

## Diabetes &amp; its Complications

## A Systematic Review of Culturally-Appropriate Population Strategies to Reduce Diabetes Burden among the Middle Eastern Population in New South Wales, Australia

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**ABSTRACT**

**Objectives:** (1) Examine past and current risk reduction/awareness strategies implemented among Middle Eastern populations in Australia with a focus on New South Wales (NSW), (2) evaluate contributing risk factors between diabetes and the Middle Eastern nationality, and (3) propose new risk reduction/awareness strategies for diabetes in NSW, Australia with an emphasis on high prevalence areas.

**Research Design & Methods:** A systematic review from freely available information from both literature and non-literature sources. Selected papers had to include interventions involving cultural aspects on lifestyle improvements. Outcomes included qualitative or quantitative reports of increased patient satisfaction, patient sense of self-management, weight-loss or changes in HbA1c. Studies included in this review had to (1) be from January 1995 onwards, (2) be carried out in Australia and (3) involve a Middle Eastern target audience. Five studies of pilot interventions in Australia involving culturally-specific means were identified and selected.

**Results:** Five small-scale community programs using Middle Eastern-specific groups (involving dance, swimming, fitness or nutrition) were introduced with varying successes in different cohorts. One intervention reported changes in weight and waist circumference respectively whilst the remaining interventions were not appropriately followed up.

**Conclusion:** Recruiting and training bilingual teachers can have clinically significant changes in weight scores in high-risk type II diabetes patients and weight reduction as well as increase overall patient knowledge. Further Australian trials including scale cohorts and higher quality end-point studies are encouraged in this area.

**Keywords**

Quality of Life, Middle East, Arabic, Afghan, cultural, culture, diabetes, nutrition, health outcomes, Fairfield, Liverpool, New South Wales, community, Muslim.

**Introduction**

Diabetes mellitus (DM) is classified as a chronic progressive metabolic disorder characterized by hyperglycemia caused by either absolute (Type 1) or relative (Type 2) deficiency of insulin

[1-3]. Given the seriousness of the disease and its consequent impact on the entire body, DM is associated with several complications that can result in mortality such as microvasculature complications, cardiovascular diseases, neuropathy and nephropathy (microalbuminuria and macroalbuminuria) [4-8]. In addition to the detrimental impacts of DM on patient quality of life, diabetes also presents a tremendous economic burden on the healthcare system. In the US, diabetes accounted for \$218 billion in both direct and indirect costs in 2007 [9]. The total annual cost

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impact of diabetes in Australia is estimated at \$14.6 billion and type 2 diabetes accounts for 85% of all diabetes and is increasing 16. Of this, 58 % of type 2 diabetes can be prevented or delayed with regular exercise and a healthy diet regimen [17].

Non-pharmacological therapies such as psychological support and structured educational programs are considered essential for improving quality of life, patient motivation and self-empowerment through improved glycaemic control [10-12]. Some of these programs include the Dose Adjustment for Normal Eating (DAFNE) [13], the Diabetes Education and Self-Management for Ongoing and Newly Diagnosed (DESMOND) [14,15] program and Düsseldorf structured teaching and treatment program (STTP) [16], which have shown not only cost-effectiveness of such programs [17], but also extensive long-term positive health and psychological outcomes within randomised controlled trials (RCTs) [12], as well as greater improvements in weight loss and smoking cessation [14]. The introduction of holistic care by a multi-disciplinary team (MDT) in primary and secondary care has allowed patients to actively self-manage their condition and engage in the decision-making process with health-care professionals. Specifically, in the context of diabetes, emphasis has been placed on reducing individual glycemic targets according to personalized performances and comorbidities such as weight, cardiovascular disease risk, etc.

The last two decades have shown an increase in the development and major advances in technology regarding monitoring accurate glucose levels and targeted therapeutic approaches. However, the literature does not show culturally-specific programs and their effectiveness as a non-pharmacological therapy in reducing the prevalence of diabetes in ethnic groups susceptible to the chronic condition. Ethnicity has always been understood in medical literature as an important confounder in determining the severity and onset of diabetes. In fact, previous studies have demonstrated that bilingual educational care could significantly reduce mean HbA1C levels in patients with poorly controlled blood glucose levels and of African-American and non-White Hispanic people [18,19]. It is generally acknowledged that Type 2 DM is up to six-times more likely in people of South Asian descent and up to three-times more likely in African and Caribbean people [20]. Previous studies have focused extensively on the higher HbA1C levels in African-Americans [21-23], Latinos [24] and Asians [24,25] in comparison to White European persons.

Despite the limited studies focusing on the impact of culturally-specific programs on health outcomes, there has been an increasing interest in understanding more about the health-promoting lifestyle behaviours among various cultural groups [26-28]. In recent times, the Middle Eastern communities have been subject to increased attempts to optimise diabetes management. Literature on health promoting lifestyles among Middle Eastern populations suggest heart disease, stroke and diabetes are the most common types of morbidities and mortalities among Arab immigrants in the US. El-Sayed et al. identified three critical reasons for the discrepancy in health outcomes for Arab-Americans as opposed to the general

population: (1) the disproportionate immigration of Arabs to the US, (2) cultural and religious practices, specifically influenced by Islamic behavioural restrictions subsequently impact health trajectory, and (3) the marginalisation of the Arab communities from the general population due to heightened political turmoil [29].

In Australia, 35% of the population who reported having diabetes in 2001 were born overseas [11]. Of these, people born in the Middle East and North Africa had the second largest hospitalization and death rates for diabetes [12]. In 1997-8, the prevalence of diabetes among Middle Eastern Australians was 8.1% compared with 3.8% for Australian-born [13]. A 2006 NSW population survey found that the prevalence of diabetes among 16 year old and over was 16% for males and 14.4% for females [14]. The top three suburbs in NSW with the highest incidences of diabetes include Liverpool, Blacktown and Hinchinbrook respectively while the highest prevalence for diabetes was found in Fairfield (6.2% of diagnoses of diabetes) [1,2]. Fairfield local demographics show that the greatest proportion of the migrant population (22%) of the Fairfield population identified as Iraqis (Middle Eastern) [3]. The 2011 census also showed that those born in the 'Middle East and Africa group' make up the second largest group of overseas born residing in Liverpool [15].

Reasons for sub-optimal health outcomes among Middle Eastern patients have been proposed based on previous studies such as (1) poor compliance and motivation, (2) inadequate servicing by the primary physician and (3) language, cost, educational literacy and transport [30]. Previous studies involving cardiovascular disease risk in 851 Arabic-speaking patients have demonstrated that 73% of males and 36% of females were considered overweight (BMI>25), with Arabic-speaking females being less likely to have their blood sugar levels checked ( $p<0.05$ ) as opposed to non-Arabic speaking counterparts [31]. Other possible reasons include the dietary habits of Middle Eastern and North African communities, as well as a sedentary lifestyle and the rise of urbanisation [32,33]. According to the United Food and Agricultural Organisation, the dietary habits of Middle Eastern and North African communities was deemed to be sub-optimal, with dietary habits regularly consisting of processed meats and trans-fatty acids [33].

Given the high incidence, prevalence, disproportionately high hospitalisation and death rates among the Australian Middle Eastern population with diabetes, this group is an important and ideal target for government focused population health strategies to prevent or delay type 2 diabetes in Australia. This could serve to reduce the cost to government in estimates of billions. In this paper, we present a systematic review of the literature available concerning intervention strategies currently employed. The objectives of this study were to (1) examine past and current risk reduction/awareness strategies implemented among Middle Eastern populations in Australia with a focus on NSW, (2) evaluate contributing risk factors between diabetes and Middle Eastern heritage, and (3) propose new risk reduction/awareness strategies for diabetes in NSW, Australia with emphasis on high prevalence areas.

## Methods

### Study Eligibility & Selection Criteria

Articles were included into the review given the following conditions: (1) article was published from 1995 onwards, (2) study carried out in Australia, (3) participants were screened and assessed appropriately for risk of developing diabetes mellitus or metabolic syndrome as defined by the International Diabetes Federation, (4) an intervention employed was specifically a culturally-appropriated strategy for the target population, and (5) participants were of Middle Eastern descent and currently living in Australia. An Australian of Middle Eastern descent refers to either being born in Australia to parents and/or grandparents of Middle Eastern and North African heritage. Middle Eastern and North African heritage is used to refer to people originating from countries such as Iran, Iraq, Turkey, Saudi Arabia, Yemen, Lebanon, Qatar, Bahrain, Oman, Kuwait, UAE, Syria, Jordan, Palestine, Egypt, Sudan, Algeria, Morocco, and Tunisia. Studies that were categorized as grey-area literature (non-peer reviewed literature) were still incorporated even if no follow-up investigation of results was obtained by the facilitator/service provider. Furthermore, for this review we did not specify according to study designs, to account for any scant literature available. Studies were excluded from this review if the study (1) was reported in a language other than English and outside of Australia, (2) was not culturally-appropriated, and (3) did not target the Middle Eastern community.

### Information Sources & Search Strategy

Our study plan abided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) recommendations for carrying out this qualitative systematic review. We performed serial literature searches for English language articles published in Australia. Cumulative Index to Nursing & Allied Health (CINAHL), Multicultural Australia and Immigration Studies (MAIS), and MeSH on demand/MeSH browser/Medline were searched for studies published between 1995 and 2017 using MeSH and appropriate keywords based on diabetes, intervention strategies, ethnic minority groups and cultural programs. Non-peer reviewed literatures were also searched, specifically, Diabetes Australia (DA), Australian Institute of Health and Welfare

(AIHW), Australian Bureau of Statistics (ABS) and NSW Health Surveys. All human studies published in full-text were eligible for inclusion while manuscripts with no publication date were not used. Furthermore, we identified further studies of interest by hand searches of bibliographies. The search was last updated on June 2017.

### Study Selection

Studies as provided by the search engines were initially screened and selected for relevance by reading the title and abstract of the candidate studies. All authors of this study independently studied titles and abstracts of other studies for eligibility to this review. Studies were noted into our database collection and then assessed on content against our selection criteria as specified above. Eligibility was performed independently in an un-blinded standardized manner. Disagreements between reviewers were resolved by consensus.

### Data Extraction

We used the standardized form template from the PRISMA approach for data extraction from studies that met the eligibility criteria for this review. For all the studies obtained, the following data were extracted: author(s), study design, location, cultural program, delivery staff, and duration of study, quality score, outcome measures and major findings, as reflected in Table 1. The first author extracted the data from the studies that met the selection criteria, while the other authors checked the extracted data to ensure accuracy.

### Risk of bias

To assess validity for the eligible studies reviewed in this study, the reviewers worked independently to determine the adequacy of health care and intervention providers, data collectors, study outcomes and the impact of the culturally-appropriated intervention strategy. In addition, the studies analyzed in this review were assessed for quality by use of a tool developed by the National Heart, Lung and Blood Institute (NIH), called the Quality Assessment Tool for Before-After (Pre-Post) Studies without a Control Group. This tool utilizes the aforementioned

Study	Study Design	Study arms/ intervention	Location	Sample Size & Characteristics	Delivery/ Frequency	Outcome
Di Francesco A and Hansen S, 2002 [35].	Pilot program, Before-After (Pre-Post) Studies without a Control Group	Study arms Intervention only  Intervention components Group discussion Swimming sessions	Perth	Sample size N = 22 women, including 9 Afghan women  Age (yr) Of the 9 Afghan women, 6/9 were in their 30s, 1 was in her teens, 1 was in her 40s and 1 was in her 20s.	Delivery Small group sessions  Frequency 1 hr sessions weekly over 51 days.	<ul style="list-style-type: none"><li>considered the program culturally appropriate.</li><li>reported that they intended to continue being physically active</li><li>developed water skills and feelings of self-efficacy about those skills</li><li>reported increased knowledge of the benefits of physical activity</li></ul>
West Bay Alliance, 2002 [36]	Intervention Before-After (Pre-Post) Studies without a Control Group	Study arms Intervention only  Intervention components consultation with the target group, community agencies and private organisations	Melbourne	Sample size Indeterminate	Women's only program -Female staff -Private heated indoor pool and spa	Consultative and collaborative processes used in the project ensured its success but no objective evaluation appears to have been undertaken.

Active for Life VicHealth, 2000 [37]	Intervention Before-After (Pre-Post) Studies without a Control Group	Study arms Intervention only Intervention components Information sessions Dabkeh Dancing Aerobics	Melbourne	Sample size N = 13	Delivery Small group sessions 6 month program	No objective evaluation appears to have been undertaken. Participants are more likely to attend culturally appropriate exercise activities facilitated by an instructor from the same cultural background. Activities involving the whole family including extended family members will encourage women from culturally and linguistically diverse backgrounds to attend health information sessions and community development activities.
Health Promotion Unit of the Central Sydney Area Health Service, 2003 [38]	Intervention Before-After (Pre-Post) Studies without a Control Group	Study arms Intervention only Intervention components	Sydney	Sample Size: Indeterminate	6-week Arabic radio and pamphlet campaign targeting Arabic speakers about coronary artery disease and fatty foods	Focus groups were organised to evaluate success of the advertisement. Low response rate of hearing the advertisement.
Sulaiman N, Hadj E, Hussein A and Young D [34]	Intervention Before-After (Pre-Post) Studies without a Control Group	Study arms Intervention only Intervention components 2-hour phone session.	Melbourne	Sample size N = 94 Middle-aged Turkish and Arabic-speaking people	Delivery 2 x 2 hours interactive sessions one week apart Frequency 2-day training program	Based on self-reporting of changes in behaviour. Significant reduction in weight (P = 0.001) and waist circumference (P = 0.004) 3 months after intervention. Participants who undertook activities to reduce their risk of diabetes did not experience more significant weight loss than those who did not (P = 0.597). This was also the case for waist reduction (P = 0.306).

**Table 1:** List of findings from intervention studies carried out on Middle Eastern populations.

elements for assessing the internal validity of studies that met our selection criteria. This tool was used given the specific nature of the studies acquired from this review. Furthermore, in exploring the heterogeneity of the study results, we hypothesized that effect size can differ according to methodological quality of the studies.

### Summary measures

The primary outcome measure varied from participant-reported satisfaction with programs, enhanced understanding and awareness of diabetes and the importance of physical exercise in preventing diabetes and other health complications, self-reported changes in behavior, and significant reduction in weight and waist circumference after intervention.

## Results

### Study Selection

A total of five small-scale community programs using Middle Eastern-specific groups (involving dance, swimming, fitness or nutrition) were identified and analyzed for this review. The search of the several databases specified earlier provided a total of 12 citations. After making the necessary adjustments for duplicates eight remained. Of this amount, a total of six small-scale programs were identified as meeting the selection criteria, each of which was examined further in more detail. Out of the six programs identified, one was found not to meet the criteria as it was a study performed outside of Australia. This left a total of five small-scale programs that met the criteria for inclusion after in-depth review of the location in which the study was carried out, intervention strategy and a target population of individuals with a Middle Eastern background.

### Study characteristics and results

Our findings of each intervention study that met our selection criteria involved studies adopting a Before-After (Pre-Post) Study without a Control Group study design. Only one of the listed studies ascertained in this study acquired quantitative statistical data [34]. Hence, due to the nature of their study design, none of

the studies we acquired in this review involved concealment of randomization, patient blinding, healthcare blinding, data collector blinding or outcome assessor blinding.

Firstly, the Di Francesco and Hansen [35], study was performed in Perth, Western Australia and involved a total of 9 women of Afghan background interviewed following their small group swimming sessions. The women developed and enhanced their confidence in swimming, felt the program was culturally-appropriate and reported increased knowledge into the benefits of physical activity on diabetes prevention. A survey was collected for demographic study of the participants and another survey was provided for the swimming instructor to distribute after the session pertaining to participants' level of progress and participation in the program. Having an accredited Dari speaking interpreter aid in dissemination of structured questions provided by the health promotion officer helped this study in terms of improving its internal validity. Additionally, great flexibility in obtaining the data was made with respect to cultural sensitivities. For instance, in one example, the health promotion officer used office paper as an interactive aid to record qualitative data from the participants instead of recording interview sessions during formative evaluation phase due to the women previously declining providing their responses over audio-tape.

Secondly, the West Bay Alliance [36], study was carried out in the Maribyrnong area of Melbourne, however no conclusive outcome could be retrieved. The primary element of this project was to increase the capacity of the target population in the study through confidence, skill enhancement and self-empowerment through consultation/education between the target, private and community agencies. While success of the project is ensured, no objective evaluation of outcomes from this study were undertaken or at least reported.

Thirdly, the Active for Life VicHealth study [37], involved the

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introduction of a “dance for fitness” program tailored for Muslim and Arabic speaking women in Melbourne. The objective of the study was to allow women to have access to exercise facilities in a culturally-appropriate environment for the female participants. The “dabke” dance, and the information sessions in Arabic allowed women to feel comfortable with one another and with their instructor (who was female). While no outcome measurements were made, it was stated that participants generally received the program positively as a means of increasing physical activity.

Fourthly, the study carried out by the Health Promotion Unit of the Central Sydney Area Health Service [38], involved an intervention via a 6-week media healthy-eating nutrition campaign targeting the Arabic-speaking community in Sydney. The outcome of this study suggested that media campaigns are not ideal for targeting Arabic-speaking communities as only a handful of focus group participants heard the radio broadcast outreach.

The only study that recorded outcome measures was the Sulaiman et al. study which involved 94 participants [34]. This study was the only study performed to measure changes in lifestyle behavior as well as participants’ weight and waistline following diabetes education. The intervention involved two 2-hour group sessions and 30-minute reinforcement and support telephone calls. The study was carried out in Melbourne and focused on type 2 diabetes among high-risk middle-aged Turkish and Arabic-speaking people. The results acquired suggested a significant reduction in weight ( $P = 0.001$ ) and waistline ( $P = 0.004$ ) three months following the intervention.

## Discussion

Five small-scale community programs using Middle Eastern-specific groups (involving dance, swimming, fitness or nutrition) were identified and analysed. One intervention reported clinically significant changes in weight and waist circumference respectively whilst the remaining interventions did not demonstrate valid improvement in primary outcomes. Other studies reported improvement in confidence of the participants as well as an improvement in their awareness and willingness to engage in physical activity. Overall, the evidence from the studies reviewed as demonstrated in Table 1 largely involved small group activity sessions or over the radio or phone discussion sessions with targets of interest. All the studies obtained for this study adopted a Before-After (Pre-Post) Study without a control group study design.

The most significant result that came from this review was the Sulaiman et al. study [34], which showed that a simple bilingual session comprising of topics about: 'prediabetes', 'benefits of a healthy lifestyle', 'weight management', 'reducing fats and sugars', and 'general self-care' led to a reduction of mean weight from 78.1 kg to 77.3 kg ( $Z$  score = -3.415,  $P = 0.004$ ) whilst an additional 79.6% of participants responded with a change in lifestyle post the intervention. Knowledge was also increased from 70 to 80% ( $P = 0.055$ ) as measured by a pre-session quiz and a post-session quiz. The main limitation with this study was the self-reporting nature of the questionnaire which is subject to significant bias.

The swimming interventions [35,36] were reported as largely qualitatively successful in mitigating barriers to exercise such as privacy, childcare and social support. Despite this, all the swimming programs analyzed involved highly subsidized swimming instructors and partially subsidized childcare services. The main issue with this type of intervention strategy is the economic viability of such services. These costs are largely ongoing and may not be practical in implementing in the community. The attrition rate and final reporting rate was unacceptably low and the unstructured nature of the reporting made it difficult to assess. Furthermore, the participants were mainly female and results translated into the greater population may not be reflective of the community's composition.

Lastly, the use of radio-based [38], and a dance-based intervention [37], interventions demonstrated the same qualitative responses as the swimming based interventions but also suffered from the same issues - unstructured feedback, high attrition, poor reporting, and female only cohort studied. The radio-based intervention was the least valid of all the interventions as it did not attempt to follow up or measure any sort of outcome.

In one review by Abuyassin and Laher [32], the authors assert that diabetes in Middle Eastern populations was attributed to the following causes:

**Obesity:** a study of 851 Arabic speaking patients in Sydney demonstrated that 73% of males and 36% of females were considered overweight or obese ( $BMI > 25$ ). The study showed that Arabic females were less likely to get their blood sugars checked ( $p < 0.05$ ) than their non-Arabic NSW counterparts. The limitations to this study was that it was a questionnaire performed during a short period of time (2 weeks), it had a sub optimal response rate (62%) and the sample number for this experiment was only 851 patients.

**Dietary Habits:** The diet of the "Middle East and North Africa" group was deemed by the United Food and Agricultural Organization to be sub-optimal compared with protective diets such as fruit and vegetables. The Middle East diet was characterized by greater consumption of processed meats and trans-fatty acids. While this comparative risk assessment was pooled from the most recent meta-analyses and had country specific estimates of cardiovascular disease, it did not adjust for confounders and the effects of exercise and/or co morbidities in its cardio metabolic disease.

## Gaps that were found in the literature included

1) Sedentary lifestyle: Although there are numerous studies suggesting increasing sedentary lifestyles among Arabian populations (in Egypt only 9.2% of the population were reported as being "highly active") [22], no specific studies were performed comparing exercise levels among Middle Eastern cohorts versus non-Middle Eastern cohorts in NSW, Australia.

**Urbanisation:** Studies in Saudi Arabia found the prevalence of Type II diabetes was much higher in urban areas (12 % for males)

Issue identified from the literature	Proposal for Fairfield	Proposal for Liverpool
Diabetes clinic not accessible by transport	Build a small clinic centre for diabetes near Fairfield train station and have a bilingual nurse educator to facilitate education and health care.  Subsidise a community bus for those who do not reside near a train station.	No change is recommended as Liverpool hospital is nearby the Liverpool train station.  Subsidise a community bus for those who do not reside near a train station.
Diabetes education resources not delivered in a culturally acceptable manner	Send an envelope containing a pamphlet written in Arabic to every household in Fairfield detailing specific Middle Eastern cuisines/ foods which may harmful to their general health.  Send registered patients under the National Diabetes Services Scheme (NDSS) specific instructions in the mail on how to manage their diabetes in written Arabic.  Work with information technologies services to produce an Arabic application (Android or iPhone) which can assist Arabic patients with their daily blood sugar measurement readings.	Send an envelope containing a pamphlet written in Arabic to every household in Liverpool detailing specific Middle Eastern cuisines/foods which may harmful to their general health.  Send registered patients under the National Diabetes Services Scheme (NDSS) specific instructions in the mail on how to manage their diabetes in written Arabic.  Work with information technologies services to produce an Arabic application (Android or iPhone) which can assist Arabic patients with their daily blood sugar measurement readings.
General practitioners not honouring Middle Eastern traditions and/or not speaking in their native language of comprehension.	Provide fast real time translator services by telephone.  Pamphlet to general practitioners about the Middle Eastern cuisine and the solutions to dealing with common barriers such as non-adherence.	Provide fast real time translator services by telephone.  Pamphlet to general practitioners about the Middle Eastern cuisine and the solutions to dealing with common barriers such as non-adherence.
Obesity	Recruit high risk patients with diabetes and provide a free phone session of up to 2 hours in duration with a diabetes trained bilingual community leader.  Subsidise high risk patients with diabetes at the Fairfield City Leisure Centre for swimming lessons.	Recruit high risk patients with diabetes and provide a free phone session of up to 2 hours in duration with a diabetes trained bilingual community leader.  Subsidise high risk patients with diabetes at the Liverpool Whitlam Leisure Swimming Centre for swimming lessons.

**Table 2:** Proposed recommendations for the Fairfield and Liverpool councils respectively to adopt culturally specific strategies in NSW.

than when compared with rural areas (7 % males).<sup>23</sup> It would be interesting to conduct an Australian study comparing Middle Eastern populations in the Sydney city district versus the Non-Middle Eastern populations living in rural NSW to assess the level of sugar control and exercise levels.

The study of Girgis S and Ward J [18], demonstrated that achieving good diabetes control amongst Arabic-speaking patients in Sydney was hampered by the lack of Arabic specific resources and advice. The Hawthorne K, Robles Y, Cannings, John R and Edwards A [4], study proved that culturally appropriate education produced clinically significant changes in HbA1c. We recommend that this study should be extended and repeated in NSW for reliability and specificity in Australian cohorts. The landmark study in Sydney by Sulaiman N, Hadj E, Hussein A and Young D [5], showed that recruiting and training bilingual teachers can have clinically significant changes in weight scores in high risk diabetes patients.

## Conclusion

Middle Eastern populations are overrepresented in the hospitalisation and death rates due to diabetes. The largest prevalence and incidence of diabetes in NSW were in Fairfield and Liverpool respectively with the majority of these regions being from the Middle East and North Africa region. Culturally directed programs such as Arabic brochures, specific nutrition advice on Arabic foods and exercise lessons for at risk populations and may positively impact diabetes associated health outcomes such as

weight loss and HbA1c.

## Ethics

Information obtained was from freely available public data. No experimentation of human or tissue data was used as per NHMRC guidelines.

## Key points

- Liverpool has the highest incidence whilst Fairfield has the highest prevalence of diabetes in NSW, Australia.
- People of Middle Eastern heritage make up a significant portion of both the Liverpool and Fairfield regions.
- Barriers encountered involve inadequate servicing by primary physicians and lack of language and cultural specific resources.
- Bilingual diabetic education and local exercise regimens may help to reduce weight, improve HbA1c and improve patient health knowledge.

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