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RESEARCH ARTICLE

Prevalence and predictors of multimorbidity among immigrant Asian Indian women residing in Sydney Australia: A cross-sectional study [version 1; peer review: awaiting peer review]

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Abstract

Abstract

Background: There has been a rise in multimorbidity as people age and technology advances which is challenging for health systems. Multimorbidity prevalence varies globally due to various biological and social risk factors which can be accentuated or mitigated for populations in migration. This study investigated the prevalence and predictors of multimorbidity amongst a group of migrant Asian Indian women living in Australia.

Methods: A cross-sectional descriptive study design using convenience sampling investigated the multimorbidity risk factors among first generation migrant Asian Indian women in Australia. This study was part of a larger study titled "Measuring Acculturation and Psychological Health of Senior Indian Women Living in Australia" that was conducted in Sydney, Australia. Data were collected using validated instruments as well as investigator developed questions. Women completed questionnaire surveys either by themselves or through the assistance of bilingual coordinators as English was not their first language.

Results: 26% of the participants had one chronic condition and 74% had multimorbidities. The prevalence of individual conditions included cardiovascular disease 67.0%, osteoarthritis 57.6%, depression 37.4%, diabetes 31.5%, chronic respiratory conditions 10.8%, cancer 4.9% and nephrological problems 1.47%. In the unadjusted model, factors such as increasing age, education level,

employment status, living arrangements, low physical activity, and elements of acculturative stress were significantly associated with multimorbidity. Multi-variable analysis identified the acculturative stress factor of threat to ethnic identity as a predictor of multimorbidity.

Conclusion: Identifying the key determinants of multimorbidity in older adults from a migrant community with pre-existing risk factors can assist with the development of culturally appropriate strategies to identify people at risk of health conditions and to mitigate the health effects of acculturative stress.

Keywords

Acculturation, Asian Indian, immigrant, multimorbidity, women

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Introduction

Advances in technology and increased awareness and treatment of diseases has enhanced the longevity of the world population, in particular women.¹ Currently 70% of those aged 90 or older and 60 % of those aged 70 or older are women.² Living longer is associated with an increased susceptibility to multimorbidity - the simultaneous occurrence of two or more chronic diseases.³ Global estimates of multimorbidity for people aged 65 years and older range from 12.9% to 95.1%,⁴⁻⁶ with 51% multimorbidity in the Australian population.⁷ The large prevalence variance indicates methodological differences in measurement globally.

Numerous studies have demonstrated that the prevalence of multimorbidity is higher in women compared to men.^{4,7-11} This difference might be related to biological, sociocultural, environmental, or economic factors. In particular, elderly women of lower socio-economic status have been reported to have the highest risk for multimorbidity.⁴ Research has seen a protective effect of estrogen on the development of certain chronic conditions such as heart disease, however the hormonal change post-menopause removes this protective effect and the risk increases significantly.¹² Nevertheless, as these factors vary globally, their associations with multimorbidity may differ across populations.

Burden of multimorbidity

Multimorbidity has a significant impact on patients, their families, the health care system and society in general.¹³ The evidence suggests a higher risk of mortality among those with multimorbidity.^{14,15} Similarly, the presence of multimorbidity increases the risk of hospitalizations,¹⁶⁻¹⁸ and causes a decrease in physical functioning¹⁹ and overall quality of life.^{7,20-22} In addition, multimorbidity increases polypharmacy²³⁻²⁵ and psychological distress²⁵⁻²⁸ resulting in substantial economic burden for health systems.¹⁴ Among those who are employed, multimorbidity is also associated with lower work productivity⁷ including a higher number of sick leave days and early retirement.^{27,29} For those unemployed, the odds of obtaining employment are lowered. All these factors place an immense burden on society.

Multimorbidity among South Asians

The magnitude of multimorbidity and the rise of noncommunicative diseases is rapidly increasing in developing countries. A systematic review of multimorbidity research in South Asia demonstrates that prevalence levels are up to 83%.²⁸ The number of chronic conditions reported for people in South Asia ranges from 7 to 22,²⁸ with the most common chronic conditions being hypertension, arthritis, diabetes, cardiac problems and skin diseases.²⁸ Fewer patients have reported the presence of stroke, cancer, renal disease, and depression.³⁰

Populations of South Asian background have been identified of having increased risk of cardiovascular disease and other chronic conditions,^{31,32} which could contribute to multimorbidity. The determinants of chronic diseases include a range of biological and societal factors which can persist when people from South Asia migrate overseas.^{33,34} In the United States, up to 32.4 % of Asian Indians had a combination of high cholesterol and hypertension which are risk factors for diabetes and coronary heart disease.³⁵ In a study undertaken among migrant Asian Indian women in Australia, over a third experienced obesity, hypertension and diabetes which was higher than the national average of hypertension incidence.³⁶

There is growing research about the effects of migration and acculturative stress on migrant populations, which can also have significant effect on those with pre-existing chronic health conditions. Acculturation is the process when individuals and groups from different cultures meet and adopt the attitudes, beliefs and behaviours of another culture.³⁷ This process can have positive or negative effects on the psychological and physical health of migrants.³⁸ Theories of the effect of acculturation on health have moved from one dimensional understandings to more sophisticated multi-dimensional models that outline the effects of various degrees of acquiring host culture and/or retaining heritage culture, and the development of acculturative stress associated with some of these variations.³⁹ There have been reports that the longer that migrants from low-middle income countries live in high income countries and adopt unhealthy behaviours, the more weight they can gain, but there are numerous factors affecting these outcomes including the negative effect of acculturative stress.³⁷ Migrant older women are seen to be more vulnerable to experiencing cultural change or acculturative stress when adjusting to a new society, as they can face more social isolation, changes in socioeconomic status and language barriers.^{36,40}

There have been limited studies which have examined the effect of acculturative stress on chronic health conditions in Indian migrant communities. Indian migrants who settle in Australia may face numerous difficulties as they settle in a new culture which is vastly different from their own.⁴¹ Acculturative stress and depression has been linked to having a negative effect on cardiovascular health and other chronic conditions with Asian Indian migrants in the United Kingdom.³³

In Australia, the Asian Indian born migrant population is the fastest growing minority group, and at the time of this study, there were an estimated 400,000 Indian born migrants living in Australia.⁴² However, there is limited information on

multimorbidity prevalence particularly among South Asian women residing in Australia. Therefore, this study aimed to investigate the prevalence and predictors of multimorbidity among migrant Asian Indian women in Australia. Identifying the key determinants of multimorbidity can assist in the development of culturally appropriate strategies to prevent and manage chronic morbidities.

Methods

Study design, setting and sample

A cross-sectional descriptive design using convenience sampling was conducted among migrant Asian Indian women in Australia. Ethical approval was obtained from the Local health district Human Research Ethics Committee. This study was part of a larger study titled “Measuring Acculturation and Psychological Health of Senior Indian Women Living in Australia” that was conducted in a metropolitan Local Health District (LHD) in Sydney, Australia during 2013. Non-probability sampling was used to recruit Asian Indian women who were members of the Resourceful Australian and Indian Network (RAIN). RAIN is a community organisation that was established in 2006 to provide support to migrants originally from the Indian subcontinent and at the time had a membership of 300.

A detailed description of the recruitment strategy has been presented elsewhere.⁴³ In brief, women were included in the study if they are aged between 50-100 years, spoke English, Hindi, Punjabi, Marathi, Gujarati and/or Tamil and were willing to complete a questionnaire. Women were informed about the project through an announcement being made and a flyer being distributed at a RAIN meeting. Women who expressed an interest were given a subject information sheet and asked if they preferred to self-administer a questionnaire survey in English or required the assistance of one of the bilingual coordinators who spoke their language and could assist them to undertake the surveys (see questionnaire <https://doi.org/10.5061/dryad.3r2280gfz>).

Data collection and study variables

The self-reported questionnaire was developed following intensive discussions with RAIN staff and multicultural health staff of the LHD along with a comprehensive literature review. The questionnaire consisted of items relating to demographic details (age, gender, country of birth, level of education, living arrangements, length of stay in Australia), smoking status, anthropometrics (height, weight, and waist circumference measured at the RAIN centre), and participation in physical activity (assessed using the Active Australia Survey (AAS)⁴⁴ with correlation coefficients: 0.71 to 0.86; and Spearman's Rho: 0.54 to 0.77⁴⁵). Acculturative stress was measured using the Multi-dimensional Acculturative Stress Scale (MASS)⁴⁶ which consisted of 24 items in five subscales. These sub-scales measured discrimination, threat to ethnic identity, lack of opportunities for occupational/financial mobility, homesickness, and language barriers. The items were rated on a four-point scale with 1 = disagree, 2 = to some extent disagree, 3 = to some extent agree, 4 = agree. Lower scores indicated a lower level of acculturative stress and higher scores showed higher levels of acculturative stress. The 24-items MASS had a coefficient alpha of .89 and the discrimination, threat to ethnic identity, lack of opportunities for occupational and financial mobility, homesickness and language barriers subscales had alphas of .82, .77, .87, .56, and .64, respectively. Depression was assessed using the PHQ 12 questionnaire developed for Asian Indians⁴⁷ which had an internal consistency scale of 0.88.

The presence of multimorbidity was measured through questions about prevalence of non-communicable chronic conditions (diabetes, high blood pressure, high cholesterol, cardiovascular disease, chronic respiratory conditions, osteoarthritis, depression, nephrological problems and cancer). Participants gave self-reported information which was verified through the assistance of the bilingual coordinators and through survey questions asking if they were taking any medications for the treatment of the same. Table 1 presents the definitions of the individual chronic conditions used in this study.

Statistical analysis

All analyses were completed using SPSS Version 25. Descriptive analyses (frequencies, percentages, means and standard deviations) were undertaken to assess the characteristics of the participants and associated outcomes. Multimorbidity was defined as the presence of more than one of the seven conditions in the same individual. Multimorbidity was then dichotomized as present or absent for assessing its relationship with the independent variables. Each of the individual conditions were coded as a binary response (0 = absent, 1 = present). The cumulative effect of the seven conditions (range 0 = absence of all seven conditions to 7 = all seven conditions present) were further dichotomized into presence or absence of multimorbidity, where multimorbidity was defined as the presence of two or more conditions (cumulative score of ≥ 2).

We assessed multicollinearity of covariates using Variance Inflation Factors (VIFs). The VIFs for all covariates that were included in the logistic regression analysis were less than 2.0. Associations between the covariates and multimorbidity

Table 1. Definition of chronic conditions included in the study.

Conditions	Definition
Diabetes	Self-report of diabetes and taking diabetetic medications (eg. insulin, hypoglycemic). <i>The diabetes condition was coded as "1" and its absence as "0".</i>
Cardiovascular disease (CVD) or 'heart problems'	Presence of any of the following conditions: <ul style="list-style-type: none"> • Self-report of "heart problems" or taking medication for 'heart condition (eg. Digoxin)' • Self-report of 'high blood pressure' or taking medications 'to control blood pressure' • Self-report of 'high blood cholesterol' or taking medications to 'control blood cholesterol'. • Self-report of 'stroke/Cerebro-vascular accident' or 'taking medications to prevent blood clots (eg. Aspirin)' <i>CVD was coded as "1" and its absence as "0".</i>
Chronic respiratory conditions	Self-report of 'chronic lung diseases', 'asthma' or taking medications 'for breathing difficulties'. <i>Chronic respiratory conditions were coded as "1" and its absence as "0".</i>
Osteoarthritis	Self-report of 'osteoporosis'. <i>Osteoarthritis was coded as "1" and its absence as "0".</i>
Cancer	Self-report of 'cancer' <i>Cancer was coded as "1" and its absence as "0".</i>
Nephrological problems	Self report of 'kidney failure' <i>Nephrological problems was coded as "1" and its absence as "0".</i>
Depression	Self-report of 'depression/anxiety' or taking medications 'for depression/anxiety' <i>Depression was coded as "1" and its absence as "0".</i>
Multimorbidity	Multimorbidity was defined as the presence of more than one of the seven conditions in the same individual. Multimorbidity was then dichotomized as present (i.e. 2-7 conditions) or absent (i.e., single or no condition) for assessing relationships with the independent variables.

were checked using a Chi-square test. All the co-variables with $p\text{-value} \leq 0.05$ with the dependent variables in univariate analysis were considered in the multivariable analysis.

Ethical approval

Ethical approval was obtained from the Local health district Human Research Ethics Committee (reference no HREC 12/282).

Consent for publication: Written informed consent to publish aggregate details of participants was obtained from the participants as part of the consent process.

Results

Sample characteristics

We included 203 immigrant women in the study, the majority of which were born in India, while a third came from other countries in the Indian diaspora (Kenya, South Africa, Fiji, East Africa, Malaysia, Pakistan, Sri Lanka). The mean age of the study participants was 66.11 (± 9.59) years, with 33% in the 50-60 and 61-70 years age groups, and 34% in the 70 + years age group. Most ascribed to the Hindu religion. Around half of the women reported to be married or living with their partner (56.7%) at the time of the survey. Of the total, only 24.1% recorded themselves as employed. In terms of education, 18.7% had received primary education, 39.4% secondary and 41.9% had gained a higher education. The length of stay in Australia ranged from < 1month to 42 years (mean 18 years). Of the surveyed participants, 28.1% had a history of alcohol consumption, 1% were smokers and 37.4% were physically active. A large proportion of women indicated use of both Indian and English languages with the majority speaking both Hindi and English. Fewer than half of the women spoke Gujarati.

Multimorbidity prevalence

Overall, 73.9% of the study participants had multiple chronic conditions and 26.1% were found to have one chronic condition. The prevalence of diabetes, cardiovascular disease, chronic respiratory conditions, osteoarthritic, depression, nephrological problems and cancer was 31.5%, 67.0%, 10.8%, 57.6%, 37.4%, 1.47%, and 4.9%, respectively (Table 2).

Table 2. Prevalence of chronic conditions and multiple morbidities among Asian Indian women immigrants.

	Diabetes	CVD	Chronic respiratory disease	Osteoarthritis	Depression	Nephrological problems	Cancer
Diabetes	64 (31.5%)	55 (27.09%)	2		29 (14.28%)		4
CVD		136 (67.0%)		77 (37.93%)	57 (28.07%)		
Chronic respiratory conditions		10 (4.92%)	22 (10.8%)		9 (4.43%)		0
Osteoarthritis	32 (15.76%)		14 (6.89%)	117 (57.6%)			
Depression				48 (23.64%)	76 (37.4%)		7 (3.44%)
Nephrological problems	2 (0.98%)	3 (1.47%)	0	2 (0.98%)	3 (1.47%)	3 (1.47%)	
Cancer		7 (3.44%)		7 (3.44%)		2 (0.98%)	10 (4.9%)
Multiple morbidities	150 (73.9%)						

Table 3. Factors associated with multimorbidity.

Variables	Presence of multimorbidity		p-value
	Yes	No	
Age group (years)			
<60	39 (26.0)	28 (52.8)	<0.001
60-70	49 (32.7)	18 (34.0)	
71 and higher	62 (42.3)	7 (13.2)	
Education status			
Primary	35 (23.3)	3 (5.7)	.006
Secondary	60 (40.0)	20 (37.7)	
Higher education	55 (36.7)	30 (56.6)	
Employment			
Yes	26 (17.3)	23 (43.4)	<0.001
No	124 (82.7)	30 (56.6)	
Living arrangement			
With partner	77 (51.3)	38 (71.7)	.015
Not with a partner	73 (48.7)	15 (28.3)	
Smoking habit			
Yes	2 (1.3)	53 (100.0)	.61
No	148 (98.7)	0 (0)	
Alcohol use			
Yes	43 (28.7)	14 (26.4)	.75
No	107 (71.3)	39 (73.6)	
Physical activity			
>150 minutes/week	48 (32.0)	28 (52.8)	<0.01
<150 minutes/week	102 (68.0)	25 (47.2)	
BMI			
<24	30 (23.3)	17 (37.8)	0.05
>25	99 (76.7)	28 (62.2)	
Acculturation stress			
<i>Employment opportunity</i>			
No	116 (77.3)	38 (71.7)	.41
Yes	34 (22.7)	15 (28.3)	
<i>Ethnic identity threat</i>			
No	104 (69.3)	52 (98.1)	<0.001
Yes	46 (30.7)	1 (1.9)	
<i>Language barrier</i>			
No	150 (100.0)	53 (100.0)	NS
Yes	0 (0)	0 (0)	
<i>Homesickness</i>			
No	117 (78.0)	49 (92.5)	.01
Yes	33 (22.0)	4 (7.5)	
<i>Cultural discrimination</i>			
No	115 (76.7)	44 (83.0)	.33
Yes	35 (23.3)	9 (17.0)	

Table 4. Predictors of multimorbidity in multivariate logistic regression analyses.

Variables	Unadjusted OR	Adjusted OR
Threat to ethnic identity		
No	1	1
Yes	6.23 (2.81-13.78)	5.67 (2.35-13.68)

Associates of multimorbidity

In our study sample, we observed significant differences between age group, education level, employment status, living arrangements, physical activity, the acculturative stress of threat to ethnic identity and homesickness, and the presence of multiple morbidities (Table 3). The multi-variable analysis identified threat to ethnic identity as a predictor for multimorbidity among the Immigrant Asian Indian women (Table 4).

Discussion

The aim of this study was to investigate the prevalence and predictors of multimorbidity amongst a group of immigrant Asian Indian women residing in Sydney, Australia. This is the first study that presents self-reported multimorbidity and its associates among this group. Identifying the key determinants of multimorbidity can assist with the development of culturally appropriate strategies that can identify people at risk of health conditions and recognise the impact of migration and other risk factors on their health.

Prevalence of multimorbidity

The study results demonstrate that the prevalence of multimorbidity was 74%. This result is much higher compared to the prevalence worldwide,³ in South Asia²⁶ and in the Australian population.⁴⁸ There was a high prevalence of the combined chronic conditions of cardiovascular disease 67.0% and osteoarthritis 57.6%, a combination which has been recorded in other studies.³ The high prevalence of cardiovascular disease among Asian Indians has been reported in the literature.³² Among this sample group, the high prevalence could be due to the consumption of a carbohydrate dense diet and lack of physical activity when living in a new country.^{33,49–51}

A potential cause for higher prevalence of multimorbidity could be because the women were members of the RAIN group which provides social support to women, and as a result the women felt more confident to share their health conditions. In addition, the data were collected using self-reports which may have reduced accuracy,^{48,52} and that women may have a higher tendency to share their conditions in self-reports.^{47,53}

Other influences for this excess multimorbidity in women could be higher exposure to biological and sociocultural risk factors for non-communicable diseases or gender inequality in access to healthcare.^{4,9,10,32,36,37,41} Results from this study demonstrated that older women had a higher prevalence of multimorbidity which is consistent with the literature.^{4,7} The increase in life expectancy means that older adults experience a higher incidence of aging conditions such as diabetes, CVD and osteoarthritis.³

Correlations with multimorbidity

There was a significant correlation between multimorbidity and the factors of increasing age, low education, being unemployed, living alone, lack of physical activity, threat to ethnic identity and homesickness. Women with higher education levels had a lower prevalence of multimorbidity. It could be postulated that women with higher educations have higher incomes, access to better quality food, and access to medications thus leading to improved quality of life and lower prevalence of multimorbidity. Research has also indicated the effects of lower socio-economic status on multimorbidity.^{7,54}

Three quarters of the women who did **not** have multimorbidity were married or living with a partner. It has been well established that a partner is form of social support and that the presence of a personal relationship leads to better health outcomes⁵⁵ particularly among older adults. The absence of a partner could indicate a lower level of support particularly in attending medical appointments and obtaining medications for health conditions. What is known is that migrants may struggle in relation to chronic conditions as patient self-management may be an unfamiliar concept^{63,33}; especially for older migrants, and women who are living alone.⁶⁴ For the Indian women, living alone could also be an indication of widowhood and possible cultural stigma.^{43,50} For Indian women who have been widowed, traditional Hindu expectations and taboos may contribute to social isolation.⁵⁶

Physical activity continues to remain the corner stone of overall health and wellbeing. The risks of being physically inactive in relation to multimorbidity have been reported.^{7,57–60} Numerous studies have reported that participation in physical activity reduces the risk of diabetes, blood pressure, cardiovascular disease and arthritis.^{61,62} It is no wonder in our study that there was a low prevalence of multimorbidity among those who participated in physical activity. The link between acculturative stress and increased settlement time on obesity suggests that health interventions should target first generation migrants to promote retention of their original healthy behaviours.³⁷

The results also demonstrated an association of multimorbidity and the acculturative stress factor of homesickness. This acculturation stress is intensified by the existence of cardiovascular disease and frequency of modifiable risk factors⁴⁹ especially for women. Add gap between footnote numbers.^{63,64}

Multi-variable analysis of predictor for multimorbidity

The multi-variable analysis identified threat to ethnic identity as a predictor for multimorbidity. This factor is one of the components taken from the MASS acculturation scale survey and includes the indicators of feeling sad when not seeing cultural roots in this society; losing Indian identity; feeling neither Indian nor Australian; feeling divided between India and Australia; and worrying that the next generation will become very broad minded.⁴⁶ The impact of cultural displacement and acculturative stress on health^{64,65} and mental health⁶⁶ has been noted in research. Feelings of being divided between the host and native country can contribute to being marginalised in the acculturation model, a psychological state which produces the most stress.³⁹ This confirms the other reported results of this research stating that the senior Indian women experienced feelings of cultural stigma and thus social isolation.⁴³

Addressing risk factors

Although non-modifiable risk factors such as age play a significant role in the prevalence of multimorbidity, modifiable risk factors can be addressed. This includes considering the impact of adjusting to a new culture, loss in networks, family support, lifestyle/physical activity, and lack of employment on health.⁶⁷ Public health intervention strategies and community support need to be tailored to the cultural background of the women and recognise the impact of acculturative stress and homesickness to ensure healthy and active ageing.⁵¹

Community focused strategies to address multiple chronic conditions should take an integrated approach including increasing the knowledge and skills of the older Indian population in preventing and managing cardiovascular disease, diabetes, depression, and arthritis; facilitate interventions targeting emotional health and wellbeing to improve self-confidence; and promoting culturally and linguistically relevant health resources to the community.

Health practitioners should be informed about the psychosocial and cultural issues amongst older Indian women; develop partnerships between multicultural health service providers for ongoing dialogue of specific community health needs; develop multidisciplinary management packages and care plans for chronic multimorbid conditions; and tailor self-management programs and coaching programs to the patient's cultural and linguistic background and level of health literacy.⁶⁸

Reducing acculturative stress could be addressed through linking and referring vulnerable individuals to existing Indian and culturally appropriate social support services. Acculturation studies have indicated integration to Australian society while also maintaining strong connections with cultural traditions incur the best outcomes for psychological wellbeing.^{39,69}

Strengths and limitations

Some of the strengths of this study include data collection in a variety of languages of the participants by trained data collectors. In addition, the use of validated questionnaires added to the robustness of the study. Despite the evidence presented, some of the limitations inherent in undertaking such a study need to be acknowledged. Firstly, the sample comprised of only 203 women from a single community organisation. Hence further research using larger samples from the wider Indian diaspora in Australia is needed. The data collected was self-reported data, hence participants may have overestimated the severity of their illnesses. It is worth mentioning that this information is related to data collected approximately 10 years ago at a subnational level.

Further research is needed to address the multidimensional factors contributing to multimorbidity especially for older adult migrants to prevent poor health outcomes. The effect of acculturative stress on multimorbidity is an area that should be further researched. While this study examined a range of factors, the effects of having a low English proficiency for migrants should be further examined.

Conclusion

Risk factors contributing to increased multimorbidity is a growing area of research which will assist in containing its human and economic costs. Although the evidence base for the link between acculturative stress and multimorbidity needs to be further developed and much more research is still needed beyond just self-reports, current best practice should focus on the culturally responsive prevention and management program for chronic multimorbidity and older migrants who may have pre-existing risk factors.

Authors' contribution

Conceived and designed the study: COC, UNY, RF, SN and SS. Performed field work: SN, SS, RF and COC. Analysed data in the present study: COC, UNY and RF. Initial draft preparation: UNY, RF and COC. All authors read and approved the final manuscript.

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Data availability

Free access to de-identified individual data is restricted for ethical reasons as i) doing so may potentially identify the psychological and physical health details of individuals from a minority population; and ii) the investigators have not sought approval of the patients to share the raw data and have informed them that data will be published in aggregate. The South Eastern Sydney Local Health District's Human Ethics Committee have approved these prohibitions (reference no HREC 12/282, SESLHD-RSO@health.nsw.gov.au).

Extended data

Dryad: Measuring Acculturation and Health of Indian Women Living in Australia (MAHILA) study questionnaire. <https://doi.org/10.5061/dryad.3r2280gfz>.⁷⁰

This project contains the following extended data.

- MAHILA_questionnaire.pdf (a copy of the questionnaire given to participants).

Data are available under the terms of the [Creative Commons Zero "No rights reserved" data waiver](#) (CC0 1.0 Public domain dedication).

References

1. Lunenfeld B, Stratton P: **The clinical consequences of an ageing world and preventive strategies.** *Best Pract Res Clin Obstet Gynaecol.* 2013; **27**(5): 643–59.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
2. World Health Organization: **10 facts on health inequities and their causes.** Im Internet, 2011.
[Reference Source](#)
3. Harrison C, Britt H, Miller G, *et al.*: **Examining different measures of multimorbidity, using a large prospective cross-sectional study in Australian general practice.** *BMJ open.* 2014; **4**(7).
[Publisher Full Text](#)
4. Violan C, Foguet-Boreu Q, Flores-Mateo G, *et al.*: **Prevalence, determinants and patterns of multimorbidity in primary care: a systematic review of observational studies.** *PLoS One.* 2014; **9**(7): e102149.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
5. Van Oostrom SH, Picavet HSJ, Van Gelder BM, *et al.*: **Multimorbidity and comorbidity in the Dutch population—data from general practices.** *BMC Public Health.* 2012; **12**(1): 715.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
6. Formiga F, Ferrer A, Sanz H, *et al.*: **Patterns of comorbidity and multimorbidity in the oldest old: the Octabaix study.** *Eur J Intern Med.* 2013; **24**(1): 40–4.
[PubMed Abstract](#) | [Publisher Full Text](#)
7. Australian Institute of Health and Welfare: *Chronic conditions and multimorbidity.* Canberra: Australian Government, 2020.
[Reference Source](#)
8. Alimohammadian M, Majidi A, Yaseri M, *et al.*: **Multimorbidity as an important issue among women: results of a gender difference investigation in a large population-based cross-sectional study in West Asia.** *BMJ open.* 2017; **7**(5): e013548.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
9. Almagro P, Ponce A, Komal S, *et al.*: **Multimorbidity gender patterns in hospitalized elderly patients.** *PLoS One.* 2020; **15**(1): e0227252.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
10. Xu X, Mishra GD, Dobson AJ, *et al.*: **Progression of diabetes, heart disease, and stroke multimorbidity in middle-aged women: A 20-year cohort study.** *PLoS Med.* 2018; **15**(3): e1002516.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

11. Low LL, Kwan YH, Ko MSM, *et al.*: **Epidemiologic characteristics of multimorbidity and sociodemographic factors associated with multimorbidity in a rapidly aging asian country.** *JAMA Network Open.* 2019; 2(11): e1915245-e.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
12. Pathak LA, Shirodkar S, Ruparelia R, *et al.*: **Coronary artery disease in women.** *Indian Heart J.* 2017; 69(4): 532–8.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
13. Oni T, Unwin N: **Why the communicable/non-communicable disease dichotomy is problematic for public health control strategies: implications of multimorbidity for health systems in an era of health transition.** *Int. Health.* 2015; 7(6): 390–9.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
14. Hurst JR, Agarwal G, van Boven JFM, *et al.*: **Critical review of multimorbidity outcome measures suitable for low-income and middle-income country settings: perspectives from the Global Alliance for Chronic Diseases (GACD) researchers.** *BMJ Open.* 2020; 10(9): e037079.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
15. Bowling CB, Plantinga L, Phillips LS, *et al.*: **Association of multimorbidity with mortality and healthcare utilization in chronic kidney disease.** *J Am Geriatr Soc.* 2017; 65(4): 704–11.
[PubMed Abstract](#) | [Publisher Full Text](#)
16. Lea M, Mowe M, Mathiesen L, *et al.*: **Prevalence and risk factors of drug-related hospitalizations in multimorbid patients admitted to an internal medicine ward.** *PLoS One.* 2019; 14(7): e0220071.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
17. Gruneir A, Bronskill SE, Maxwell CJ, *et al.*: **The association between multimorbidity and hospitalization is modified by individual demographics and physician continuity of care: a retrospective cohort study.** *BMC Health Serv Res.* 2016; 16(1): 154.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
18. Wen Y-C, Chen L-K, Hsiao F-Y: **Predicting mortality and hospitalization of older adults by the multimorbidity frailty index.** *PLoS One.* 2017; 12(11): e0187825.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
19. Wei MY, Kabeto MU, Galecki AT, *et al.*: **Physical functioning decline and mortality in older adults with multimorbidity: joint modeling of longitudinal and survival data.** *J Gerontol A Biol Sci Med Sci.* 2019; 74(2): 226–32.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
20. Williams JS, Egede LE: **The association between multimorbidity and quality of life, health status and functional disability.** *Am J Med Sci.* 2016; 352(1): 45–52.
[PubMed Abstract](#) | [Publisher Full Text](#)
21. Shad B, Ashouri A, Hasandokht T, *et al.*: **Effect of multimorbidity on quality of life in adult with cardiovascular disease: a cross-sectional study.** *Health Qual. Life Outcomes.* 2017; 15(1): 1–8.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
22. Kanesarajah J, Waller M, Whitty JA, *et al.*: **Multimorbidity and quality of life at mid-life: A systematic review of general population studies.** *Maturitas.* 2018; 109: 53–62.
[PubMed Abstract](#) | [Publisher Full Text](#)
23. Mc Namara KP, Breken BD, Alzubaidi HT, *et al.*: **Health professional perspectives on the management of multimorbidity and polypharmacy for older patients in Australia.** *Age Ageing.* 2017; 46(2): 291–9.
[PubMed Abstract](#) | [Publisher Full Text](#)
24. van den Akker M, Vaes B, Goderis G, *et al.*: **Trends in multimorbidity and polypharmacy in the Flemish-Belgian population between 2000 and 2015.** *PLoS One.* 2019; 14(2): e0212046.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
25. Holvast F, van Hattem BA, Sinnige J, *et al.*: **Late-life depression and the association with multimorbidity and polypharmacy: a cross-sectional study.** *Fam Pract.* 2017; 34(5): 539–45.
[PubMed Abstract](#) | [Publisher Full Text](#)
26. Assari S, Smith J, Bazargan M: **Depression fully mediates the effect of multimorbidity on self-rated health for economically disadvantaged African American men but not women.** *Int J Environ Res Public Health.* 2019; 16(10): 1670.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
27. Yeung P, Severinsen C, Good G, *et al.*: **Social environment and quality of life among older people with diabetes and multiple chronic illnesses in New Zealand: Intermediary effects of psychosocial support and constraints.** *Disabil Rehabil.* 2020; 1–13.
[PubMed Abstract](#) | [Publisher Full Text](#)
28. Pati S, Swain S, Hussain MA, *et al.*: **Prevalence and outcomes of multimorbidity in South Asia: a systematic review.** *BMJ Open.* 2015; 5(10): e007235.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
29. Sum G, Ishida M, Koh GC-H, *et al.*: **Implications of multimorbidity on healthcare utilisation and work productivity by socioeconomic groups: Cross-sectional analyses of Australia and Japan.** *PLoS One.* 2020; 15(4): e0232281.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
30. Pati S, Hussain MA, Swain S, *et al.*: **Development and validation of a questionnaire to assess multimorbidity in primary care: an Indian experience.** *Biomed Res. Int.* 2016; 2016.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
31. Patel V, Chatterji S, Chisholm D, *et al.*: **Chronic diseases and injuries in India.** *Lancet.* 2011; 377: 413–28.
[Publisher Full Text](#)
32. Mahajan D, Bermingham M: **Risk factors for coronary heart disease in two similar Indian population groups, one residing in India, and the other in Sydney, Australia.** *Eur J Clin Nutr.* 2004; 58(5): 751–60.
[PubMed Abstract](#) | [Publisher Full Text](#)
33. Mohan S, Wilkes L, Jackson D: **Lifestyle of Asian Indians with coronary heart disease: The Australian context.** *Collegian.* 2008; 15: 115–21.
[PubMed Abstract](#) | [Publisher Full Text](#)
34. Sathe A, Flowers E, Mathur A, *et al.*: **A culturally specific health coaching program targeting cardiovascular disease risk in South Asians: rationale, design, and baseline data.** *Ethn Dis.* 2013; 23(3): 304–9.
[PubMed Abstract](#)
35. Zhang Y, Misra R, Sambamoorthi U: **Prevalence of Multimorbidity among Asian Indian, Chinese, and Non-Hispanic White Adults in the United States.** *Int J Environ Res Public Health.* 2020; 17(9): 3336.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
36. Fernandez R, Rolley JX, Rajaratnam R, *et al.*: **Risk factors for coronary heart disease among Asian Indians living in Australia.** *J Transcult Nurs.* 2015; 26(1): 57–63.
[PubMed Abstract](#) | [Publisher Full Text](#)
37. Alidu L, Grunfeld E: **A systematic review of acculturation, obesity and health behaviours among migrants to high-income countries.** *Psychol Health.* 2018; 33(6): 724–45.
[PubMed Abstract](#) | [Publisher Full Text](#)
38. Abraido-Lanza A, Armbrister A, Flórez K, *et al.*: **Toward a theory-driven model of acculturation in public health research.** *Am J Public Health.* 2006; 96(8): 1342–6.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
39. Berry J: **Immigration, acculturation, and adaptation.** *Appl Psychol.* 1997; 46(1): 5–34.
[Publisher Full Text](#)
40. Greenwood R, Adshead M, Jay S: **Immigrant Women's Experiences of Acculturative Stress: Ordinary Privileges, Overt Discrimination, and Psychological Well-Being.** *Psychol Women Q.* 2017; 41(4): 497–512.
[Publisher Full Text](#)
41. Stoddart B, Weigold A: *India and Australia: Bridging Different Worlds.* New Delhi: Readworthy Publications; 2011.
42. Statistics ABo: *Migration, Australia, 2011–12 and 2012–13.* Author Canberra: ACT; 2013.
43. Fernandez R, O'Callaghan C, Loukas P, *et al.*: **Measuring Acculturation and Psychological Health of Senior Indian Women Living in Australia (MAHILA).** 2014.
44. Armstrong T, Bauman AE, Davies J: **Physical activity patterns of Australian adults: results of the 1999 National Physical Activity Survey.** Australian Institute of Health and Welfare. 2000.
45. Australian Institute of Health and Welfare: **The Active Australia Survey: a guide and manual for implementation, analysis and reporting.** Australian Institute of Health and Welfare. 2003.
46. Jibeen T, Khalid R: **Development and preliminary validation of multidimensional acculturative stress scale for Pakistani immigrants in Toronto, Canada.** *IJIR.* 2010; 34(3): 233–43.
[Publisher Full Text](#)
47. Poongothai S, Pradeepa R, Ganesan A, *et al.*: **Reliability and validity of a modified PHQ-9 item inventory (PHQ-12) as a screening instrument for assessing depression in Asian Indians (CURES65).** *JAPI.* 2009; 57: 1–6.
[PubMed Abstract](#)
48. Lujic S, Simpson J, Zwar N, *et al.*: **Multimorbidity in Australia: Comparing estimates derived using administrative data sources and survey data.** *PLoS ONE.* 2017; 12(8).
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
49. Fernandez R, Rolley JX, Rajaratnam R, *et al.*: **Reducing the risk of heart disease among Indian Australians: knowledge, attitudes, and beliefs regarding food practices—a focus group study.** *Food Nutr Res.* 2015; 59(1): 25770.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
50. South Eastern Sydney Local Health District, Hurstville City Council, Resourceful Australian Indian Network: **Making new lives: wellbeing of senior women of Indian backgrounds in Sydney.**

- Sydney, Australia: Multicultural Health Service, South Eastern Sydney Local Health District (SESLHD); 2015.
51. Fernandez R, Everett B, Miranda C, *et al.*: **Migratory implications for coronary heart disease risk prevention in Asian Indians: Evidence from the leading health indicators.** *J Cult Divers.* 2015; **22**(1).
[PubMed Abstract](#)
 52. Marengonia A, Anglemana S, Melisa R, *et al.*: **Aging with multimorbidity: A systematic review of the literature.** *Ageing Res. Rev.* 2011; **10**: 430–9.
[PubMed Abstract](#) | [Publisher Full Text](#)
 53. Australian Bureau of Statistics: **Migration, Australia, 2011–12 and 2012–13.** Canberra: ACT; 2013.
 54. Krueger P, Tran M, Hummer R, *et al.*: **Mortality attributable to low levels of education in the United States.** *PLoS One.* 2015; **10**(7).
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 55. Feeney BC, Collins NL: **A new look at social support: A theoretical perspective on thriving through relationships.** *Pers Soc Psychol Rev.* 2015; **19**(2): 113–47.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 56. Sreerupa R: **Gender and Widowhood: Disparity in Health Status and Health Care Utilization Among the Aged in India.** *J Ethn Cult Divers Soc Work.* 2010; **19**(4): 287–304.
[Publisher Full Text](#)
 57. Price K, Gill TK, Adams R, *et al.*: **Multimorbidity - not just an older person's issue. Results from an Australian biomedical study.** *BMC Public Health.* 2010; **10**: 718.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 58. Autenrieth CS, Kirchberger I, Heier M, *et al.*: **Physical activity is inversely associated with multimorbidity in elderly men: results from the KORA-Age Augsburg Study.** *Prev Med.* 2013; **57**(1): 17–9.
[PubMed Abstract](#) | [Publisher Full Text](#)
 59. Taylor A, Price K, Gill T, *et al.*: **Multimorbidity - not just an older person's issue. Results from an Australian biomedical study.** *BMC Public Health.* 2010; **10**: 718.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 60. Sakib M, Shoostari S, St John P, *et al.*: **The prevalence of multimorbidity and associations with lifestyle factors among middle-aged Canadians: an analysis of Canadian Longitudinal Study on Aging data.** *BMC Public Health.* 2019; **19**(1): 243.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 61. Ferraro R, Pallazola V, Michos E: **Physical activity, CVD, and older adults.** *Ageing.* 2019; **11**(9): 2545.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 62. Liu X, Tedeschi S, Lu B, *et al.*: **Long-term physical activity and subsequent risk for rheumatoid arthritis among women: a prospective cohort study.** *Arthritis Rheumatol.* Sep 2019; **71**(9): 1460–71.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 63. Cauquelin J, Lim P, Mayer-König B: *Asian values: Encounter with diversity.* Routledge. 2014.
 64. Sundquist J, Winkleby M: **Country of birth, acculturation status and abdominal obesity in a national sample of Mexican-American women and men.** *Int J Epidemiol.* 2000; **29**(3): 470–7.
[PubMed Abstract](#)
 65. Lommel L, Thompson L, Chen J, *et al.*: **Acculturation, Inflammation, and Self-rated Health in Mexican American Immigrants.** *J Immigr Minor Health.* 2019; **21**: 1052–60.
[PubMed Abstract](#) | [Publisher Full Text](#)
 66. Minas H, Kakuma R, Too L, *et al.*: **Mental health research and evaluation in multicultural Australia: Developing a culture of inclusion.** *BioMed Central.* 2012.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 67. Australian Institute of Health and Welfare: **Women and heart disease: cardiovascular profile of women in Australia.** Canberra: 2010.
 68. Harris M, Harris-Roxas B, AW K: **Care of patients with chronic disease: achievements in Australia over the past decade.** *Med J Aust.* 2018; **209**(2): 55–7.
[PubMed Abstract](#) | [Publisher Full Text](#)
 69. Sam D, Berry J: **Acculturation when individuals and groups of different cultural backgrounds meet.** *Perspect Psychol Sci.* 2010; **5**(4): 472–81.
[PubMed Abstract](#) | [Publisher Full Text](#)
 70. O'Callaghan C, *et al.*: **Measuring Acculturation and Health of Indian Women Living in Australia (MAHILA) study questionnaire.** *Dryad, Dataset.* 2021.
[Publisher Full Text](#)

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