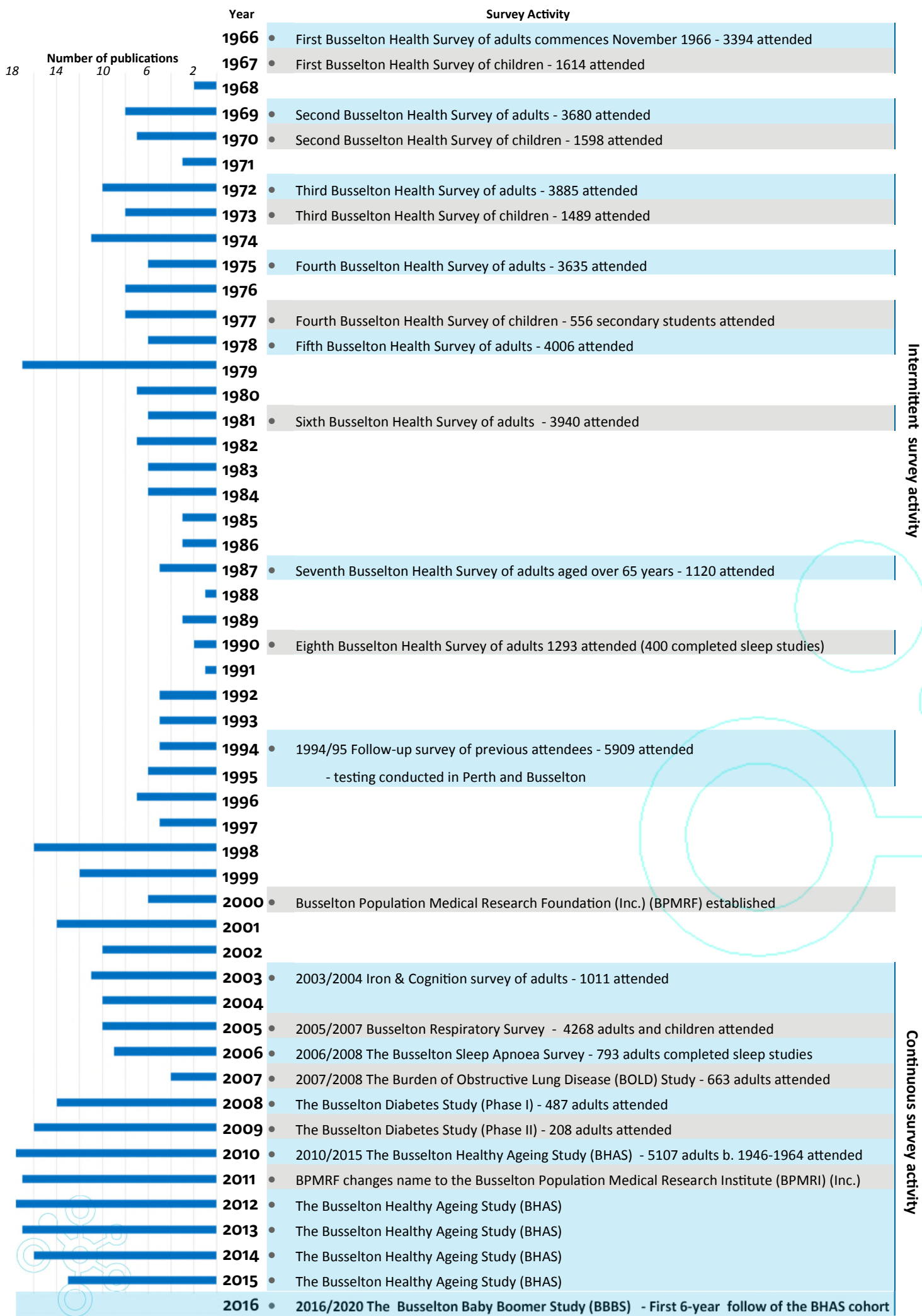


Celebrating 50 Years of the Busselton Health Study



Welcome

"On behalf of the Busselton Population Medical Research Institute we are delighted to be celebrating the 50th year of the Busselton Health Studies. Initiated by Busselton's visionary GP, Dr Kevin Cullen in 1966, the series of population health studies continue to contribute a wealth of knowledge for population health and medical research.

The data collected from more than 20,000 residents of the City of Busselton has resulted in over 400 scientific publications (*page 14*) mapping common chronic diseases and their risk factors, defining normal values for common health tests, informing health policy, investigating the natural history of common conditions through the life span and uniquely expanding laboratory findings to the "real world" of the general population.

Working with national and international research groups, the Busselton Health Studies have been at the forefront of population genetics (*page 8*), discovering the first gene linked to asthma, establishing the role of genetic screening for iron overload, establishing techniques for studying genetics in large populations and now using "next-generation" gene sequencing to uncover genetic links to disease.

Over the last 10 years there has been continuous survey activity at the Busselton Study Centre with the support of the Department of Health and Office of Science. This has resulted in increased research output, has attracted PhD, medical and nursing students and high-quality post-doctoral and experienced researchers and has trained a large number of staff in health monitoring techniques.

The BPMRI's key goals into the future are two-fold:

- 1) To maintain Kevin Cullen's vision of a dedicated research facility in Busselton (*page 10*). This regional centre of excellence in population health and medical research will ensure the ability to monitor trends in health and risk factors in the population and train the next generation of population and medical researchers;
- 2) To maintain the precious collection of health data and bio-specimens to advance medical research and population health.

The success and longevity of the surveys are testament to community goodwill and the dedication of numerous study participants, volunteers, researchers and supporting organisations. With continued support we look forward to a bright and sustainable future for this irreplaceable Western Australian resource."



Clinical Professor Alan James
Chair
BPMRI Board



Dr Michael Hunter
Director
BPMRI Busselton Health Study Centre

Patrons of the BPMRI Busselton Health Study



Dr Michael Chaney OA CitWA
BPMRI Patron

"The population research conducted in this project has resulted in a rich store of health data, biospecimens and scientific publications. The fact that the data is population-based makes this collection unique and promises significant health outcomes for West Australians"



Professor Barry Marshall
Nobel Laureate - BPMRI Scientific Patron

"I have made use of the family-linked data and serum samples collected in Busselton to better understand the spread of Helicobacter in the community. This contributed to the weight of evidence that resulted in the awarding of the Nobel Prize for Medicine in 2005"

About Us

The Busselton Population Medical Research Institute (BPMRI) is a charitable organisation conducting globally significant medical and population health research.

With research facilities in the Western Australian cities of Busselton and Perth, as well as collaborations nationally and globally, the institute conducts internationally recognised cross-sectional and longitudinal population health studies

Advancing Medical Research

BPMRI's medical and population health research aims for a better understanding and management of disease and illness.

The institute's research activities are diverse and encompass a wide range of health conditions and measures. Our areas of study include sleep disorders, respiratory diseases, cardiovascular diseases, diabetes, genetics and others.

BPMRI manages a valuable database and Bio Bank (biological specimens) as a resource for medical researchers. The institute often works collaboratively with leading local, national and international researchers on medical and population health studies and projects.

BPMRI Busselton Health Study

The internationally significant Busselton Health Study is managed by BPMRI. BPMRI's Busselton Health Study incorporates an expanding series of individual population health studies utilising the Busselton population. A unique database of information has been compiled and is managed by the School of Population Health at the University of Western Australia (under the custodianship of Professor Matthew Knuiman).

A collection of biological specimens from the surveys (blood samples and DNA) is maintained by the School of Pathology and Laboratory Medicine at the University of Western Australia (under the custodianship of Professor John Beilby). The database and specimen collection have been recognized and relied upon by major international research centres as well as by researchers here in WA. The BPMRI Board upon recommendations by the BPMRI Scientific Research Committee grants access to the data after carefully considering the scientific merit and value of all applications received. To ensure participant confidentiality data are only supplied to investigators after all identifying information has been removed.

Governance

During the 1960's to 1980's the 'Busselton Population Studies Group' lead by Dr Kevin Cullen, was responsible for the governance of the Busselton Health Study. From July 2000, the Busselton Population Medical Research Foundation Inc. governed and managed the Busselton Health Study. To better reflect it's core activities the Foundation updated it's name to the Busselton Population Medical Research Institute (Inc.) in October 2011.



Current BPMRI Board Members

The BPMRI Board consists of leading clinicians, medical researchers and scientists, as well as business, marketing and legal advisors. The Board meets monthly in Perth with an annual meeting in December each year in Busselton. All members are volunteers.



Clinical Professor Alan James - Chair

Research Interests:

Epidemiology of respiratory disease, Pulmonary physiology, Airway remodelling, Sleep disorders

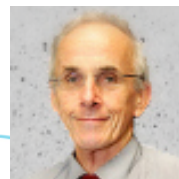


Professor Matthew Knuiman

Chair BPMRI Research and Scientific Committee

Research Interests:

Biostatistics, Epidemiology and control of diabetes, Vascular disease, Respiratory diseases



Clinical Professor Bill Musk

Research Interests:

Epidemiology of Respiratory disease, Pulmonary physiology, Occupational lung disease



Professor Timothy Davis

Research Interests:

Diabetes and General medicine



Professor Eric Moses

Research Interests:

Genetic epidemiology, Statistical genetics



Adjunct Professor Nick de Klerk

Research Interests:

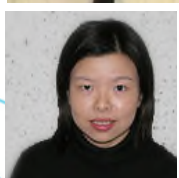
Biostatistics, Cancer epidemiology, Child health, Occupational and environmental epidemiology, Respiratory health



Dr Peter Hollingsworth

Research Interests:

Immunology, Biogenetics



Dr Jennie Hui

Director, BPMRI Busselton Health Study Laboratory
Ex officio member

Research Interests:

Immunology, Molecular genetics



Dr Siobhain Mulrennan – Vice Chair

Research Interests:

Cystic Fibrosis & Bronchiectasis



Clinical Associate Professor John Walsh

Vice Chair BPMRI Research and Scientific Committee

Research Interests:

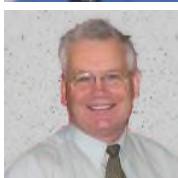
Thyroid disease, Paget's disease, Osteoporosis



Clinical Associate Professor Joseph Hung

Research Interests:

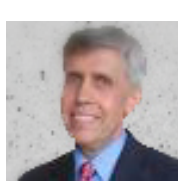
Cardiovascular disease



Professor John Beilby

Research Interests:

Cardiovascular genetics, Biochemistry



Professor David Ravine

Research Interests:

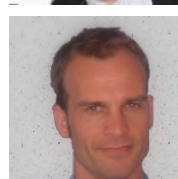
Medical genetics, Genetic epidemiology



Dr Digby Cullen

Research Interests:

Gastrointestinal disease, Haematochromatosis



Dr Michael Hunter

Director, BPMRI Busselton Health Study Centre

Ex officio member

Research Interests:

Respiratory disease, Cardiovascular disease, Sleep Apnoea

Mr Barry Rubie - Business Development Advisor

Mrs Denise Young - Treasurer

Mr Jeremy Wade - Legal Advisor

Ms Phillippa Henderson - Events & Marketing

Mr Richard Marsh - Business Advisor

Mr Alan Eggleston - Business Advisor

Our Research

Research activities undertaken as part of the Busselton Health Studies are diverse and encompass a wide range of health conditions and measures. These have included **cardiovascular disease, respiratory disease, diabetes and endocrine disorders, gastrointestinal, kidney and liver diseases, cancer, obesity, sleep disorders, cognition and genetic epidemiology**. Extensive information on demography, lifestyle and behaviour have also been collected at each of the studies along with blood samples for biochemical measures and genetic studies.



The studies bring together some of Australia's leading researchers and a growing list of international collaborators who recognize the value of this unique data set. The use of standardized questionnaires and methodology, international best practice guidelines in data collection and a stable representative population ensures that the studies can provide important information about the prevalence of disease and the factors associated with them.

Due to population growth and limited resources it is no longer possible to survey everyone in the region. Instead, recent surveys have focused on certain age-groups or particular diseases or conditions. Below are some of the ongoing and recently completed data collection projects conducted in Busselton.

Current Surveys

2016 -2020: The Busselton Baby Boomer Study (BBBS) – Phase II – Six year follow-up interval (underway)

2010 – 2015: The Busselton Healthy Ageing Study (BHAS) – Phase I (completed)

A large multidisciplinary project investigating the causes of and risk factors for a wide range of conditions of public health importance in an ageing population commenced in 2010. The study brings together WA's leading research groups and is the most comprehensive survey undertaken by the BPMRI.

Collaborating partners:



The **Busselton Healthy Aging Study (BHAS)** collected measures on vision and hearing disorders, respiratory and cardiovascular disease, muscle strength and physical function, obesity, diabetes, sleep disorders, bone health, spinal pain, and mental health and cognition from over 5100 adults born between 1946 and 1964.



Retesting of this cohort commenced in March 2016 under the name of the **Busselton Baby Boomer Study**. This second phase of the study marks six years between visits and will provide important information about the progression of disease and debilitation and the impact of multiple chronic diseases (multi-morbidity). This comprehensive longitudinal study will look into how multi-morbidity and its risk factors relate to changes in cognitive and physical function and impact on work ability, quality of life, physical activity and hospital separations.

Risk Factor	Criteria	BHAS	NHS	Comparison - BHAS to national
Obesity	BMI > 29.9 kg/m ²	29%	31%	similar obesity prevalence
Large Waist	> 101cm M, > 88cm W	35%	31%	more waist circumference
High Blood Pressure	Diagnosed (ever)	27%	17%	more men with high BP
Risky Alcohol Intake	>2 STD daily	16%	15%	similar consumption
Physical Inactivity	< 150 min per w/ 5 times	62%	61%	similar inactivity
Inadequate Fruit/Veg	< 5 veg / 2 fruit per day	76%	92%	better consumption
High Fat Intake	full-fat milk (proxy)	24%	41%	less saturated fat intake
Tobacco Smoker	Current	10%	19%	smoke less

Table 1. The prevalence of common risk factors among Busselton's Baby-Boomers attending the BHAS compared with the National Health Survey

Recent Surveys

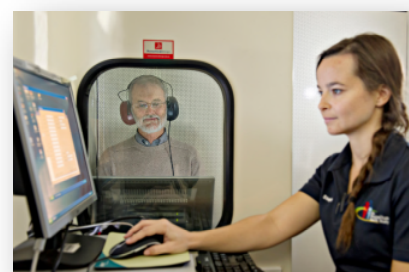
The Busselton Diabetes Study (BDS) - Phase I and II (2008 - 2009)

The Busselton Diabetes Study (BDS) collected information about the effects and characteristics of diabetes in a semi-rural population and is based on the long running Fremantle Diabetes Studies. The study recruited over 200 patients with diabetes and 200 age/sex-matched controls. The tests included a comprehensive physical, neurological and cardiovascular assessment, biochemistry, vision tests and questionnaires collecting information on lifestyle and diabetes management, care and complications. This study along with data from previous surveys has provided important information relevant to the growing prevalence of Type-II diabetes and complications including depression, disability and falls.



Burden of Lung Disease Study (BOLD) (2007 - 2008)

In 2007, Busselton was one of numerous sites taking part in the international Burden of Lung Disease (BOLD) study, which aims to assess the world-wide impact and prevalence of COPD and emphysema. Post-bronchodilator spirometry, forced oscillation technique, airway inflammation, atopy and questionnaire data was collected from over 600 Busselton participants aged over 40 years. The studies were also completed in the Kimberley, Sydney, Melbourne and Tasmania and provided comprehensive comparisons with other countries into the prevalence and health and economic burden of COPD and emphysema.



The Prevalence of Sleep Disordered Breathing (ongoing)

In-home sleep monitoring devices have been used in Busselton since the early 1990's. These data along with comprehensive sleep health and behaviour information collected from standardised questionnaires continues to provide an insight to the prevalence and associated risk factors underlying sleep disordered breathing in the community. This largely under-researched area is growing in importance with a number of key findings coming from the Busselton studies and other groups that indicate that sleep disordered breathing (sleep apnoea) is prevalent in the community and if left untreated may be associated with increased risk of mortality.

The Changing Prevalence Of Asthma and COPD (2005 - 2007)

In 2005 we commenced a large scale investigation into the changing prevalence of respiratory diseases such as asthma and COPD in the community. Over 4200 adults and children completed lung function tests, including spirometry, airway inflammation and resistance and atopy. Results indicate that the prevalence of doctor-diagnosed asthma, respiratory symptoms such as cough and wheeze, and skin allergies (atopy) continue to increase in some age-groups in the community. Continuing analyses from this study and previous surveys will look at the risk factors underlying these trends and contribute to the international effort to understand the aetiology of these complex respiratory diseases.



Obesity, Metabolic Syndrome & CVD Risk Study (2006 - 2007)

A study into the prevalence of obesity, metabolic syndrome and risk for cardiovascular disease was conducted in Busselton during the 2005/2007 Respiratory Survey. The study collected ultrasound measurements of carotid intima thickness (CIMT), body measurements, biochemistry including insulin, lipids and inflammatory markers and lifestyle factors from over 1000 school-aged children and 1200 adults. This study, along with data collected from previous surveys has provided important information about the inter-relationship, risk factors and early course of obesity, metabolic syndrome and cardiovascular disease in the community.



Genetic Studies

DNA samples collected in the Busselton Health Studies have assisted researchers in the international collaborative search for the genetic causes of a wide range of common diseases and health conditions.

Genome-Wide Association Studies (or GWAS for short) are used to identify common genetic factors that influence health and disease. These studies normally compare the DNA collected from two groups of participants: people with the disease (cases) and people without the disease (controls). If one type of variant (allele) is more frequent in people with the disease, the variant is said to be “associated” with the disease. The associated variants are then considered to mark a region of the human genome which influences the risk of disease, allowing researchers to begin the large and often daunting task of pin-pointing the causal gene or genes.

These type of investigations often require large numbers of samples to increase the power or likelihood of finding an association and rely upon accurate characterisation (phenotyping) of the disease or trait under investigation. The rich and comprehensive Busselton Health Study data and biospecimen collection is an internationally recognised and accessed resource that has allowed researchers to identify genetic variants associated with a range of common and complex disorders including **asthma, chronic obstructive lung disease (COPD), cardiovascular disease, thyroid disease, liver disease and type-II diabetes**.

The techniques are also being used to pinpoint the genetic factors that influence height, weight and obesity, and even people’s preference for caffeine consumption and effect on physiological responses and metabolism.

The Busselton Health Study is involved in over 25 international collaborations and the findings from these studies have been published in leading international journals including the Lancet and Nature Genetics.

Whole Genome Sequencing

We are now witnessing the beginnings of a revolution in human disease genetics being driven by technological advancements which allow the sequencing of the whole human genome at an individual level. This new wave of genetic discovery involves the search for disease-causing variations in entire human genome sequences by multi-skilled teams comprising research centres (like the Busselton Health Study) who have collected and extensively characterised large cohorts, molecular geneticists, statistical geneticists, bioinformatics and computer programmers.

The identification of genetic risk factors for common diseases is a major priority in human medical research as it promises to pave the way for the development of next-generation “genetic medicines”, including improved predictive and diagnostic tests and targeted medication for therapeutic interventions. In collaboration with the Centre for Genetic Origins of Health and Disease (GOHaD) headed by **Professor Eric Moses** at the University of Western Australia, and with other leading international groups, the Busselton Health Study is well placed to ride this new wave of genetic discovery.



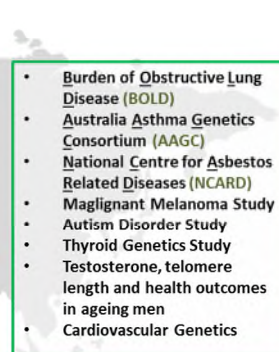
International collaborations



- AllerGEN (Asthma and allergy)
- Meta-Analysis of Glucose and Insulin traits Consortium (**MAGIC**)
- Genome-wide International **ANT**thropometrics consortium (**GIANT**)
- Caffeine consumption
- Genome-Wide Association Study of moderate/vigorous leisure physical activities
- Meta-analysis of new loci for eczema
- Genome-Wide Association Study to discover new genetic loci for circulating lipid levels



- Coronary **ART**ery Disease Genome-wide Replication And Meta-Analysis (**CARD**ioGRAM)
- Diabetes Genetics Replication And Meta-analysis consortium (**DIAGRAM**)
- International Consortium for Blood Pressure (**ICBP**)
- GABRIEL (Genetics & Environmental causes of asthma)
- SPIROMETA (Lung Function)
- Malignant Melanoma Study
- Global BPgen-Blood Pressure (Gene-Age interaction)
- Genetics associated with progression and remission of asthma



- Burden of Obstructive Lung Disease (**BOLD**)
- Australia Asthma Genetics Consortium (**AAGC**)
- National Centre for Asbestos Related Diseases (**NCARD**)
- Malignant Melanoma Study
- Autism Disorder Study
- Thyroid Genetics Study
- Testosterone, telomere length and health outcomes in ageing men
- Cardiovascular Genetics

“The bio-bank of specimens collected in the Busselton population over the last 50 years is a valuable and unique resource that is used by local and international researchers to identify the genetic causes of a wide range of diseases and traits”

Dr Jennie Hui
Director, BPMRI Busselton Health Study Laboratory

Key Achievements & Aims

- Over 400 scientific publications across a broad range of chronic diseases (*a full list is available at www.bpmri.org.au*)
- Discovery of first genetic association with asthma - opening of a whole new field of genetic investigation in asthma
- Definition of the clinical relevance of genetic testing in haemochromatosis
- Demonstration of the health effects of the survey (Kevin Cullen's initial aim)
- New gene discovery and confirmation of known genetic associations with cardiovascular disease, respiratory disease, lung function, obesity, sleep apnoea, diabetes, iron metabolism and thyroid disease
- Mapping trends of common diseases, especially asthma, diabetes and cardiovascular disease
- Dissecting the role of smoking and asthma on longitudinal lung function
- Providing reference data for the prevalence of disease and risk factors in a general Australian population (including cardiovascular disease, thyroid, disease diabetes and metabolic syndrome)
- Identified sleep apnoea as a risk factor for death, cardiovascular disease and diabetes
- Establishing the prevalence of obstructive lung disease in the community as part of the Burden of Obstructive Lung Disease in Australia survey
- Relating male hormones to health outcomes and mortality
- Examining the relationship between depression and diabetes
- Identification of subclinical levels of thyroid dysfunction as a risk factor for heart disease
- Showing the effect of obesity on bone density

"The Busselton Survey is one of the most important long term population health research surveys in the world. Started in the 1960's (when as a medical student I volunteered to help collect data during my holidays), it now consists of waves of vital information collected across several generations of families living in one community. To ensure that this study and its current and potential benefits are realised, it needs your support"



The Original Aims of the Busselton Health Study Continue Today:

- To obtain the prevalence of common diseases and associated risk factors in an Australian community
- To assess the range and variation of clinical and laboratory variables in a natural population
- To monitor disease and risk factor levels over time
- To study mortality from specific diseases in an Australian population and define the usefulness of risk factors in predicting mortality
- To provide a community service in the detection, treatment and prevention of disease and in the education of the population

Dr Kevin John Cullen (AM)

The initiator of the Busselton Health Studies was local GP **Dr Kevin Cullen**, a man of enormous energy, talent and a passionate belief in disease prevention. He graduated from Melbourne University in 1946 and was the first recipient of a MD from the University of Western Australia. He entered General Practice in Busselton in 1947 and prior to establishing the health studies in 1966 spent time in the USA where his interest in longitudinal studies and population health started.

Kevin's early research focused on a range of public health issues including investigating health disparities between people living in small country towns and workers in the timber industry. He also had a keen interest in child development and wrote a number of early papers on childhood behavioural disorders and parenting interventions.

Kevin Cullen was awarded the Western Australian "Citizen of the Year" in 1993 and inducted as a Member of the Order of Australia in 1994 for "Service to Medicine". In 2014 his achievements were recognised by the National Health and Medical Research Council's Prestigious List of High Achievers in Australian Medical Research.

Kevin Cullen along with his esteemed colleagues **Timothy Welborn**, **David Curnow**, **Michael McCall** and **Norman Stenhouse** pioneered community health screening and full disclosure of test results to patients and played a significant role in demonstrating the benefits of screening for improved health awareness and for early identification and intervention. The Busselton Health Study was a radical departure from standard practice in the 1960's and has been credited with changing the pattern of dealing with patients in general practice.



Dr Kevin Cullen 1922 to 1994



Michael McCall (top left), Timothy Welborn (top right), David Curnow (bottom left) and Norman Stenhouse (bottom right)

Reprinted from *The Medical Journal of Australia*, 1967, 2: 37

INSTITUTES OF MEDICAL STUDIES¹

KEVIN CULLEN, M.D., M.R.C.P. (Edin.)
Busselton, Western Australia

In recent years, there have been discussions of proposals to establish institutes for research under the various titles of "human ecology", "human biology", "social medicine" or "community health". Such terms recognize the need to study problems of the patient in his environment. In addition, much has been written deploring the lack of personal care of the patient. At the present time in Australia, there is no institute conducting major research into the problems of community health or patient care outside the hospital.

Considering the many problems of existing health services, the justification for establishing suitable centres has a sound economic basis. A searching analysis into prescribing methods of physicians could in itself save more than would be sufficient to establish and maintain the cost of an institute for research concerning the problems of the practising doctor.

"Medical studies" would embrace research with physicians, surgeons, obstetricians, paediatricians, ophthalmologists, or those practising in any other discipline involved in the direct care of the patient. Within these fields are those who are experienced in their work, but have had insufficient training in the basic techniques of undertaking research. Such personnel in receipt of research grants should have an association during their studies with institutions specifically concerned with methods of research.

In the future, there will develop an increasing need for permanent centres to undertake studies of the relationships between medicine and society. Such centres will attract financial support from public and private foundations, appropriate professional organizations and departments of public health.

Kevin Cullen's vision for the establishment of institutes of medical studies was a visionary concept published in the *Medical Journal of Australia* in 1967.

At the time there was no institute in Australia conducting major research in community health or patient care outside of the hospital setting. Kevin proposed that such an institute would enable cross-disciplinary research into population health and provide integrated opportunities for undergraduate and post-graduate education in the social sciences and medicine.

The BPMRI remains committed to bringing Kevin Cullen's vision a reality with the goal of establishing a dedicated, purpose-fitted research facility for future health surveys. This Centre of Excellence in Population Health and Medical Research would provide a permanent home for the health surveys and provide numerous regional training and research opportunities for PhD, medical and nursing students and post-doctoral and experienced researchers.

History of the Busselton Health Studies

The following excerpt is from an oral history of the Busselton Health Study compiled by local historian and long-serving study volunteer Margaret Tickle and the Busselton Historical Society. A full copy of this publication is available through the Library of Western Australia.

In 1966 the modest population of around 6000 residents in Busselton warranted the services of only four general practitioner doctors and perhaps less would have sufficed but for the four having chosen it for the attractions the town offered. One of these medicos was Dr Kevin Cullen, a very energetic, persistent and entrepreneurial personality who could see the benefits of health screening his community. To test the local population on a regular basis for a wide range of diseases would not only identify existing conditions but predict early signs in people who did not yet have symptoms of a variety of ailments. This could offer the opportunity for early diagnosis and treatment and anticipated better outcomes for the individual. The ramifications of this would benefit not only the participants of a screening program but could be applied much further a-field.

Two things coincided to make his plan an actuality. Firstly, a few colleagues in the capital city, Perth, were looking for an opportunity to do just what Kevin was planning. That being an epidemiological study in which to test health indicators and to also make it a longitudinal study; one that tests the same people, regularly at set times over a period of years. Secondly, a quick look at the demographics of the stable population of Busselton, with its lack of distorting factors such as pollution, showed that, yes, Busselton would be an ideal choice.

Kevin Cullen along with his colleagues, Timothy Welborn, David Curnow, Michael McCall and Norman Stenhouse began working on the logistics and funding challenges and whilst gathering support from many quarters their plans materialised. The framing of the questions for the comprehensive questionnaire alone was cause for argument, worry, and finally compromise. Kevin Cullen was the driving force and at times the challenges seemed insurmountable. The desired outcome of data retrieval, its analysis and storage, for the longer term, was made much possible by the invaluable input of an experienced person who had worked with the CSIRO. These were the early days of computerisation and although there was access in Perth to this “primitive” technology it did not extend to Busselton. Since these early days of the surveys, the huge benefit this technology brings to this type of project has been clearly demonstrated through the more sophisticated testing instrumentation being used and the ability to process the mounting piles of information.



Kevin got busy activating the community to support the health survey proposal. Initially some residents who “... felt quite well, thank you,” plus the fact that it was planned to be an on-going commitment (over a number of years) were reluctant to participate. However, when it was explained that the results would have a wider general benefit to people’s health outcomes, this persuaded others to come on board. Terms such as, “The happy guinea pigs of Busselton,” and “Busselton’s altruistic residents,” were quoted in very prominent publications of the day including The Canberra Times, Time Magazine, National Geographic and The Readers Digest.

The Canberra Times (ACT : 1926 - 1995), Wednesday 28 September 1966, page 2

Unique medical survey of town

*From ATHOL THOMAS
in Perth*

WA's recently-

Kevin had decided that all results of the testing on individuals would go to the participants. An asterisk would indicate anything out of a normal range or anything that may require further investigation by their general practitioner. In general practice, in earlier times, medical details of a patient was the province of the doctor and there was usually very limited sharing with the patient. The ‘request’ by Kevin for full disclosure was met with some alarm amongst his colleagues who soon found they were dealing with a very determined individual! The concern was that it may encourage a community of hypochondriacs – a concern which proved unfounded. Further confirmation of the value of testing for a broad range of health indicators comes from Dr Michael McCall: “In general practice it was thought almost im-

proper to test for anything other than what was symptomatic in the patient. What the Busselton Study showed was that for every known patient with hypertension, diabetes, thyroid problems, anaemia etc., there was another patient who did not yet have the symptoms but who had the condition. Early identification and intervention is in everybody's best interests. You now see general practitioners routinely screening for all sorts of things and I think the Busselton Surveys should be credited, amongst other things, with this change in the pattern of dealing with patients' in general practice".

It amazes us today when we consider, with gratitude, how much volunteer support and un-paid professional time was invested – and in fact still is to a lesser degree – to make these surveys such a success. Nowadays, with



critical factors influencing budgets, government departments invoicing each other for even minor services and the potential for litigation for anyone who even steps into the frame; it would be unrealistic to keep on expecting such a generous response. And because of this any planning for current surveys must include more of an economic-rationalist, approach.

But at the commencement of the first survey a big team of local volunteers was mustered, with sometimes the most unlikely people trained and trusted to perform various standardised tests. For analysis purposes it was important that questions were asked in the same manner to all the participants and all the tests were done to conform to specific instructions.

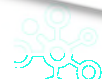
Perth's four major hospitals, and indeed our local hospital, gave generously of staff time, equipment and consumables. Weekly work rosters were reorganised, holidays rescheduled and leave with pay heralded an exodus of medical professionals to Busselton, while essential material and supplies were either donated or charged to another cost centre! Examples of support from the wider commercial area included a cool drink company which manufactured and donated all the glucose drinks for the glucose tolerance tests, which were then delivered free of charge to households in Busselton by the milkmen as an extra to their routine deliveries. Bays Transport, used by West Australian Newspapers for over-night deliveries to Busselton,

agreed to back-load the blood samples in bulky special cool boxes from Busselton to Royal Perth Hospital, while a major icecream manufacturer stored large quantities of blood samples in their freezer complex in Perth.

Sleepy Busselton was sleepy no more, certainly over that burst of concentrated activity in the community in late 1966. The response of people eligible to participate was an extraordinary 91%. Information regarding the Busselton Survey was spread widely and details of this innovative approach to community health were certainly news in the medical literature. Kevin Cullen had papers published in the medical journals *The Lancet* and *British Medical Journal* as well as reported in the popular press.

Every three years, until 1981, a survey was held with a children's survey running parallel for some of that time in the year following the adult survey. Subsequent surveys have been subject to a changing environment. Participation response percentages in the Busselton population have gradually fallen, the population demographic has changed, research money has (certainly) proved harder to access while the major hospitals can no longer justify the inputs once so generously donated. However, smaller and more specifically targeted surveys continue to be held regularly. There is now a well-experienced permanent research staff in Busselton that are assisted by local volunteers who make up the essential work force needed to undertake much of the mundane but important clerical and less technical work. There is also an optimism that a permanent survey facility will be a reality in the near future. This permanent base will also allow a world-class training facility for the next generation of up-and-coming medical and science graduates and research workers.

The increasing quantity and value of the data collected has generated over 400 research papers. It is protected under a structure initiated and supervised by the Busselton Population Medical Research Institute (BPMRI) which is proud to continue Dr Kevin Cullen's legacy.



Community

An army of volunteers from across the whole community was mobilised and assisted with a wide-range of survey activities and support during the early years of the Busselton Surveys. This spirit of community participation has persisted over the 50 year history of the Studies.

The success of the Busselton Health Studies is directly due to the generous contribution of hundreds of community volunteers, dedicated research nurses and assistants, database programmers, local businesses and organisations and of course our study participants. This commitment from the whole community has resulted in some of the highest study participation rates in the world.



Volunteers at the very first Busselton Health Study 1966



The BPMRI acknowledges:

Stewardship

Founding BPMRF Chairman Timothy Welborn
Former BPMRI Chairman Professor Bill Musk

Life members

Mrs Val Barrett
Professor Bill Musk
Mr Barry Rubie
Mr Mark Caddy

All our study participants, current and former staff, donors, ambassadors, supporters, committee members and the many hundreds of dedicated individuals who have volunteered their valuable time over the years.



Current staff at the BPMRI Busselton Health Study Centre

International Leaders in Population and Medical Research

The data collected in the **Busselton Health Study** have resulted in highly influential medical research and scientific papers which translate to better understanding of disease processes and prevention, better health delivery and the saving of lives.

With over **400 publications** produced across a wide range of health conditions and diseases, the 50 year collection of population health data has placed Busselton and indeed Western Australia at the forefront of high quality international medical research. It is a unique resource that has been used by hundreds of medical researchers and post-graduate students all over the world.

The database accumulated over 50 years enables research across a diverse range of diseases and health conditions. Below are examples of recent research and current analyses underway:

- **Determining the distribution of lung cancer risk and eligibility for lung cancer screening in Australia**
- **Relationships between skin cancer and myopia**
- **Food allergies and dietary patterns in the Busselton Healthy Ageing Study**
- **Assessment of vitamin D status in Baby-Boomers**
- **Validation of the Sub-optimal Health Status Questionnaire and correlation with risk factors for chronic disease in the Australian context**
- **The art of healthy ageing: could the arts hold the key to a new way of promoting, maintaining and improving health?**
- **Development of a health economics model of socio-demographic correlates of health-related quality of life**
- **N-glycan profiling as stratification biomarker for enhancing the prediction and treatment of Type-2 Diabetes**
- **Middle-ear functioning in adults aged 46 to 65: Busselton Health Study findings**
- **The prevalence and character of dizziness in Baby Boomers**
- **The prevalence and character of hearing loss and tinnitus in Baby Boomers**
- **Back pain beliefs are related to the impact of low back pain in Baby Boomers**
- **The relationship between hearing loss and cognition in adults aged 46 to 64: Busselton Healthy Ageing Study**
- **Harmonisation of Biochemistry Reference Intervals Study – an Australian national project coordinated by the Australasian Association of Clinical Biochemists and the Royal College of Pathologists Australia**
- **Gender differences in the relationships between lean body mass, fat mass and bone mineral density in baby-boomers – the Busselton Healthy Ageing Study**
- **Associations between body mass index, lean and fat body mass and bone mineral density in middle-aged Australians: The Busselton Healthy Ageing Study**
- **The relationship between diabetes and hearing loss**
- **Renal function, vitamin D status and bone mineral density in middle-aged Australians**
- **Change of refractive error and myopia in Australia over a generation**
- **Associations between cardiovascular disease and hearing loss: the Busselton Health Study**

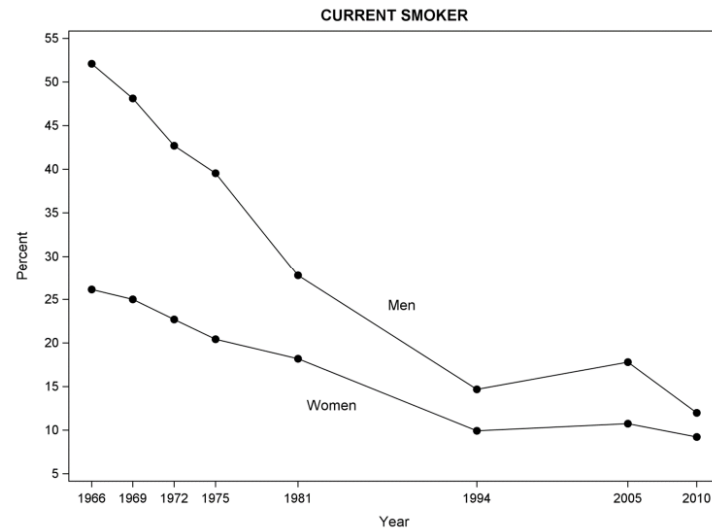


Visit www.bpmri.org.au to learn more about our research findings

Tracking Trends in Population Health

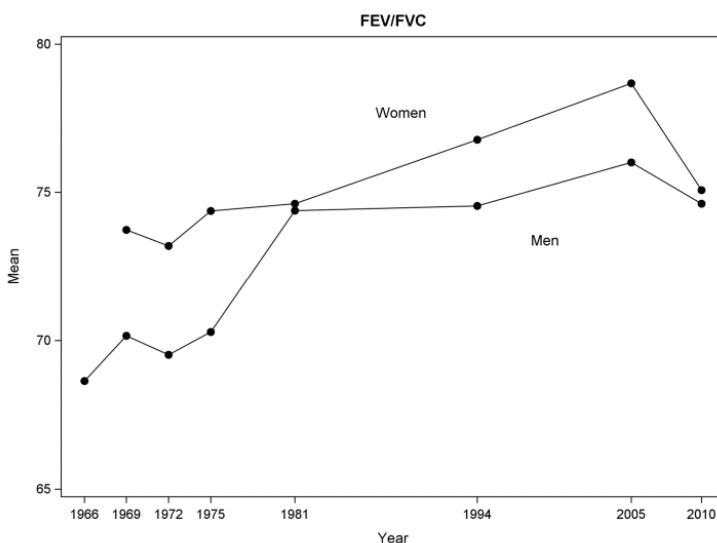
The Busselton Health Studies have collected detailed information on a number health indicators and risk factors for disease in the Busselton population for 50 years. This has allowed the monitoring of the prevalence of a number of measures including lung function, asthma, atopy (allergy), smoking rates and obesity.

Below are some examples of the changing prevalence of some key measures among middle-aged adults in the Busselton population over time.



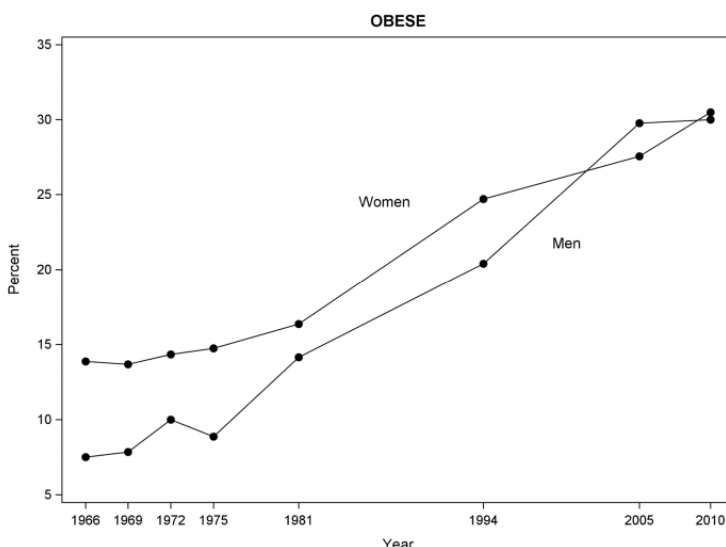
TOBACCO SMOKING

Smoking rates continue to plummet in the adult population likely due to increased public awareness of the detrimental health effects of tobacco and legislative measures. Busselton has one of the lowest prevalence rates of smoking in Australia.



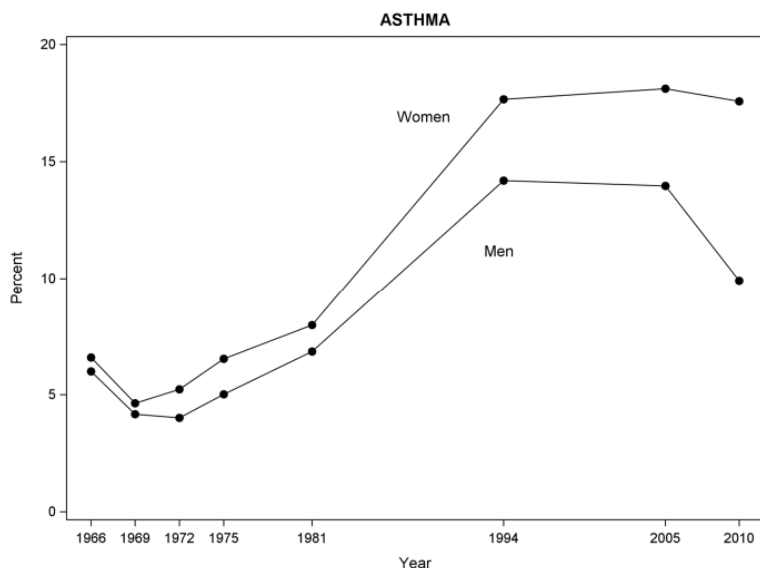
LUNG FUNCTION

As smoking rates have decreased there has been an increase in lung function amongst the population. Spirometry has been performed at each major survey conducted in Busselton allowing the tracking of changes in lung function in the population. FVC or Forced Vital Capacity is the maximum volume of air that can be forcibly expired from the lungs after a full inspiration. FEV1 or Forced Expiratory Volume is the amount of air that can be forcibly expelled from the lungs in one second. A higher ratio or percent predicted of FEV1/FVC is an indicator of healthy lung function.



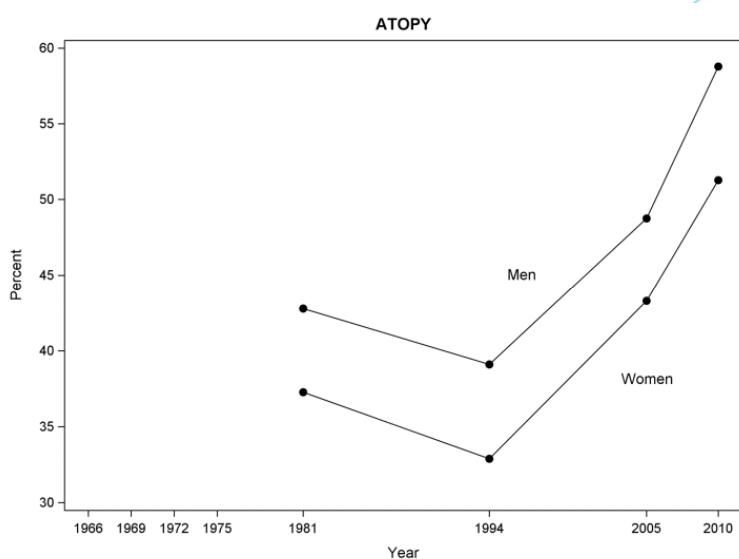
OBESITY

Obesity is a major risk factor associated with a range of chronic conditions including diabetes, sleep apnoea, metabolic syndrome and cardiovascular disease. Similar to other Western countries the rates of obesity continues to rise in the Australian population. The Busselton Health Studies have tracked the increase in obesity prevalence in the population since 1966. Increased availability and consumption of processed foods and insufficient physical activity are the likely key factors driving this trend.



ASTHMA

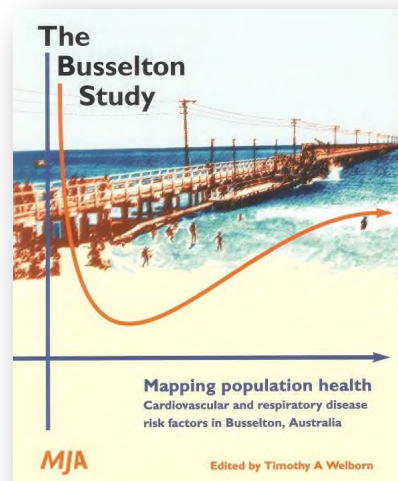
Information on asthma has been collected at each of the major surveys since 1966. The number of people reporting that they ever have had asthma or were diagnosed with asthma has increased markedly until recent times. A number of possibilities may underlie this trend such as increased awareness of asthma through public health campaigns, changes in diagnostic labelling or reflect increases in allergic or environmental triggers.



ATOPY (ALLERGY)

The Busselton Health Studies have collected information on allergy for over 30 years using skin prick tests to measure reaction to common environmental allergens such as grass, dust mites, cat fur, dog hair and moulds. There have been significant increases in the prevalence of atopy among people aged 18-55 years attending recent surveys. Although a number of hypotheses have been put forward it is not known what is driving this increase and remains an active area of research.

You can learn more about the changing trends of chronic diseases and risk factors in the publication - Mapping Population Health. Copies of this publication are available by contacting the Busselton Health Study Centre.





Support us

Many important medical breakthroughs including how chronic diseases are treated have come about from medical research like that conducted by the Busselton Health Study. Your support will help us continue to unlock the causes of common chronic disease by adequately equipping dedicated research scientists and ensuring the Busselton Health Study remains a sustainable world-class research and training centre.

The Institute has no ongoing source of financial support and relies upon successful grant applications, intermittent government funding for core operational aspects and the generous support of donors and benefactors. All funds raised or donated directly contribute to the research program by enabling us to employ highly skilled staff, purchase essential research equipment and maintain the unique collection of biospecimens and data.

Please help us make a difference by making a tax-deductable donation today

The BPMRI is reliant on grants, in-kind support and donations to conduct surveys for medical research. You can help us continue this important work by making a donation below or by visiting our secure donation portal at bpmri.org.au or by calling us on 9754 0548. **With your support the research we do locally enables breakthroughs in medical science.**

YES I would like to donate

\$ _____

to the Busselton Population Medical
Research Institute's -**Busselton
Health Study appeal.**

Please note: All donations \$2 or over are tax deductible.
For further information on our Privacy Policy, please visit:

bpmri.org.au

Busselton Population Medical Research Institute (Inc.)

PO Box 659 BUSSELTON, WA 6280

P: 08 9754 0548 e: admin@bpmri.org.au

ABN: 58 366 731 610 CCL 20568

Title _____ First Name _____

Surname _____

Company (if applicable) _____

Address _____

State _____ Postcode _____

Phone _____ Email _____

Credit card: please debit my ☐ Visa ☐ MasterCard

Name on Card _____

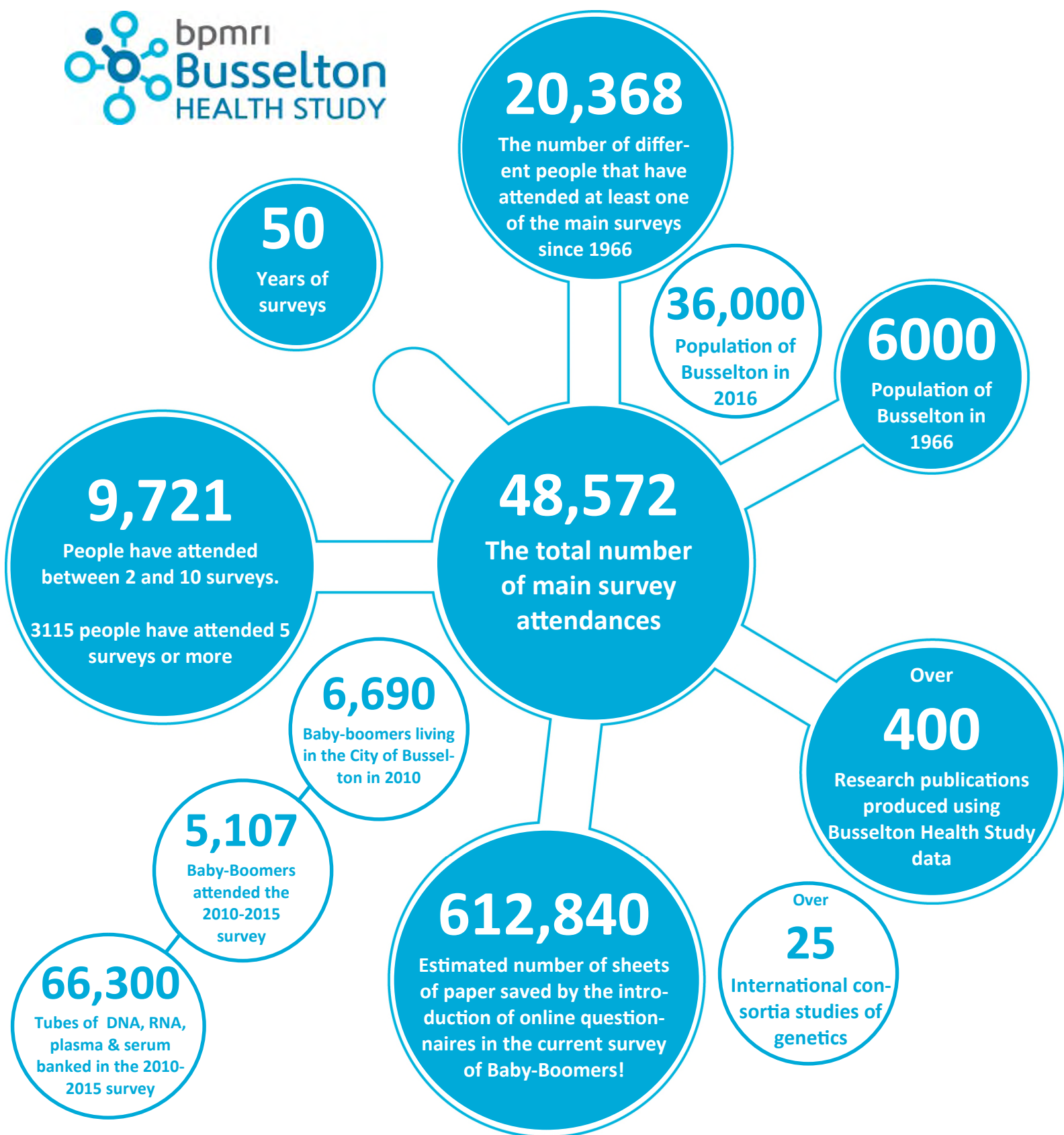
Card number _____ Expiry Date _____

Signature _____

Prefer to donate online, please visit bpmri.org.au

☐ **Cheque enclosed** (payable to Busselton Population Medical Research Institute)

Notes



Busselton Population Medical Research Institute (Inc.)

a: Department of Pulmonary Physiology and Sleep Medicine,
Sir Charles Gairdner Hospital, NEDLANDS WA 6009

p: +61 (08) 9346 2888

f: +61 (08) 9346 2034

BPMRI Busselton Health Study Centre

a: 18 West Street BUSSELTON WA 6280

m: PO Box 659, BUSSELTON WA 6280

p: +61 (08) 9754 0548

f: +61 (08) 9754 0544

e: admin@bpmri.org.au

w: bpmri.org.au

