

# PhD Presentation

Colorectal Cancer (CRC) in Relation to  
Ultraviolet-B Radiation and Disinfection  
By-Products (DBP) in Drinking Water:  
Methodological Issues in Context

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# Introduction

- **Supervisory team:**

- **Professor Bruce Armstrong, Primary supervisor, SPH of USyd and Sydney Cancer center**
- **Ms Christine Cowie, Associate supervisor, SPH of USyd and Woolcock Institute**
- **Dr. Tim Driscoll, Associate supervisor, SPH of USyd**
- **Dr. Mark Clements, Additional supervisor, NCEPH of ANU**

- **Acknowledgement:**

- **Northern River University Department of Rural Health**
- **SWC and HWC**
- **Cancer Institute, NSW**
- **NASA, USA**

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# Aims

- To develop and validate methodology for doing ecological studies on cancer and environmental exposures;
- To develop methodology for spatial ecological studies on CRC and UVB and DBP
- To validate ecological measure of exposure to DBP with individual level exposure measure by field work
- To critically assess the performance and utility of ecological methods in these contexts



# Research Questions

- Is there any association between DBP and colorectal cancer?
- Is incidence of colorectal cancer related to DBP exposure in Sydney?
- Does area level measure of DBP exposure reflect individual level measure?
- Does sun exposure protect colorectal cancer?



# Study Components

- Meta-analysis on DBP and CRC
- Spatial ecological study on CRC and UVB in NSW
- Spatial ecological study on CRC and DBPs in NSW
- Field work on individual level exposure assessment



# Meta-analysis

- ❖ Search strategy
- ❖ Inclusion criteria
- ❖ Total 18 studies (14 case-control and 4 cohorts)
- ❖ Quality scoring of the studies
- ❖ Statistical methods:
  - RE and FE methods
  - Heterogeneity tests
  - Meta-regression



# Ecological study on CRC and UVB

- Level of aggregation: LGAs of NSW
- UVB data from 1978 to 2003, TOMS of NASA, USA
- LGA level weighted exposure using IDW methods in ArcGIS
- CRC incidences from 1994 to 2003, Cancer Institute, NSW
- SEIFA data from ABS
- Statistical models:
  - BYM model
  - BYM excluding heterogeneity and clustering components
  - Negative binomial and Poisson model with random intercept



# Ecological study on CRC and DBP

- Level of aggregation: LGAs of NSW
- DBP data from SWC and HWC (as far back as possible )
  - Imputation of missing data on DBPs
  - Area level exposure estimate by ArcGIS
- CRC incidences from 1994 to 2003, Cancer Institute, NSW
- SEIFA data from ABS
- Statistical models:
  - BYM model
  - BYM excluding heterogeneity and clustering components
  - Negative binomial and Poisson model with random coefficient



# Field work on individual level exposure measure-1

- Individual level measure of exposure:
  - ✓ Measuring DBP concentration at participant's tap
  - ✓ Questionnaire survey for water consumption behavior
  - ✓ Validation of questionnaire using 3 days water consumption diary
  - ✓ Cumulative and dose-rate of DBP uptake calculation according to Jo, et.al (1990)



# Field work on individual level exposure measure

## □ Proportional contribution of different pathways to DBP uptake:

- Pathways: Dermal absorption, inhalation and ingestion
- Measuring different exposure biomarkers under controlled behavioral condition
- Correlation of DBP metabolites with DBPs in the source water



# Field work on individual level exposure measure

- Validation of ecological level exposure measure:
  - ✓ Level of aggregation is LGA (or perhaps CCD, if possible)
  - ✓ Ecological measure of exposure from SWC data
  - ✓ Calculation of correlation coefficients between average individual measure and ecological measure
  - ✓ Calculation and validation of correction factor for ecological measure



# THANK YOU

