</td>
<td>1,828</td>
<td>15%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education level</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than high school graduate</td>
<td>1,200</td>
<td>10%</td>
</tr>
<tr>
<td>High school graduate or equivalent</td>
<td>2,644</td>
<td>21%</td>
</tr>
<tr>
<td>Some college or associate degree</td>
<td>4,389</td>
<td>35%</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>2,527</td>
<td>20%</td>
</tr>
<tr>
<td>Master’s or higher degree</td>
<td>1,603</td>
<td>13%</td>
</tr>
</tbody>
</table>

Cabarrus County, 2012-2016, US Census Bureau

- High school graduate or higher: 88.9%
- Bachelor’s degree or higher: 28.6%

Counts and percentages exclude withdrawn participants without permission to use data or samples (n=104), and are from self-reported data at baseline.
The MURDOCK Study Data & Specimen Resources

Questionnaires
- Demographics
- Family Medical History
- Medical History
- Nutrition
- Lifestyle
- Hospitalizations
- Medications

Clinical Evaluations
- Vitals
- Physical Performance Measures
  - Accelerometry
  - Spirometry
  - Cognitive Testing

Samples
- Plasma
- Serum
- Whole Blood
- PAXgene RNA
- Extracted DNA
- Extracted RNA

Omics
- Proteomics
- Metabolomics
- DNA sequencing
- RNA sequencing
- Gene expression
- GWAS
The MURDOCK Study banked sample inventory

- Average number of aliquots stored per participant: ~35
  - Collection initiated in early 2009
  - Collected for all participants at enrollment under MURDOCK Registry
  - Follow-up sample collection dependent on protocol

- >450,000 samples stored

<table>
<thead>
<tr>
<th>Stored as</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma</td>
<td>0.5 mL</td>
</tr>
<tr>
<td>Serum</td>
<td>0.5 mL</td>
</tr>
<tr>
<td>Whole blood</td>
<td>3 mL</td>
</tr>
<tr>
<td>PAXGene RNA</td>
<td>2.5 mL</td>
</tr>
<tr>
<td>Buffy coat</td>
<td>not applicable</td>
</tr>
<tr>
<td>Urine</td>
<td>10 mL</td>
</tr>
</tbody>
</table>
**Longitudinal Follow up: An Example**

<table>
<thead>
<tr>
<th>Hypothetical Participant</th>
<th>Duration from enrollment to current date, Median (25%, 75%)</th>
<th>Total participant-years of follow up (time points reported during follow up)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (enrollment)</td>
<td>6.4 years (4.6, 7.6)</td>
<td>40,709</td>
</tr>
<tr>
<td>Follow up Year 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow up Year 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow up Year 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow up Year 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow up Year 5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **History of:**
  - Hypertension
  - High cholesterol
  - Obesity

- **Follow up Year 1**
  - Change to blood pressure medication
  - Loss of weight and decreased BMI

- **Follow up Year 2**
  - Increase in Quality of Life (QoL) via PROMIS measures

- **Follow up Year 3**
  - New incidence of heart attack
  - Hospitalization information related to heart attack
  - Changes to medications

- **Follow up Year 4**
  - Change in address
  - Decrease in QoL

- **Follow up Year 5**
  - New diagnosis of Atrial Fibrillation

Data as of: 09 January 2017
Beyond MURDOCK: Community population studies

Participation in Additional Studies

N=12,478 MURDOCK Study Participants

- n = 8,848 (71%)
- n = 3,081 (25%)
- n = 549 (4%)

Participants by Study

- Memory & Cognitive Health
- Physical Performance & Healthy Aging
- Multiple Sclerosis
- COPD
- Diabetes
- Project Baseline

Data as of: 09 January 2017
Beyond MURDOCK: Four nested sub-cohorts

• Memory and Cognitive Health (n=1581)
  • MoCA, Trails B, word recall at baseline and 2-y f/u
  • Serial biospecimens at 2-y follow up

• Physical Performance and Aging (n=1000)
  • 6-min walk w/oximetry, 4-m walk, 30-s chair sit/stand, single leg balance, accelerometry, MoCA at baseline and 2-y f/u
  • Serial biospecimens at 2-y f/u

• Chronic Obstructive Pulmonary Disease (n=850)
  • Spirometry, 6-m walk w/oximetry, IPAQ short form, q6 mo f/u

• Multiple Sclerosis (n=963)
  • MS focused questionnaire and health history
  • Q6 mo f/u with biospecimens for PPMS (n=100)
The MURDOCK Study Today

**HORIZON 1**

- Used legacy samples and associated data to generate molecular biosignatures
- Generated hypotheses to reclassify disease
  - Cardiovascular disease
  - Liver disease
  - Obesity
  - Osteoarthritis

**HORIZON 2**

- Prospective cohort studies:
  - Multiple sclerosis
  - Memory & cognitive health
  - Physical performance
  - Type 2 diabetes
  - Medical records
  - COPD
- Analyses using samples/data
  - Prostate cancer
  - Vascular/Alzheimer’s

**HORIZON 3**

- New molecular data from diverse patient populations
- New cohort studies
- New meta-analyses
- International collaborations
- Measurement of public health impact

**Horizon 1.5:** Community registry of adults in Kannapolis/Cabarrus County and surrounding region of North Carolina.
- More than 12,260 participants
- Over 450,000 annotated samples
TransPop study collaborators and projects

<table>
<thead>
<tr>
<th>Collaborator Footprint</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unique Collaborators</td>
<td>134</td>
</tr>
<tr>
<td>Unique Academic Institutions</td>
<td>18</td>
</tr>
<tr>
<td>Duke Faculty Collaborators</td>
<td>90</td>
</tr>
<tr>
<td>Duke Entities: Schools, Health System and Duke NUS</td>
<td>8</td>
</tr>
<tr>
<td>School of Medicine Departments or Centers</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unique Project Opportunities (2007-present)</th>
<th>117</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funded Projects</td>
<td>50</td>
</tr>
<tr>
<td>Proposals in Development, Submission or Resubmit</td>
<td>17</td>
</tr>
<tr>
<td>Early Development- submissions/budgets planned</td>
<td>25</td>
</tr>
<tr>
<td>Exploratory- initial discussions/idea development</td>
<td>11</td>
</tr>
<tr>
<td>Not awarded</td>
<td>14</td>
</tr>
</tbody>
</table>
TransPop: What are we exploring?

• Informed consent processes, participant understanding of biorepositories
• Novel smoking cessation interventions
• Intersections between CVD and cognitive impairment
• Translation of genomic signatures of prostate cancer
• Metabolic signatures of new onset and early decompensation of heart failure
• Molecular signatures of post-MI fibrosis
• Correlation between EHR documentation and participant report of medical conditions
• Molecular signatures of IPF
• Stool microbiome and metabolic risk for chronic diseases
• Effectiveness of interactive, virtual diabetes educational environment
• Drug abuse, as part of the National Institute on Drug Abuse Clinical Trials Network
• Disparities in use of anticoagulation in AF
Study Significance

• Large, community-based cohort (i.e., no disease-specific I/E criteria)

• Little population influx/efflux; broad characterization; availability of biospecimens at inception

• Unique opportunities and unanswered questions that could be addressed include
  • Social determinants of health and development or progression of illness and response to treatment or intervention
  • Influence of environmental features (built and natural) on health and illness, longitudinal progression of disease, the intersections between diseases, and outcomes
Community Engagement

• Community Advisory Boards (convened every 6 mos.) are integral for the retention of populations in clinical research.

• The Boards must represent the community including: RCCC, CHS and other local practices, Kannapolis City Schools, Community Free Clinic, local residents, study participants, CHA, CUMC, YMCA, Cabarrus College of Health Sciences, etc.

• Community Engagement Teams must be embedded in the local community (serve on boards, be multi-lingual, etc.) They engage and educate our stakeholders, establish a live local invested presence

• They attend and hold numerous events, and manage outreach- websites, social media, email, newsletters, print materials.
Collaborating is Easy

1. Investigator has new idea and consults with CTSI TransPop leadership

2. Complete online submission via MURDOCK Study website Proposal Concept Form: murdock-study.com

3. Proposal concept form to MURDOCK Leadership with budget

4. MURDOCK Leadership reviews form
   Interested investigator can present concepts

5a. Proposal approved to proceed
5b. Proposal changes are requested for re-review

6. Proposal concept evolves into proposal submission to funding agency/sponsor

Contact:
Karen Johnson, CTSI
(919) 668-8447
Kareno.johnson@duke.edu
...and it’s fun- Duke Dash 5K and Healthfest

• Annual MURDOCK Community Appreciation Event held each Fall
• Engagement table with marketing materials, friendly staff!
• More than 200 runners and walkers in the 5K and 1-mile Walk With A Doc
• Hundreds of total attendees, plus 30 vendors and entertainers
Questions are welcome!

- Sign up for our TransPop distribution list by emailing TransPop@duke.edu
- Call us at (704) 250-5861
- Take a walking tour:  https://www.youtube.com/watch?v=shIca898eGo
- Find out more: www.ctsi.duke.edu/transpop
Thank you!

Kristin Newby, MD, MHS
Julie Eckstrand, RPh

Hosted by Ebony Boulware, MD, MPH