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

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

This article is included in the Human Migration Research gateway.
Introduction

Advances in technology and increased awareness and treatment of diseases has enhanced the longevity of the world population, in particular women. Currently 70% of those aged 90 or older and 60% of those aged 70 or older are women. Living longer is associated with an increased susceptibility to multimorbidity - the simultaneous occurrence of two or more chronic diseases. Global estimates of multimorbidity for people aged 65 years and older range from 12.9% to 95.1%, with 51% multimorbidity in the Australian population. 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. 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. 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. 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. The evidence suggests a higher risk of mortality among those with multimorbidity. Similarly, the presence of multimorbidity increases the risk of hospitalizations and causes a decrease in physical functioning and overall quality of life. In addition, multimorbidity increases polypharmacy and psychological distress resulting in substantial economic burden for health systems. Among those who are employed, multimorbidity is also associated with lower work productivity including a higher number of sick leave days and early retirement. 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%. The number of chronic conditions reported for people in South Asia ranges from 7 to 22, with the most common chronic conditions being hypertension, arthritis, diabetes, cardiac problems and skin diseases. Fewer patients have reported the presence of stroke, cancer, renal disease, and depression.

Populations of South Asian background have been identified of having increased risk of cardiovascular disease and other chronic conditions, 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. 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. 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.

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. This process can have positive or negative effects on the psychological and physical health of migrants. Theories of the effect of acculturation on health have moved from one dimensional understandings to more sophisticated multidimensional 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. 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. 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.

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. 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.

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. 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. 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) with correlation coefficients: 0.71 to 0.86; and Spearman's Rho: 0.54 to 0.77). Acculturative stress was measured using the Multi-dimensional Acculturative Stress Scale (MASS) 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 Indians 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...
were checked using a Chi-square test. All the co-variates with p-value ≤ 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, osteoarthritis, 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.

<table>
<thead>
<tr>
<th></th>
<th>Diabetes</th>
<th>CVD</th>
<th>Chronic respiratory disease</th>
<th>Osteoarthritis</th>
<th>Depression</th>
<th>Nephrological problems</th>
<th>Cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>64 (31.5%)</td>
<td>55 (27.09%)</td>
<td>2</td>
<td>2</td>
<td>29 (14.28%)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CVD</td>
<td>136 (67.0%)</td>
<td>77 (37.93%)</td>
<td>57 (28.07%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic respiratory conditions</td>
<td>10 (4.92%)</td>
<td>22 (10.8%)</td>
<td>9 (4.43%)</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>32 (15.76%)</td>
<td>14 (6.89%)</td>
<td>117 (57.6%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>48 (23.64%)</td>
<td>76 (37.4%)</td>
<td>7 (3.44%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nephrological problems</td>
<td>2 (0.98%)</td>
<td>3 (1.47%)</td>
<td>0</td>
<td>2 (0.98%)</td>
<td>3 (1.47%)</td>
<td>3 (1.47%)</td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td>7 (3.44%)</td>
<td>7 (3.44%)</td>
<td>2 (0.98%)</td>
<td></td>
<td></td>
<td>10 (4.9%)</td>
<td></td>
</tr>
<tr>
<td>Multiple morbidities</td>
<td>150 (73.9%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 3. Factors associated with multimorbidity.

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

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 outcomes5 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 concept63,33; 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.50

<table>
<thead>
<tr>
<th>Variables</th>
<th>Unadjusted OR</th>
<th>Adjusted OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threat to ethnic identity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Yes</td>
<td>6.23 (2.81-13.78)</td>
<td>5.67 (2.35-13.68)</td>
</tr>
</tbody>
</table>

Table 4. Predictors of multimorbidity in multivariate logistic regression analyses.
Physical activity continues to remain the cornerstone of overall health and wellbeing. The risks of being physically inactive in relation to multimorbidity have been reported. Numerous studies have reported that participation in physical activity reduces the risk of diabetes, blood pressure, cardiovascular disease and arthritis. 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.

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 factors especially for women.

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. The impact of cultural displacement and acculturative stress on health and mental health 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. This confirms the other reported results of this research stating that the senior Indian women experienced feelings of cultural stigma and thus social isolation.

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. 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.

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.

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.

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.3r2280gtf.

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).

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