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Cohort Profile Update

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Cohort Profile Update: The Concord Health and Ageing in Men Project (CHAMP)

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Key Features

- The Concord Health and Ageing in Men Project (CHAMP), a cohort of 1705 men aged ≥70 years, was set up in 2005 to investigate health in older men, with a focus on the causes and consequences of major geriatric syndromes.
- More than 13 years of follow-up provide opportunities for new research on multidimensional understanding of the health of older men.
- The most recent wave of CHAMP (wave 5) in 2019/20 included 457 men aged 81 to 102 years.
- New measures include dietary assessment, comprehensive oral health assessment and knowledge, practice and behavioural changes during the COVID-19 pandemic.
- CHAMP data are now linked with government health administrative data on hospital admission records, incident cancers, aged care service use, mortality and cause of death.
- CHAMP has several existing collaborations. For new collaborative projects and enquiries about data sharing, please contact the CHAMP Management Committee [CHAMP@anzac.edu.au].

The original cohort

The Concord Health and Ageing in Men Project (CHAMP) was established in 2005 to investigate health in older men, with a focus on the major geriatric syndromes and reproductive hormones. As outlined in the original cohort profile paper,[1] CHAMP is a population-based longitudinal study of men aged ≥70 years. Men were the focus of the CHAMP study because epidemiological studies of ageing have tended to focus on women. Briefly, men living in a defined urban geographical region (the local government areas of Burwood, Canada Bay and Strathfield) near Concord Hospital in Sydney, Australia, were recruited. The sampling frame was the New South Wales Electoral Roll, on which registration is compulsory for Australian citizens. At baseline, the only exclusion criterion was living in an aged care facility. Eligible men were sent an invitation letter describing the study and, if they had a listed telephone number, were telephoned about 1 week later.

Participants were seen at baseline during 2005/07 and since then have undergone four follow-up assessments in 2007/09, 2012/13, 2015/16 and 2019/20. Before the visit, participants completed a self-completed study questionnaire and, during a face-to-face assessment, answered more questions and had a clinical assessment that mainly consisted of physical performance measures, cognitive functioning measures, blood tests and medication inventory. Baseline and the subsequent three follow-ups (waves 1–4) were funded by the National Health and Medical Research Council of Australia (NHMRC) and the fourth follow-up (wave 5) was funded by the Australian Research Council (ARC).

CHAMP complied with the World Medical Association Declaration of Helsinki and was approved by the Sydney South West Area Health Service Human Research Ethics Committee. Written informed consent was obtained from all participants involved in the study.

What is the reason for the new focus?

There are several reasons for this cohort profile update. First, four additional waves of data collection have been completed since the profile was originally published. Second, as data are analysed and collaborative opportunities became available, the research focus has been expanded. CHAMP was initially mainly focused on causes and consequences of major geriatric syndromes and the health effects of age-related declines in reproductive hormones (both androgens and estrogen); however, over time the research focus has moved towards a multidimensional understanding of health of older men. Consequently, new questions and assessments have been included. Notable additions to the health assessment were a dietary assessment (waves 3 and 4) and a comprehensive oral health assessment (waves 4 and 5). The rationale for collecting dietary data is that there is a bidirectional interplay between old age and nutrition[2] and we were interested in exploring some of the unresolved questions around nutrition and older people, such as the obesity paradox and optimal protein intake requirements. Oral health data were thought to be important to collect because of the interrelationship between nutrition, oral health and general health. In wave 5, we also collected more detailed data on social determinants of health including income, health-related expenses and loneliness, as it was thought that these factors could explain some of the unexplained determinants of health outcomes seen in our earlier analyses.[3,4] We had shown that some of the CHAMP men were involved in caring and volunteering activities, so in wave 5 we ask the partners (mainly spouses) who live with the CHAMP participants to complete a questionnaire about the participant's caring and volunteering activities, along with questions about their health and function. In addition, CHAMP data have now been linked to hospital admission, cancer registry, death registry and aged care data.

The COVID-19 pandemic raises questions about the impact of COVID on older people as well as questions about their knowledge of COVID and sources of information about the pandemic. We are therefore collecting this information using a self-reported questionnaire.

What will be the new areas of research?

Nutritional factors influence ageing through the adverse health effects of undernutrition in some older people and obesity in others.[5] Furthermore, at least in younger animals, dietary restriction has a beneficial effect on the ageing process.[6] On the other hand, old age influences nutrition through its effects on food intake, macro- and micronutrient composition of the diet and metabolic demands.[7] As with most age-related and geriatric issues, the mechanisms for such an association are likely to be multifactorial. Thus, an increased understanding of these mechanisms is essential to address the knowledge gap in nutrition in older people. Building on this, dietary assessment data enable us to investigate multiple factors involved in age-related changes in nutrition, obesity and sarcopenia and how these relate to healthy ageing, frailty and mortality.

Oral health is an integral aspect of general health that is often neglected and understudied among older people.[8] There is also an inter-relationship between nutrition, poor oral health and disease.[9] Tooth loss and impaired masticatory function may limit dietary intakes, affecting food

choices and the pleasure of eating in old age. Poor nutritional status among older people has been shown to be a risk factor for periodontitis and dental caries.[10] Diet may also impact on the condition of oral tissues, for instance dietary sugars increase the risk of dental caries and acid-rich foods are implicated in tooth wear. Extensive tooth loss impairs chewing efficiency,[11] and wearing removable dentures is at least 30% less efficient than chewing with natural teeth.[12] Individuals with extensive or complete tooth loss are more likely to substitute easy-to-chew foods, such as those rich in saturated fats and cholesterol, instead of fruits and vegetables high in carotenes, vitamin C and fibre.[13] Thus in CHAMP, dietary assessment data supplemented with oral health assessment and sociodemographic and biological data enable investigation of interrelationships between nutrition, oral health and disease to be explored in detail.

The World Health Organization has highlighted informal caregivers as one of six key areas for managing declines in intrinsic capacity in older people.[14] In CHAMP, we found that 11% of men were caregivers, and that 82% of these men provided care for their wives.[15] On the other hand, at baseline, many men in CHAMP reported needing help with basic (8.3%) and instrumental activities in daily living (41.6%).[16] To understand more about caregiving and receiving by CHAMP men and their partners (usually wives), in wave 5 we collected relevant detailed information including who the men and their partner provide care for, the nature of the care they provide and the time they spend on caregiving.

Michael Marmot highlighted that 'the social determinants of health of older people claim attention alongside those of health at younger age'.[17] Social determinants of health include gender, race, income, education, housing, employment, social support, transport and food security.[18] Having data on education, occupation, source of income, home-ownership, social support and driving from previous waves of CHAMP, as well as detailed data on income and loneliness in wave 5, will help us address the importance of social determinants of health of older people.

The COVID-19 outbreak has led to social distancing rules that have an enormous impact on people's lives. Older people are particularly at risk, not only from developing serious complications and death from the virus, but also from the potential negative impacts of social distancing on maintaining social relationships and good mental health.[19] Thus by collecting COVID-19-related data from CHAMP participants, we aim to evaluate the impact of COVID-19 on psychosocial health of older adults which is a serious public health concern.

One of the goals of CHAMP is to understand more about the health trajectories of older men. Illness and accidents requiring admission to hospital, cancer diagnoses, aged care and ultimately causes of death are important aspects of health trajectories. Linkage with hospital admission records provides insight into health care use patterns and how these relate to health trajectories.[20] Linkage of CHAMP with the New South Wales (NSW) Central Cancer Registry (CCR) provides data to the Australian cancer Population Attributable Fractions (PAFs) cohort consortium which aims to estimate the Australian cancer burden attributable to lifestyle-related risk factors.[21] Linkage to the Pathways in Aged Care link map [www.gen-agedcaredata.gov.au/About] provides data on aged care assessments and use of key aged care community service programmes and residential care use. As the follow-up has extended over a longer period (more than 13 years) and the participants have grown older (age range of 81 to 102 years in 2019/20), 56.6% ($n = 965$) of the original cohort are now deceased. Ascertaining cause of death helps determine the impact of health behaviours, lifestyle and medical and community services in the lead-up to death. Thus CHAMP is now linked to NSW Registry of Births, Deaths, and Marriages (RBDM: www.nsw.gov.au/births-deaths-marriages) and the Australian Bureau of Statistics/ Australian Coordinating Registry Cause of Death Unit Record File.

Who is in the cohort? How often have they been followed up?

Figure 1 shows the numbers of participants and attrition for each of the five waves. At wave 1, data from 1705 men aged ≥70 years were collected between January 2005 and June 2007. The initial baseline participation rate was 54% among eligible men with whom contact was made. Wave 2 commenced in January 2007 and completed in October 2009 ($n = 1366$). The participation rate at wave 2 was 85% of living men. There were three further study waves: wave 3 in 2012/13 (participation rate of 72% of living men), wave 4 in 2015/16 (participation rate of 75% of living men) and wave 5 in 2019/20 (participation rate of 62% of living men).

Of the 954 participants in wave 3 of CHAMP (5-year follow-up), 794 men (83%) agreed to participate in a dietary assessment interview ($n = 160$ non-respondents). We repeated dietary assessment interview 3 years later for 718 of these men collected at wave 4. Oral health assessments were completed for 614 (78.6%) of the 781 participants in the fourth wave of CHAMP (8-year follow-up) and 280 men at wave 5. We have repeat oral health assessment data for 263 participants at both wave 4 and wave 5. A total of 255 men agreed to participate in the COVID-19 survey;

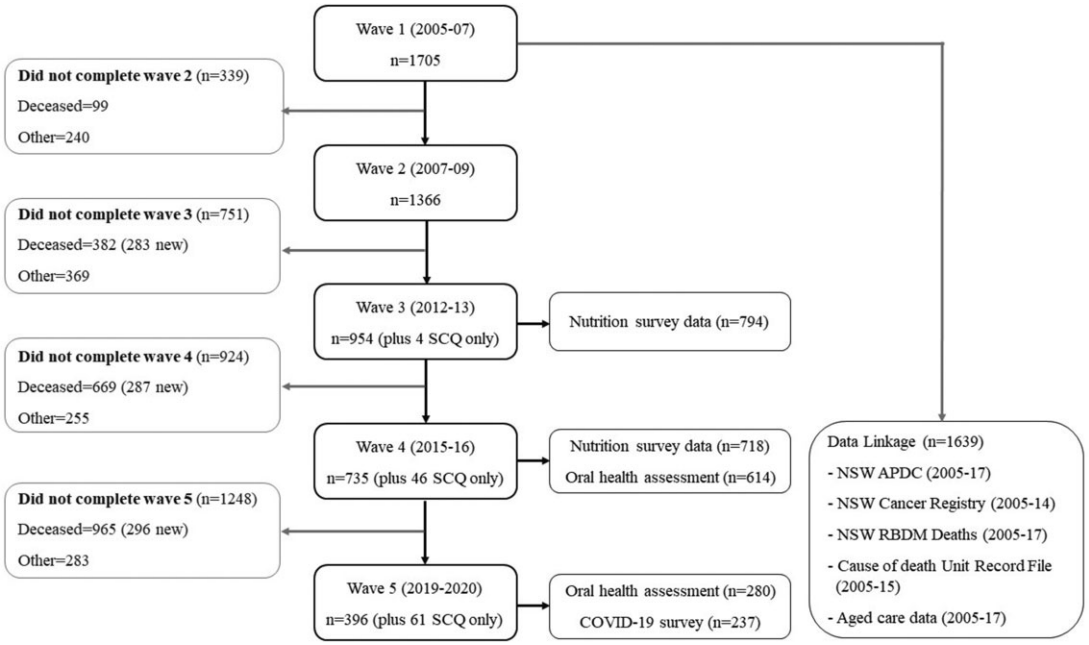

Figure 1 Participant attrition diagram for the Concord Health and Ageing in Men Project (CHAMP). SCQ, self-completed questionnaire; NSW, New South Wales; APDC, Admitted Patient Data Collection; RBDM, Registry of Births, Deaths, and Marriages

237 men have completed the survey by the end of data collection period (June 2021).

Of the 1705 participants who completed the baseline assessment (wave 1), 1639 men (96%) agreed to data linkage. Linkage hospital admission with records and aged care data is available up to December 2017, and linkage with NSW CCR is available up to December 2014. Mortality follow-up is available from January 2005 up to December 2017. The cause of death is obtained from the RBDM Cause of Death Unit Record File up to December 2015.

What has been measured?

The broad topics included at each wave are provided in Table 1. At waves 1, 2 and 3, participants completed a detailed questionnaire at home before coming to the study clinic at Concord Hospital. They then spent two to three hours at the study clinic where a series of tests were done, including dual energy X-ray densitometry (DEXA) to measure bone, fat and lean mass. Neuropsychological tests were done to identify people with cognitive impairment. Blood was taken for routine tests and then frozen and stored. Assays were done to measure vitamin D (wave 1), inflammatory cytokines (wave 3) and reproductive hormones (waves 1 to 3 and wave 5) and DNA was extracted (wave 1). Also, we now have a large frozen serum/plasma sample databank comprising nearly 4000 samples from across the 4 waves (waves 1 to 3 and wave 5) at which blood was sampled.

At wave 3, research dieticians collected dietary data at the participant's residence using the Sydney South West Area Health Service's outpatient diet history form, a standardized diet history questionnaire. The validity of the diet history questionnaire was assessed against a 4-day weighed food record collected in a subgroup of 56 CHAMP men.[22] A detailed description of the dietary data collection method has been reported previously.[23] Briefly, participants were asked questions about their usual dietary intake at different mealtimes during the previous 3 months, and quantities of foods consumed were ascertained through food models, photographs and household measures.

Wave 4 included all the core CHAMP measures except for DEXA and venepuncture. It also included dietary assessment and detailed oral health examination (Table 2). Due to the increased levels of poor health and frailty among CHAMP men, all the wave 4 assessments were performed in participants' residences, unless men preferred to come to the study clinic at Concord Hospital. Data were collected at two separate home visits, each lasting about one hour. The first visit included dietary assessment and physical/cognitive function assessment and the second visit was for oral examination.

Wave 5 included all the measures collected at wave 4 except for detailed dietary assessment; however, we collected dietary data using the Mini Nutritional Assessment

Table 1 Data collected at each wave of the Concord Health and Ageing in Men Project (CHAMP)

Measures	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
Self-completed/clinical questionnaires					
Demographic characteristics					
Age	X	X	X	X	X
Marital status	X	X	X	X	X
Living arrangement	X	X	X	X	X
Number of children	X				
Country of birth	X				
Parents' country of birth	X				
Ancestry		X			
Language speaks at home	X				
First learned English	X		X		
Socioeconomic indicators					
Education	X				
Occupation	X				
Employment status	X	X	X	X	X
Source of income	X	X	X	X	X
Housing arrangement	X	X	X	X	X
Finance					X
Health-related behaviour					
Alcohol use	X	X	X	X	X
Smoking	X	X	X	X	X
Physical activity	X	X	X	X	X
Sun exposure	X	X	X		
Oral health					
Use of oral health services				X	X
Oral health impact profile				X	
Physical health					
Medical history	X	X	X	X	X
Prostate health	X	X	X	X	X
Family's medical history	X	X	X		
Functional disability	X	X	X	X	X
Activities of daily living	X	X	X	X	X
Pain	X	X	X	X	X
Fractures[a]	X	X			
Hearing loss	X	X	X		
Psychological health					
Depressive symptoms	X	X	X	X	X
Anxiety	X	X	X	X	X
Loneliness					X
Health-related quality of life	X	X	X	X	X
Dietary data					
Diet history			X	X	
Mini Nutritional Assessment tool					X
Other					
Driving	X	X	X	X	X
Caregiving	X	X	X	X	X
Health service use	X	X	X	X	X
Social support	X	X	X	X	X
Internet use					X
Volunteering activities	X	X	X	X	X
Partner volunteering activities					X

(Continued)

Table 1 Continued

Measures	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
Health examination					
Anthropometry	X	X	X	X	X
Medications	X	X	X	X	X
Vision acuity/eyesight	X	X			X
Eye diseases	X	X	X		
Gait	X	X	X	X	X
Muscle strength	X	X	X	X	X
Neuromuscular function	X	X	X	X	X
Balance	X	X	X		
Spirometry	X	X			
Urinary function	X	X	X		
Sarcopenia	X	X	X		
Bone health	X	X	X		
Cognitive function	X	X	X	X	X
Cardiovascular system	X	X	X	X	
Hearing handicap inventory					X
Oral health				X	X
Blood tests					
Routine biochemistry and haematology	X	X	X		X
Bone metabolism	X				
Reproductive hormone	X	X	X		X
DNA	X				
Cytokines			X		

Most of the measures have remained largely the same during follow-ups, with some additions, removals and modifications to specific questions. Some measures such as cognition, neuromuscular function andhealth-related quality of life have been greatly reduced at follow-ups.

[a]Fractures after wave 2 identified by data linkage.

tool.[24] Measures on income, economics of health care, volunteering, loneliness, caregiving and receiving and internet use have been added. Like wave 4, wave 5 follow-up assessments were done in the participant's residence. Recently we sent a COVID-19 self-complete questionnaire to active participants in CHAMP. In this follow-up survey, we repeated assessments about social relationships and psychological health, with the addition of specific questions related to COVID-19 knowledge and practices, behavioural changes during pandemic and digital literacy (Table 2).

In 2017, CHAMP data were linked via the Centre for Health Record Linkage (CHeReL: www.cherel.org.au/) using probabilistic linkage methods to the NSW Admitted Patient Data Collection (APDC), NSW RBDM, the NSW Cause of Death Unit Record File and NSW CCR. The APDC includes records for all hospital separations (discharges, transfers and deaths) from all NSW public and private hospitals and day procedure centres. The APDC records include a range of demographic data items (e.g. date of birth, residential address, language spoken at home and country of birth), administrative items (e.g. admission and separation dates) and coded information (e.g. reason for admission, significant comorbidities and procedures performed during the admission). The CCR maintains records of all cases of cancer diagnosed in NSW residents and includes staging information and year of diagnosis. CHAMP data are also linked via the Australian Institute of Health and Welfare (AIHW: www.aihw.gov.au/) to the Pathways in Aged Care link map which covers aged care assessments and use of key aged care service programmes.

What has it found? Key findings and publications

CHAMP has published extensively on a broad range of ageing and geriatric health issues, especially frailty,[25–28] reproductive hormones,[29–32] osteoporosis[33,34] and medications.[28,35,36] By mid-November 2020, there were 114 publications in peer-reviewed journals. Here we highlight the key findings from analysis of the dietary, oral health and linkage data which give insights into the value of widening our data collection and research focus.

Using dietary assessment data of CHAMP men, we examined diet quality,[37,38] adequacy of nutrient intake[23] and change in micronutrient intake.[39] Diet quality was assessed by the Dietary Guideline Index (DGI-2013). More than half of participants were not meeting recommendations

Table 2 Additional data collected in the Concord Health and Ageing in Men Project (CHAMP) oral health assessment and COVID-19 survey

Oral health measurements	
Oral examination	Number of natural teeth
	Condition of soft tissues
	Type and condition of any dentures
	Examination of coronal and root surfaces of teeth:
	- presence of caries
	- type and condition of all restorations
	- presence of any exposure of roots
	- cervical and coronal wear
	- presence and position of restored and unrestored spaces
	- natural tooth contacts
	Periodontal examination:
	- presence and severity of tooth mobility, plaque, periodontal pocketing and loss of attachment
	Tongue coating thickness and dimension
Salivary flow measure	Assessment of salivary hypofunction
Oral health questionnaire	Preventative behaviours:
	- tooth brushing
	- interdental cleaning and mouth rinse use
	- name and brand of toothpaste and mouth rinse
	- professional application of fluoride
	Eating and chewing difficulties
	Dry mouth
	Perception of dry mouth (xerostomia)
	Dental service use
	Oral health-related quality of life
	Attitudes to oral health:
	- perceived importance of oral health
	- perception about the value of dental services
COVID-19 questionnaire	
	Experience related to COVID-19
	Knowledge about COVID-19
	Attitudes about COVID-19
	Sourcing information about COVID-19
	COVID-19-related practice
	COVID-19 impact
	Social contact

(under-consuming) for vegetables, dairy products and fluid but were over-consuming added sugar, saturated and unsaturated fat and discretionary foods. The main factors associated with DGI-2013 were education, income, smoking status and physical activity level.[37] We also showed that the Mediterranean dietary pattern, as assessed by the Mediterranean dietary pyramid score, appears to be a better measure of healthy diet among culturally diverse Australian men than DGI-2013.[38] In a cross-sectional analysis, we showed that dietary intakes were adequate for most nutrients in older age (protein, iron, zinc, riboflavin, calciumand vitamin D); however, only half of the participants met the Nutrition Risk Value of five or more key nutrients.[23] Using longitudinal dietary intake data from waves 3 and 4 of CHAMP, it was found that most of the micronutrient intake decreased over a 3-year follow-up time, but sodium intake increased.[39] The association between nutrient intakes and sarcopenia was dependent on the definition used for sarcopenia.[40] We also showed that inadequate antioxidant intake is associated with elevated depressive symptoms[41] and incident frailty.[42] There was no association between Australian and Mediterranean dietary patterns and depressive symptoms.[43]

Oral health status,[44] oral health behaviour[45] and chewing function[46] of CHAMP men have been well characterized. Among 614 men aged $\geq$78 years, the prevalence of edentulism was relatively low (14.7%). Just over 60% of CHAMP men had fewer than 20 natural teeth. Men had a mean of 13.8 missing teeth and 10.3 filled teeth.[44] Those in the low-income group had a higher rate of decayed teeth

and lower rate of filled teeth. Visiting a dental provider and dental check-up at least once per year or more was reported by 57% of men.[45] Among those with some natural teeth, 59% reported they brushed their teeth at least twice per day and 96% reported using standard fluoride toothpaste.[45] Twenty-one percent of CHAMP men had difficulty chewing hard foods, 23% reported discomfort when eating and 9% reported having had their meals interrupted because of problems with their teeth, mouth or denture. In cross-sectional analysis, chewing/eating difficulties were associated with dental status and self-rated dental health. General health conditions associated with chewing/eating difficulties included disability, physical activity, comorbidities, cognitive status and depression.[46] Most men viewed their oral health positively, however, those with objectively assessed oral health care needs did not perceive themselves as requiring dental treatment.[47] We also found, in cross-sectional analysis, that presence of dental caries was independently associated with frailty[48]; having fewer than 20 natural teeth or having chewing difficulties was associated with cognitive impairment[49]; and oral health conditions, chewing capacity and having three or more untreated decayed teeth were associated with depressive symptoms.[50]

Data linkage has enabled us to examine potential determinants of specific- and all-cause mortality, including socioeconomic position,[51,52] ethnicity,[53] sarcopenia,[54,55] sexual function[56] and caregiving.[57] Using the NSW APDC, we found that frailty increased the risk and number of non-elective hospitalizations[25]; low total cholesterol was associated with increased risk of major adverse cardiovascular events in men without known ischaemic heart disease, who were not taking statins[58]; and branched-chain amino acids were biomarkers for major adverse cardiovascular events, frailty and mortality.[59]

What are the main strengths and weaknesses?

The main strengths of CHAMP are the advanced age of the study participants, good retention of participants for more than 13 years and detailed interviews, questionnaires and comprehensive face-to-face health assessments, including oral health. Moreover, CHAMP includes men from diverse cultural backgrounds (20% born in Italy and 4% born in Greece). Repeated waves of data collection facilitate longitudinal analysis which facilitates causal pathway investigation. A further strength is record linkage with routinely collected data, which offers value addition to primary modes of CHAMP data collection. Data linkage provides a rich and continuous source of data that would be impossible to obtain by other means and enables us to understand better factors that influence disease, disability, death, health service use and trajectories of health and ageing.

One weakness inherent in the study design is that CHAMP is based on older men, so results may not apply to older women or younger adults. Another weakness is not including individuals living in a residential aged care facility at baseline. However, men continued to be involved in the study if they moved into an aged-care facility during follow-up.

Can I get hold of the data? Where can I find out more?

Some access restrictions apply to the data underlying this study's findings. Qualified researchers may submit a request to the CHAMP Management Committee [CHAMP@anzac.edu.au] and access will require additional ethics approval from the Sydney LHD HREC-CRGH. Researchers have to agree to conditions of access to the data through a data utilization form and use the data in compliance with human ethics committee (HREC) requirements

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Conflict of Interest

None declared.

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