DASMAN DIABETES INSTITUTE-CANBERRA GEOHEALTH INITIATIVE

Building capacity for spatially-enabled health research to understand diabetes in relation to social, built and physical environmental factors in the State of Kuwait

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KUWAIT – A CONTEXT

• Located on the northeastern edge of the Arabian peninsula

• The country has 17,820 square kilometers of land

• Population of about 4.2 million people – Approx. 30% National and 70% expatriates
THE DIABETES PROBLEM – A HEALTH AND AN ECONOMIC BURDEN

• 415 million adults have diabetes; this number is expected to rise to 642 million by 2040

• More than 35 million (9%) of adults aged 20-79, live with diabetes in the Middle East and North African (MENA) Region

• the International Diabetes Federation estimated that prevalence of diabetes in Kuwait is about 15% out of a population of 4 million – compared to Australia with prevalence of 6.5%

• Studies within Kuwait show that prevalence is around 20%

• Mainly due to a change of lifestyle that was entrenched with the growth of oil wealth and rise of obesogenic urbanization

• Kuwait has spent approximately 16% of its health expenditure on diabetes alone in 2010, and it is estimated that this number increase by 150% in 2030
DDI-UC GEOHEALTH INITIATIVE

Aim

To assist DDI build a GeoHealth lab, help build spatial epidemiology expertise and develop knowledge and understanding of the diabetes epidemic in Kuwait through spatial associations.

- The GeoHealth lab is a spatial infrastructure enabling process which includes hardware, software, data, methodology and staff capacity building, including education and Higher Degree Students.

- The project is designed in three phases where each phase incorporates certain objectives and deliverables.
PROJECT PHASES

Phase 1: Capacity Building
- Prevalence of diabetes in Kuwait (magnitude and extend)
- Data collection
- Consolidating GIS infrastructure
- Basic descriptive epidemiology
- Spatial Epidemiology
- Population monitor design
- Training for DDI staff - series of intensive workshops

Phase 2: Direct Observation
- Spatial observations
- Primary data on behavior, lifestyle and environment
- Direct observation
- Population survey
- High resolution data
- Description to inference
- Geo database development
- Develop input model
- Develop user interface

Phase 3: Prevention and Intervention
- Prevention and Intervention programs
- Shift the norms

Years 1 - 2
Phase 1: Capacity Building

Years 3 - 4
Phase 2: Direct Observation

Years 5 - 6
Phase 3: Prevention and Intervention

Training, Education and Dissemination
- Seminars
- Workshops
- Spatial Epidemiology Graduate Diploma
- Publications
ESSENTIAL GIS DATA

GIS Data

- PACI
  - ArcGIS Online access to PACI Geoportal

- CSB
  - GIS Shapefiles – Governorates, Suburbs, Blocks, Road network

- Municipality
  - GIS Shapefiles – Governorates, Suburbs, Blocks, Parcels for the Capital governorate

- European Space Agency
  - 10 meter multispectral resolution satellite image
# Key Variables

## Built Environment
- Public Open Space
- Parks
- Cooperatives
- Schools
- Fast foods
- Primary Health Care centres

## Physical Environment
- Temperature
- Air Quality
- Dust

## Health & Demography
- Age
- Gender
- Race
- Socioeconomic status
- Vital signs
- Phenotypes
- Bio markers of disease
PUBLIC AUTHORITY FOR CIVIL INFORMATION (PACI) - CIVIL IDENTIFICATION (CIVIL ID)

Civil ID for all residents in Kuwait (Nationals & Non-nationals)

- Unique ID
- Each civil ID is linked to a unique Address ID
- Smart chip
- Linked to all ministries and governments services
PACI – KUWAIT FINDER

DDI User Access GIS Online Portal
GEOCODING

• Data Quality
• Proxy – suburb-block to map diabetic patients
• Aggregated to the block level (census tract SA1)
MUNICIPALITY AND CSB GIS DATA

- Governorates
- Suburbs
- Blocks
- Roads – Major and Minor
- Parcels – Capital only
  - Parks
  - Mosques
  - Schools
  - Coops
PILOT STUDY
DDI HEALTH DATA – NOVEMBER EXTRACT

- Fake ID
- District name – Governorate
- Area name – Suburb
- Block
- Street
- Building
- Age as of Nov 1
- Gender
- Nationality
- Race
- Blood Type
- Height
- Weight
- Systolic
- Diastolic
- Heart rate
- Blood glucose
- Blood glucose measure state
- HbA1c
- HDL
- IDL
- Trig
DDI GIS PILOT – METHODS

Suburbs and Blocks – Unique identifier

Count of patients per block

Patient data – unique address ID
DDI GIS PILOT – METHODS

GIS tool for assigning patients as spatial points within their respective blocks

Data Input
- GIS
- Suburbs Blocks
- Tabular Patient data Count per block

Data prep – GIS merge, block patient count table, generate unique spatial identifier

Clean up data for processing – data issues E.g. Duplicates, missing fields, format

Create random points

Link random points in polygon

Create Random Points in Polygon

Clean up data for processing – data issues E.g. Duplicates, missing fields, format

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RESULTS – DDI PATIENTS GEOCODED

Patients are randomly distributed within their respective blocks (Geo-masking their location)
SYMBOLOGY AND SPATIAL VISUALIZATION

Expected results – patients under investigation are diabetics.
SYMBOLOGY AND SPATIAL VISUALIZATION

Spatial visualization of weight classes

Diabetics - likelihood to be overweight

Can be utilized to understand environmental association such as food and open public space.
ANALYSIS

Green Space
Proximity to Fast Food
COOPERATIVES

- Comprising 70% of the retail trade in the country
- Legal basis for consumer cooperatives was established in 1962
- Suburb residents are shareholders in their respective cooperatives
- Shareholders retain unique membership IDs
- Non retained profit is distributed as dividends to existing shareholders
Unit 1: GIS in Health
October 2018 – 1 week intensive
Basic concepts of spatial cognition, spatial technologies and spatial models and the major technologies for dealing with spatial information, GIS, remote sensing, and GPS.

Unit 2: Statistical Analysis of Spatial Data
December 2018 – 1 week intensive
principles and methods of reasoning that underlie biostatistics. It will provide knowledge and abilities regarding specific descriptive and inferential techniques commonly used in population health practice and research.

Unit 3: Advanced Spatial Modelling and Analysis for Health Research
February 2018 – 1 week intensive
This unit broadens the theoretical basis and introduces advanced GIS concepts including the creation, visualization and analysis of multidimensional spatial data.

Unit 4: Research Project in Health PG
Mar/May 2019 – on-campus (DDI) + distance mode (UC) supervision
In this unit students undertake applied spatial health research that can be individualized to suit student personal interest and student workplace relevance.

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THANK YOU