Factors influencing food choice for independently living older people - a systematic literature review

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Abstract
Unyielding, disproportionate growth in the 65 years and older age group has precipitated serious concern about the propensity of health and aged-care services to cope in the very near future. Preservation of health and independence for as long as possible into later life will be necessary to attenuate demand for such services. Maintenance of nutritional status is acknowledged as fundamental for achievement of this aim. Determinants of food choice within this age group need to be identified and better understood to facilitate the development of pertinent strategies for encouraging nutritional intakes supportive of optimal health. A systematic review of the literature consistent with PRISMA guidelines was performed to identify articles investigating influences on food choice among older people. Articles were limited to those published between 1996 and 2014 and to studies conducted within countries where the dominant cultural, political and economic situations were comparable to those in Australia. Twenty-four articles were identified and subjected to qualitative analysis. Several themes were revealed and grouped into three broad domains: (i) changes associated with ageing; (ii) psychosocial aspects; and (iii) personal resources. Food choice among older people is determined by a complex interaction between multiple factors. Findings suggest the need for further investigations involving larger, more demographically diverse samples of participants, with the inclusion of a direct observational component in the study design.

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Factors Influencing Food Choice for Independently Living Older People – A Systematic Literature Review

ABSTRACT

Unyielding, disproportionate growth in the sixty-five years and over age group has precipitated serious concern about the propensity of health and aged-care services to cope in the very near future. Preservation of health and independence for as long as possible into later life will therefore be necessary to attenuate demand for such services. Maintenance of nutritional status is acknowledged as fundamental for achievement of this aim. Determinants of food choice within this age group need to be identified and better understood to facilitate the development of pertinent strategies for encouraging nutritional intakes supportive of optimal health.

A systematic review of the literature consistent with PRISMA guidelines was performed to identify articles investigating influences upon food choice amongst older people. Articles were limited to those published between 1996 and 2014. Twenty-four articles were identified and subjected to qualitative analysis. Several themes were revealed and grouped into three broad domains: (i) changes associated with ageing; (ii) psychosocial aspects; and (iii) personal resources.

Food choice amongst older people is determined by a complex interaction between multiple factors. Findings suggest the need for further investigations involving larger, more demographically diverse samples of participants, with the inclusion of a direct observational component in the study design.

Keywords: older adults, old age, ageing, aged, independent, community, food choice, eating habits, influences
BACKGROUND

Population aging is a growing concern in many nations around the world (1-10). In Australia, recent statistics reveal that the proportion of people aged 65 years and over has almost doubled - from 8% to 14% - since 1970-71 (11), with 2% now aged more than 85 years (12). These figures have been predicted to escalate to approximately 22% and 5%, respectively, by the year 2061 (12).

Amplifying concerns amongst Australian economists and healthcare service providers is the concurrent downward shift in the proportion of people of working-age (13), and thus also available taxpayer dollars to fund mounting health care costs. In 2002, more than five persons of working-age contributed to the support of each person aged over 65 years, however, this figure is predicted to drop to less than 2.5 - with growth at almost zero percent - by the year 2042 (13). This presents an untenable situation, both economically and from a resource perspective. Consequently, State and Federal governments are seeking to keep older people living as healthily and independently as possible into later life, so as to delay the need for reliance upon public health care services and residential aged-care support (11).

Good nutrition during the senior years is important for sustaining health, preventing disease and disability (2,6,8,14-20), and hence, maintaining independence and quality of life (8,14,17,20). Yet the aging process is associated with a number of physiological, pathological, psychosocial and environmental changes which may adversely impact food choice and dietary intake (1-4,14,18-21). For example, declining chemosensory perception (1,3,6,7,10,14,15,18,20,22), poor dentition (3-7,10,15,16,19,21), loss of appetite (1,2,4,6,10,14,19,22,23), onset of chronic illness (1-3,5,6,8-10,14,15,18,20-25), loneliness (2-4,6-10,14,15,20-27), and loss of disposable income (1-3,5,7-10,14-16,18-20,24-27) have been found to contribute to suboptimal dietary intakes in some older adults.
A primary goal for health professionals is to devise and deliver programmes that will support sound nutrition and better health outcomes into, and throughout, old age. This requires identification of factors specific to older populations that influence their food choice, and further, an understanding of the way in which these factors operate to either encourage or constrain consumption of nutritious foods (2,3,7,9,14,19,20,26). It is postulated that such factors will be wide ranging, and specific to the particular population under study. A systematic literature review has been undertaken to amalgamate existing knowledge, outline any identifiable gaps, and determine underlying implications for future interventions.

METHODS

A systematic review of the literature was performed in line with PRISMA guidelines (28) to answer the following research question: Which factors influence food choice amongst independently-living older people?

An electronic search was first implemented through the Web of Science database and then repeated within a further nine databases. Inclusive and exclusive search terms, and Boolean phrases reflective of key words contained within the research question, were employed.

Limits were applied to the area and category of research, document type, language, and year of publication (1996 - 2014, inclusive), as well as the study locale. Studies were included if conducted within countries where the dominant cultural, political and economic situations are comparable to those in Australia. All studies utilising population groups where these factors are significantly dissimilar to those from within the broader Australian community - including studies specific to minority populations - were excluded.
A participant age range of 50 years or more was applied, both to ensure an adequate number of articles for review, and also due to the variation within the different studies generated from the database search.

Specific details of the inclusion and exclusion criteria applied to this review may be found in Table 1.

All studies included in the review were rated according to the National Health and Medical Research Council (NHMRC) levels of evidence hierarchy (29) wherever applicable, and graded for quality.

RESULTS

The review process generated twenty-four articles for inclusion in the final review (Figure 1). Of these, only one article considered the opinions of ‘experts’, with all others reflecting the perceptions of older people themselves. Findings from the included articles are summarised in Table 2.

Qualitative analysis revealed a wide range of themes, which were subsequently collated into three broad domains: (i) changes associated with aging, (ii) psychosocial aspects and (iii) personal resources.

Physiological changes associated with the aging process were frequently cited as having a significant impact upon food choice. In particular, poor dentition, taste or chemosensory change, loss of appetite, illness or medical conditions, and mobility/functional limitations were identified as serving to shape decisions regarding foods consumed.

The domain of psychosocial aspects was constructed to incorporate thoughts, experiences, values, and beliefs relating to food choice. Seven major themes emerged within this domain,
including life course, loneliness (and/or living arrangement), lack of motivation and/or energy, personal interest in health and/or nutrition, self-perception of health status and desire for independence.

Personal resources identified as influential for dietary intake included income/food cost, access to quality produce, transportation issues, knowledge and/or skills in food preparation, access to support, and individual dietary resilience in the face of barriers encountered.

DISCUSSION

The enormity of the challenge being posed to health and aged care services, the world over, by the magnitude and speed of growth in the proportion of individuals aged 65 years and over cannot be underestimated. Given the relative importance of ensuring sound nutritional intakes for maintaining independence into old age, there appears to be a considerable lack of research into identifying and understanding those factors which might be influential in determining why older people eat the foods they do. Despite this, the present literature has resulted in the identification of a number of common themes surrounding issues that impact upon food choice amongst older people living independently within the community.

Synthesis of the existing literature

Three key domains emerged from analysis within this review: physiological changes associated with aging, psychosocial aspects and personal resources.

Physiological changes associated with aging
Taste has been widely identified as a key consideration governing food choice in older people; yet, paradoxically, taste acuity often declines with age (1,3,10,14,15,18,22). In addition, older people often take medications which may further compromise flavour sensation (7,22). These factors detract from the enjoyment of eating and have been associated with reduced appetite (7) as well as the selection of foods high in salt and sugar to compensate for flavour loss (10,22).

Poor dentition, dentures and difficulty with chewing also limit the range of foods eaten (3-7,10,15,16,19,21); in particular, protein-rich foods (such as meat and nuts) (4,6,15) and fruits and vegetables (4,21). A reduced intake of such foods significantly increases nutritional risk, since they provide a good source of protein, vitamins and minerals - some of which (including protein) are needed in higher amounts during old age (30).

Loss of appetite (due to factors such as reduced activity, loneliness or the onset of medical conditions) increases risk for an inadequate intake (1,4), which in turn can both cause and exacerbate health problems (14,15). Compromised health further limits dietary intake, often through avoidance of certain foods, and restriction in both variety and amounts of foods consumed (3,8,15,17,18,20,23,24,26). In contrast, however, Brownie (2013) found that some older people became more interested in their health following the diagnosis of a health problem, and subsequently improved their nutritional intake (22).

Mobility and functional limitations are often cited as significant barriers to food access and preparation (3,5,6,8,10,15,18,20,23,24,26), particularly for those who lack private transport or support from family and friends, and therefore must rely upon public transport services or walk to and from shops (5,15,26). Of note, studies involving observation of participants functioning in their natural environments (23,26) were better able to detect the nature and extent of problems encountered during shopping expeditions (26), as well as identify modifications required within the home environment to accommodate mobility/functional limitations (23). This suggests of
a need for inclusion of a direct observational component in future research endeavours, since some pertinent issues may fail to be unveiled through interview alone.

Psychosocial aspects

Life-course (ie. the differing roles and experiences encountered during a lifetime) often serves to shape food choice in old age (3,9,23). Many ideals surrounding food are formed during childhood, and may persist a lifetime; however, food preferences and decisions regarding which and how much food is consumed have also been found to fluctuate in response to changing life circumstances (3,23).

Living alone is well-documented as a risk factor for nutritional inadequacy during old age (2,4,5,7-10,14,15,17,19,21,22,24,25,27). Grief and bereavement following the loss of a partner and a higher incidence of depression may also serve to reduce appetite and intake (4,5,7,10,19,23,24). For many, eating is regarded as a social activity, and thus an absence of companionship manifests in loss of pleasure normally associated with both cooking and eating (3,8,10,14,15,23). Increased intakes have been observed when in company, dining within relaxed meal environments (2,3,4,20) and when a television or radio is playing (2,20) to simulate company. Lack of motivation and energy for food shopping, preparation and eating meals, as well as skipping meals, replacement of nutritious meals with snacks and/or processed/convenience foods, and a diminished amount and variety of foods consumed is also more common amongst those living alone (4,8,10,19,20,22,23). Single men are particularly vulnerable (4,7,15,20,22,27), and some have expressed a desire for foods which are tasty, and quick and easy to prepare (9,20). Interestingly, Lane et al (2013) found that some older individuals relished the opportunity to gain new food skills and experiment with different foods.
and flavours (23); while for others, living alone provides a sense of release from the constraint of cooking\(^3\) and eating foods that please the preferences of others (23).

Self-perception of health during old age has been indicated as being equally, or more, influential for determining food habits than the state of health itself (5,22). Those with a more positive view of their own health were found to consume more nutritious diets than those with a less positive view (5,7,19). Likewise, an interest in health and/or nutrition, and valuing good health, have also been shown to favourably impact upon food choice and dietary intakes (2,7,9,17,20,22,31).

The desire (or lack thereof) to maintain independence into old age may also effect food choice (9,14,20,22,23,26). Associated higher levels of physical activity (from independent shopping and cooking) has proven advantageous for some (22), while for others, a strong will to remain independent has created a barrier to sound nutritional intake due to a reluctance to accept help from meal services, government support, or family and friends - compromising the range and amount of foods able to be accessed and eaten (14,24,26).

**Personal resources**

Access to resources such as personal transport, higher levels of disposable income and greater support from family, friends, government and community services have all been shown to exert a positive influence over food choice and nutritional intake in elderly people (2,3,5,8-10,14,18-20,23,24,26,27). Having one’s own transport facilitates continued independence and the ability to access shops whenever required, while more income equates to a greater ability to afford foods that are desired or otherwise needed for health/disease management. Support from others may help to overcome obstacles such as lack of transport, mobility and functional limitations, or lack of motivation and energy to cook, through, for example, provision of meals or assistance.
with shopping. It is of note, however, that one study found perceived resources amongst older people to be of equal importance for health and nutritional intake as the actual resources possessed (2).

Knowledge and skills related to nutrition, selection of appropriate foods and adequate cooking techniques are also essential for ensuring sound nutritional intake (4,9,10,15,17,19,20,27). For many women, the delineation of gender roles from childhood and throughout life have equipped them with such skills (10,17,19,27), however, men often report experiencing deficits in this area and difficulty in coping, especially upon widowhood (4,9,10,15,17). While some men will actively seek to acquire skills in these areas, others are happy to settle for convenience meals or snack-type foods instead (9,15). This suggests a need for programmes specifically targeting the needs of older men, with a desire having been expressed for recipes that are tasty and affordable, yet quick and simple to prepare (15,27). Of concern, however, is the confusion and frustration felt by many older adults, including both men and women, due to what they perceive to be mixed and changing messages provided in public nutrition campaigns (22,31). This further highlights a need for consistent evidence-based messages, and perhaps regulation of health/nutrition information that is promoted to the public.

In three of the studies reviewed, limited access to food of acceptable freshness and quality was cited as a significant factor impacting food choice (2,15,26). Munoz-Plaza et al (2013) found that some older people travelled a considerable distance or visited multiple stores in order to access food of an acceptable quality, while those with compromised mobility were forced to accept produce of inferior quality, or else do without. This implies that access to quality produce could be a considerable factor constraining food choice for less mobile older people living within the community.
Some researchers propose a concept of dietary resilience, or a ‘repertoire’ of adaptive strategies developed by individuals to overcome barriers relating to the acquisition and consumption of food (8,15,20,23,31). Such self-imposed behaviour modifications may facilitate the maintenance of adequate food intake, in spite of difficulties encountered. Strategies commonly employed include compromise, substitution, avoidance or restriction/moderation of foods, compensatory behaviours, establishment of routines, seeking out opportunities for companionship during meals (eg. through congregate meal sites) or attending education programmes to develop food knowledge and skills (3,15,20,23,31). Vesnaver et al (2012) have suggested, however, that achievement of dietary resilience may be dependent upon personal motivation, assessment of one’s own resources, preparedness to accept available support, and resource availability.

In summary, this literature review confirms that food choice during the senior years results from a complex interplay between a number of factors that serve to both constrain and encourage the consumption of a nutritious diet. While there is evidence to suggest some degree of commonality between population subgroups, it has also been shown that different subgroups are subject to specific sets of circumstances that may impact their food choice in variable ways. Consequently, initiatives to enhance nutrition amongst the aged will need to first identify, and then subsequently address, factors relevant to the particular demographic concerned.

Limitations and gaps inherent to the literature

Notwithstanding the rigorous, systematic process applied, the outcomes obtained from this review are limited in terms their wider application. Most studies were qualitative in nature, which therefore precludes the generalisability of findings outside of the immediate study populations from which they were derived. Moreover, participation was voluntary in all studies
considered, and data largely self-reported. Although the majority of studies included were published in recent years, seven were published between 1996 and 1999. While it is possible that the findings from some of these earlier studies may not accurately reflect the opinions and behaviours of the current older population, similar themes were evident.

Despite the use of trained interviewers in many studies, data remains highly subjective and thus open to potential for multiple biases. In addition, many of the studies were limited by sample size, gender and ethnic/racial construct, thus limiting the ability to compare findings between studies. Men, ethnic/racial populations and the infirm or incapacitated have been widely under-represented.

**Implications for future research and interventions**

It is likely that factors influencing both the desire and capacity to make nutritious food choices during the senior years will be specific to particular population subgroups. It is therefore essential that the most pertinent of these factors are identified and addressed by health initiatives so as to maximise the potential for safeguarding nutrition, maintaining independence and improving outcomes for health with advancing age.

Further research involving larger, more demographically broad samples and which considers how and why food choices change in the more advanced stages of life (for example, from initial retirement through to 85 years of age and beyond) is warranted. In addition, the inclusion of a direct observational component to facilitate identification of factors potentially missed through interview would be beneficial.

Results from this review are suggestive of a widespread need for interventions designed to stimulate poor appetites, encourage adequate consumption of nutritious foods and ensure access
to affordable, fresh, quality foods that are easy to prepare. Potential strategies include, for example: educating older populations about the importance of maintaining an adequate protein intake with age; identifying suitable options that are easy to prepare and eat; informing older persons about strategies for increasing the palatability of meals without the need for the addition of high levels of salt and sugar; the development and marketing of convenience high-protein food products that are nutritious and easy to chew; creating opportunities for older people living alone to socialise with others during mealtimes, with provision of transport assistance when required; and providing assisted shopping services for older persons living within the community with compromised mobility or lacking access to personal transport.

CONCLUSION

While the findings from this review will provide a basis from which the design of initiatives targeting nutrition in old age may be informed, the qualitative nature of the evidence and limitations inherent to the available research necessitate cautionary application. Health and nutrition professionals will need to develop and implement clear, simple nutrition messages and intervention strategies that remain specific to the expressed needs and priorities of targeted groups. Ongoing evaluation of such initiatives will be imperative to ensure that programmes remain relevant, effectual and viable, and thus that available funding is most efficaciously applied.

TAKE-AWAY POINTS
• The food choices of older persons living within the community are shaped by a multitude of factors that may serve either to promote, or constrain, both one’s desire and capacity to consume a nutritious diet.

• These factors may be broadly grouped into three categories: physiological changes associated with the ageing process, psychosocial aspects and access to personal resources.

• Each of these factors may vary in significance to, and the ways in which it impacts upon, the food choices of different population groups.

• Findings are suggestive of a need for further research involving larger, more demographically broad population samples, with the inclusion of a direct observational component. Population-specific interventions should be designed to stimulate poor appetites, encourage adequate consumption of nutritious foods and ensure access to affordable, fresh, quality foods that are easy to prepare.

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Figure 1: Summary of review process.

667 articles identified through database searching

666 articles after duplicates removed

666 articles screened

27 articles considered for eligibility

25 articles included in the qualitative analysis

24 articles included in the final analysis

629 articles excluded

2 articles excluded due to population characteristics

1 article excluded due to genetic/environmental focus
<table>
<thead>
<tr>
<th>Criterion</th>
<th>Inclusion</th>
<th>Exclusion</th>
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</thead>
<tbody>
<tr>
<td>Population age</td>
<td>≥50 years of age</td>
<td>&lt;50 years of age</td>
</tr>
<tr>
<td>Population gender</td>
<td>Male, female or mixed gender studies</td>
<td>N/A</td>
</tr>
<tr>
<td>Population health status</td>
<td>Healthy, free from serious chronic disease. Selection of study participants not dependent upon presentation with a specific medical condition, disease, disability or other diagnosis.</td>
<td>Participant inclusion dependent upon presence of pre-existing disease state, disability or medical condition.</td>
</tr>
<tr>
<td>Population ability to self-care</td>
<td>Participants free-living in the community, in their own home, and independent for at least most activities of daily living (ADLs). Able to freely select foods consumed.</td>
<td>Study participants dependent upon carers, community services, etc. (eg. inpatients in hospitals or hospices; residents of nursing homes and assisted-living aged-care facilities, etc.); those unable to freely select foods consumed (eg. dependent upon availability from a menu); or else significantly dependent upon others for accomplishing ADLs.</td>
</tr>
<tr>
<td>Population biological classification/study focus</td>
<td>Human (non-drug/non-therapeutic interventions). Focus upon factors limiting or influencing food choice amongst elderly populations</td>
<td>Non-human (animal, microbiological or biochemical and nutrient studies) investigations and human interventions involving administration of drug, therapy or dietary intervention, or investigation of particular biochemical phenomena. Focus upon areas of diet other than food choice (eg. nutrient intake, adherence to national dietary guidelines)</td>
</tr>
<tr>
<td>Study setting/locale</td>
<td>Countries where the dominant cultural, political and economic situation is comparable to that in Australia (eg. Australia, New Zealand, United States, Canada, United Kingdom,</td>
<td>All countries and populations where the cultural (including diet), political and/or economic situation is significantly dissimilar to that in Australia (eg. Asian nations, African</td>
</tr>
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England, Ireland, Scotland, Wales, Germany, Austria, Switzerland, Sweden, etc.).

debates conducted within minority populations (e.g. indigenous, Inuit, African-American populations, twins).

<table>
<thead>
<tr>
<th>Databases</th>
<th>Web of Science</th>
<th>Scopus</th>
<th>Science Direct</th>
<th>PubMed</th>
<th>Medline</th>
<th>Academic Search Complete</th>
<th>ProQuest Central</th>
<th>Informit databases</th>
<th>CINAHL</th>
<th>Health Source: Nursing/Academic Education</th>
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<tbody>
<tr>
<td>Databases</td>
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<td></td>
<td>All databases other than those listed under ‘Inclusion’</td>
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</tr>
</tbody>
</table>

| Language        | English        | All languages other than English |

| Year of publication | 1996-2014 (to ensure an acceptable number of articles could be captured by the search) | Pre-1996 (search initially included 1990-1995, however, later refined due to extensive article numbers) |

| Limits specific to Web of Science database: | Nutrition and Dietetics; Public, Environmental and Occupational Health; Psychology (biological or Gerontology) | All other |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Web of Science categories                 | Nutrition and Dietetics; Public, Environmental and Occupational Health; Geriatric Gerontology; Behavioral Sciences or Biomedical Social Sciences |
| Research areas                            | All other                                                                                                        |
### Table 2: Summary of articles included in the final review.

<table>
<thead>
<tr>
<th>Author/s, Date of Pub. [Study Location and Year]</th>
<th>Participants</th>
<th>Key Findings, Conclusions and Recommendations</th>
<th>Strengths, Limitations, Comments</th>
<th>NHMRC Level of Evid.</th>
</tr>
</thead>
</table>
Age: N/A (experts reporting on residents aged ≥70 years) | Nine domains identified (county, programs, transportation, kin, medical, economic, food habits, knowledge and attitudes). Three common themes across domains: geographical (physical distances and cultural barriers), social (family structure, economics, racial and ethnic conflict, reluctance for volunteers) and factors pertinent to the elderly population itself. Collective knowledge of barriers to nutritional health for elderly people is comprehensive, however, individual knowledge is restricted to the area of expertise. Need to educate service providers and promote awareness of multidisciplinary nature of nutrition. Nutrition needs to be made part of the strategic planning process. | Results not generalisable.  
Strengths: involved experts from a number of specialisations  
Limitations: sample size; may involve participant bias; subjective data. | VI |
| Best and Appleton, 2013 (15) [Ireland; date not specified] | No: 28 (1M/27F)  
Age: ≥65 years (range 65-93 years, mean 81 years)  
Inclusion: able to provide informed consent and participate fully.  
Exclusion: not specified, but listed as ‘few’ | Nineteen themes categorised into three domains: product-based (taste, texture, odour, biting/chewing/swallowing difficulties, change in tastes, freshness, quality, safety, product origin), environment-based (convenience, effort to cook, restricted mobility, access to shops, living alone, lack of cooking skills, spoilage, waste, cost/multi-buy promotions) or cognitive-based reasons (health information, previous experiences, education, awareness of own frailty and importance of health, medical constraints). Reduction in chemosensory, dental and physical abilities often leads to decreased consumption of high-protein foods. Further research required to understand and address reasons for lack of consumption. | Results not generalisable  
Strengths: qualitative focus; data saturation point reached.  
Limitations: small sample size with under-representation of vulnerable groups; voluntary participation | VI |
| Brennan and Singh, 2010 (16) [Adelaide, South Australia, Australia; 2008] | No: 444 (48%M, 52%F)  
Age: 60-71 years  
Inclusion: age; enrolled to vote  
Exclusion: not stipulated | Results indicate that food choices amongst elderly people are influenced by chewing ability and SES, but not level of dietary knowledge. Those with chewing limitation or of lower SES are less likely to comply with national dietary recommendations. Further research required to determine types of foods that are restricted due to chewing limitations, as well as the extent of tooth loss needed | Sample contained higher % of Australian-born persons than Census; possible under-representation of those in high-care facilities. Findings | IV |
for detrimental impact upon food intake, and the subsequent public health significance for nutrition and health outcomes.

Brownie, 2013 (22)  
[Northern Rivers, NSW, Australia; 2010]  
No: 29 (21%M, 79%F)  
Age: 60-93 years (mean 73 years)  
Inclusion: age (60 years and over)  
Exclusion: not stipulated  
Participants expressed interest in health and food, and were open to dietary and food behaviour changes. Reduced need and intake of food reported, which may jeopardise adequacy for some nutrients, including protein. Participants felt confused by sometimes conflicting food messages, and unclear about appropriate food choices. Further study required with larger and more ethnically and socially diverse samples. Suggested that older people might benefit from information about nutrient density and quick, simple recipes to meet their nutritional needs.

Brownie and Coutts, 2013 (25)  
[Northern NSW, Australia; 2010]  
No: 29 (6M,23F)  
Age: 60 to 93 years (mean 73.3 years)  
Inclusion: age (60 years and over)  
Exclusion: not stipulated; non-dentate individuals excluded from analysis  
Four main themes identified: healthy foods, quantity, personal circumstances and good intention. Fresh, seasonal produce and were thought important for health, with conflicting opinions about the importance/benefit of dairy foods; cereal foods rarely discussed. Merit of pre-packaged convenience and frozen foods questioned. Participants believed reducing food intake (especially red meat and fat) was beneficial for health. Price, preferences of others, health conditions and a desire to regain/maintain health also influenced food choice. Participants unaware of special nutritional needs in older age. Older Australians may benefit from a media campaign promoting their increased needs for certain nutrients. Further research required to guide
<table>
<thead>
<tr>
<th>Study</th>
<th>No:</th>
<th>Age:</th>
<th>Inclusion:</th>
<th>Exclusion:</th>
<th>Findings</th>
<th>Strengths</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlton, 1997 (1) [Sunderland, UK; year not specified]</td>
<td>66 (all M)</td>
<td>≥70 years (mean 78.9 years), divided into 70-79 years and 80+ years</td>
<td>male; 70 years or more</td>
<td>not stipulated</td>
<td>47% with suboptimal energy intakes and 53% underweight. Added sugar accounted for ~1/5 of energy intake, but overall energy intakes low, and mean micronutrient intakes adequate (except vitamin D). Suboptimal mean fibre intake. Subjects appreciated importance of diet for optimising health, with ¾ willing to make dietary changes. Factors most influential in food choice were taste and enjoyment, followed by availability, health and convenience. Main source of nutrition information was the media, followed by family and friends. Most men unwilling to partake in nutrition programmes unless held during regular community luncheons or at their place of residence. Findings suggest elderly men living alone are aware of importance of diet for achieving and maintaining health, and willing to make dietary changes, however, not open to participation in nutrition education programmes. Reaching and engaging elderly men living alone remains a challenge for nutrition educators.</td>
<td>Findings not generalisable to all elderly men living alone.</td>
<td>Use of validated tools; random sample</td>
</tr>
<tr>
<td>de Morais et al, 2013 (21) [Eight European countries (Denmark, Germany, Italy, Poland, Portugal, Spain, Sweden, and UK); based upon data collected from 2003-2005]</td>
<td>644 (quota gender controlled)</td>
<td>65 to 98 years (mean 74.8 years)</td>
<td>not specified (data obtained from another study)</td>
<td>as per inclusion</td>
<td>Almost half sample reported good health, one quarter moderate nutritional risk and one quarter high nutritional risk - demonstrating poorer risk status amongst this sample compared other elderly living in the community (apply caution to comparisons between studies). Extremes of BMI associated with poorer physical functioning and lower perception of health. Nutritional risk associated with choosing foods easy to chew, difficulty with chewing (for men), lower consumption of F &amp; V per day, lower- health-related QOL, and living alone. Tool employed lacked sensitivity for acute situations. Choice of instrument should reflect objectives of study and specific population. Findings strengthen and add to previous evidence re determinants of nutritional risk. The Nutrition Screening Initiative (NSI) is a useful tool for identification of nutritional risk amongst community-living older people.</td>
<td>As sample was quota controlled for a number of variables, results cannot be generalised to the whole European population.</td>
<td>Strengths: sample size; cross-cultural</td>
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<td>Dean et al, 2009 (2) [Eight European countries (Poland, No: 3200 (400 from each country; ~50%M, ~50%F) ≥65 years</td>
<td>Actual and perceived resources (financial and other, such as social), physical and mental health, and individual food goals impacted dietary intake and variety, supporting existing evidence.</td>
<td>Findings not generalisable</td>
<td>Strengths: sample size; cross-cultural</td>
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<td>Study</td>
<td>Country/Region</td>
<td>Inclusion</td>
<td>Exclusion</td>
<td>Findings</td>
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<td>Portugal, UK, Germany, Sweden, Denmark, Italy and Spain; 2005</td>
<td>Increase food knowledge of older people and providing quality foods that are familiar may improve intakes and dietary variety. Research required to determine how perceived as well as actual resources influence dietary variety, as well as how food-related goals to increase dietary variety may be evoked.</td>
<td>Limitations: sample not representative of population constituencies nor size; non-response not recorded; use of food variety score (applicability across countries); limited objective measures for resources; self-reported resource inventory (halo effect)</td>
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<td>Donkin et al, 1998 (27) [Nottingham, UK; 1994]</td>
<td>No: 369 (443 weighted sample); 177M, 192F Age: ≥65 years Inclusion: people aged 65 or over; over-representation of 75+ years Exclusion: not stipulated; analysis excluded composite foods</td>
<td>Single men ate vegetables less often and with less variety than women or married men. Women ate more fruit, with single men eating the least. Vegetables eaten more frequently and in greater quantities in summer. Gender was the most influential variable, followed by living status. Increasing age and lower education associated with decreased vegetable (but not fruit) intake. Income significant for fruit, but not vegetables. Single men prefer meals that are easy to prepare, cook and open. Money more important for those living alone. Consumption of all foods decreased in those aged 75+ years. Interventions should focus upon basic cooking skills (especially for single men) and preparation of appetising, non-bulky vegetable dishes. Single elderly men may benefit from encouragement to increase social activities involving food to improve F &amp; V intake. Research needed to determine whether the oldest age group requires 5 serves of vegetables per day (a lesser amount may be adequate). Easy-to-open, prepare and cook foods, in an appropriate portion size and at an affordable price, recommended.</td>
<td>Strengths: sample size Limitations: Based upon frequency of consumption without weighted portions, limiting accuracy; results may have been partially affected by exclusion of composite products</td>
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<td>Falk, Bosgni and Sobal, 1996 (3) [Upstate New York, USA (3 counties); year not specified]</td>
<td>No: 16 (gender ratio not specified) Age: ≥65 years Inclusion: 65+ years; controlled for gender, age, educational and income level, living situation.</td>
<td>Three food choice components identified: life course (experiences, especially during childhood, changing roles and environments), influences (ideals including meal constitution, social and family rules and expectations surrounding meals, the cultural significance of food and the food-health relationship; social framework, including socialisation and companionship; personal factors, including physical conditions, limitations, knowledge and skills) and personal system</td>
<td>Findings not generalisable. Strengths: develops a model to help coalesce knowledge from a number of disciplines to explain the process of food choice amongst the elderly.</td>
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<td>Exclusion</td>
<td>Limitations</td>
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<td>less than 65 years; those dependent for ADL’s; existing acute-stage disease</td>
<td>small sample size; all participants Caucasian, from upstate New York, attend congregate meals, were free-living and relatively healthy; most participants female; reliant upon self-report.</td>
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| Holmes and Roberts, 2011 (4) [UK; Data collected from 2003-2005] | Better diet quality associated with eating meals at the table, good appetite (women) and being a non-smoker (women). Although not significant, poorer diet quality tended to be associated with age greater than 75 years, eating alone and poorer cooking skills. Men more likely to report limited cooking skills, most of these living alone. Those with poorer dietary intakes more likely to be at risk for consuming suboptimal amounts of many nutrients. For men, chewing difficulties resulted in poorer quality intake. Research that includes a focus upon the eating environment (ie. where and with whom meals are consumed) required. | Comparisons between populations limited due to lack of standard for measuring dietary quality. **Strengths:** sample size; division into young old and older old categories **Limitations:** reliant upon self-report; no allowance for misreporting made in analyses; limited to materially deprived people; possible under-representation of men |

| Hughes, Bennett and Hetherington, 2004 (17) [Merseyside, England; Year not specified] | Four main themes: health and well-being, energy and nutrient intakes, cooking skills, and fruit and vegetable intake. No significant differences for health based upon age or smoking status. Better perceived health associated with higher levels of physical health and greater life satisfaction. Life satisfaction also associated with social engagement. Only 4 participants met or exceeded energy requirements for at least one of two days assessed. Higher energy intakes associated with alcohol consumption. Lowest F & V intake linked to more alcohol and less energy from protein. Most acknowledged the importance of nutrition, but exhibited incongruence between understanding and actual consumption. | Results not generalisable to whole population **Strengths:** qualitative component **Limitations:** small sample size; voluntary participation; possible under-representation of those with physical or other limitations |
Study confirms lower energy and F & V intakes in elderly people. Older men living alone had the least adequate intakes for energy and F & V, less variety and poorer cooking skills. Most did not meet requirements for energy, therefore advice to increase F & V intake alone insufficient. Interventions should seek to clarify understanding of what constitutes a healthy diet in old age, and further encourage cooking and consumption of more vegetables by men. Must consider needs and wishes of the target group during intervention design.

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample Size</th>
<th>Inclusion</th>
<th>Exclusion</th>
<th>Strengths</th>
<th>Limitations</th>
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<tr>
<td>Keller et al, 1999 (5) [London, Ontario, Canada; Year not specified]</td>
<td>No: 145 (32M, 113F) Age: 53-98 years (mean 78 years, S.D. 8) Inclusion: degree of functional limitation; adequate memory and mental status Exclusion: inadequate memory or mental status as determined by SPMSQ</td>
<td>Those with greater dependency for meal preparation and eating were associated with better dietary intakes. Transportation was found to be the single greatest barrier to food intake. Higher income and education level, as well as older age, better hearing and participation in grocery shopping, were associated with better food intakes. Results suggest that the perception of health is more influential than actual morbidity. More medications were associated with better intake, while smoking was associated with poorer intake. Further research needed to examine relationship between quality of life and food intake or nutritional status, and to determine whether decreased dietary intakes in a large cohort of seniors followed over time are preceded by activity limitations.</td>
<td>Sample not representative or generalisable to whole population Strengths: use of validated tools and trained interviewers Limitations: relatively small sample size; no comparison for seniors without functional limitation; under-representation of those with considerable health or other problems; subjective measures; measures based upon self-report and recall</td>
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<td>Keller, Ostbye &amp; Bright-See, 1999 (6) [London, Canada]</td>
<td>No: 145 (32M, 113F) Age: 53-98 years (mean 78 years, S.D. 8) Inclusion: degree of functional limitation; adequate memory and mental status Exclusion: inadequate memory or mental status as determined by SPMSQ</td>
<td>25% of women and 31% of men had poor dietary intake. Two-thirds of participants consumed less than recommended number of F &amp; V serves daily, and only 6% met recommendations for grain products. Many reported a decreased intake of foods from one or more of four food groups considered. Chewing difficulties were associated with decreased intake of meat and alternatives, and in turn, with weight loss. Concerns over fat and cholesterol possibly placed at risk for low intake of protein rich foods. Convenience an important factor in determining food choice, and in part explained a reduction in intake of F &amp; V. Seniors with a higher BMI consumed a more balanced diet overall.</td>
<td>Sample not representative or generalisable to whole population Strengths: use of dietary supplements ascertained; validated tools and trained interviewers Limitations: relatively small sample size; no comparison for seniors without functional limitation; under-</td>
<td>IV</td>
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Many participants reported recent weight loss, citing a recent health crisis or decreased activity as the primary reason. Results suggest those with mild to moderate limitation, who likely receive less formal support, are at increased risk for poor dietary intake and should be targeted by intervention programmes. Further study needed to ascertain whether change in nutritional status is preceded by deterioration in independence for ADLs.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Inclusion</th>
<th>Exclusion</th>
<th>Findings/Recommendations</th>
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<tr>
<td>Lane et al, 2014 (23) [Norfolk, UK; 2007-2008]</td>
<td>No: 40 (all F) Age: 65-95 years (mean age 82 years) Inclusion: female, age 65+ years, living independently, reduced preparation from scratch for main meals to ≤2 weekly, English fluency Exclusion: not stipulated</td>
<td>Many changes around food related to life course; in particular, health, energy levels, loss of a partner, missing family/friends, changes in life role and socialisation, and contemplation of alternative options available. Older women actively changed their relationship with food by responding to changes in circumstance. Time-release from food preparation and cooking was diverted to other enjoyable activities, such as socialising and pastimes, rather than withdrawing from public and social engagements. Reduced contact with food was either voluntary or in response to changes in health, energy, or loss of significant others, with intentional adaptations made. Developing a repertoire of strategies to compensate or adapt to changes in physical, mental and social conditions was viewed as reflective of successful aging. Flexibility enabled women to exercise a degree of choice in their responses to changing circumstances, suggesting a strong degree of resilience that may be overlooked by the literature and public perceptions. Satisfaction derived from the ability to shape responses to changing circumstance should be acknowledged when developing policies and initiatives.</td>
<td>Findings not generalisable to all populations Strengths: broad sample in terms of method of deriving meals, urban vs rural setting, degree of dependency and SES Limitations: mostly widows and lack of ethnic diversity</td>
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<td>Locher et al, 2009 (18) [USA; Year not specified]</td>
<td>No: 185 (20% M, 80% F) Age: range not specified; mean 78.9 years Inclusion: meet Medicare’s definition for homebound status, reside in the community, able to communicate unaided</td>
<td>Important motivators included sensory appeal, convenience and price, with ethical concerns, mood and natural content of foods of less importance. Frequent barriers to consuming desired foods were health, adherence to a special diet, and inability to shop. Lack of appropriate cooking equipment/facilities, being unable to self-feed and companions during a meal were least frequently reported. Older people were more likely to be motivated by health and mood, but not weight, and those with lower educational attainment by price (with money problems posing a barrier). African Americans reported money problems and representation of those with considerable health or other problems; subjective measures; supplement formulation/strength not verified; measures based upon self-report and recall</td>
<td>Not clear whether findings may be generalisable to other population groups; further investigations required. Strengths: questionnaires administered by second party, although</td>
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<td>Study</td>
<td>Exclusion: cognitive impairment, terminal illness, reliance upon enteral tube-feeding or ventilator-dependant</td>
<td>adherence to a special diet as barriers. Most participants had suboptimal intakes for energy and vitamin D. Participants viewed health as a barrier, rather than a motivation, for eating foods they desired, suggesting a possible need for liberalisation of the diet for this age group to ensure adequate food and energy intake and to afford QOL. Neither motivations nor barriers differed significantly by gender, ethnicity, marital status or living arrangement. Interventions to alter dietary intake in the aged need to consider motivations beyond those relating to health and acknowledge individual preferences and concerns so as to encourage participation and desired changes. Effort and cost on behalf of the participants must be minimised.</td>
<td>Limitations: study reliant upon subjective data and self-report; relatively small sample size</td>
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<td>Lundkvist et al, 2010 (31) [8 countries (Sweden, UK, Denmark, Italy, Germany, Poland, Portugal, and Spain); 2003-2005]</td>
<td>No: 564 (gender ratio not stated)</td>
<td>Participants expressed an awareness of nutrition, its implications for health, and their own responsibility for eating well. Many were motivated to eat healthily, but some viewed this as an ‘ideal’. Foods were often categorised as ‘good’ or ‘bad’, with some foods avoided and others included to benefit health. Dietary variety, regular meals, and food preparation methods were considered important, with home-cooked meals viewed as more nutritious, and processed and takeaway foods distrusted. Concerns were held about sources of nutrition information and food safety. Participants reported a range of strategies for making food choices, however, much decision-making was routine and uncomplicated. This study highlights the need to view food choice as a multidimensional phenomenon that incorporates behavioural, psychological, social, cultural, biological, economic, political, historical, environmental, geographic and other elements, both consciously and subconsciously. Acknowledging that people are not always aware of the decisions they make and may not interpret or utilise information in the manner intended is important when communicating food and health messages</td>
<td>Findings not generalisable. Strengths: sample size; cross-cultural sample Limitations: inconsistent recruitment between countries may have biased some of the sample; equal numbers of people from each country may not provide a culturally representative of Europe as a whole; demographic variables not considered.</td>
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<td>Munoz-Plaza et al, 2013 (26)</td>
<td>No: 30 (6M, 24F)</td>
<td>Factors influencing shopping, cooking and eating were categorised into intrapersonal, social and environmental factors, and specific strategies employed to overcome barriers faced discussed.</td>
<td>Findings not generalisable. Strengths: includes observational data collected</td>
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Inclusion: black, white or Latino ethnicity; speak English or Spanish; able to understand purpose of study and participant burden. For qualitative component: English fluency, have completed baseline measurements for parent study, reported being the primary household food purchaser
Exclusion: not stipulated

Independence was viewed as an important part of personal identity. Participants valued shopping and cooking for themselves, although few drove and many were reluctant to pay cab fares or delivery fees to overcome difficulty. Health conditions and environmental hazards served as barriers to food access, as did price, quality and variety. Quality of fresh produce was perceived to vary by neighbourhood and racial make-up, and concerns over food safety and deceptive practices raised.

Few participants ate restaurant meals (price, lack of control over nutritional composition). Use of food pantries, community meal centres and/or support from family and neighbours were reported by two-thirds of the sample.

Data supports findings from previous research, and could be used to guide future health behaviour interventions and clinical practice. Price and access are important aspects which need to be considered. Researchers acknowledge that more nutritious diets are likely when food is more conveniently accessed.

Limitations: sample size; under-representation of males, married people, white people and the food insecure

Radermacher, Feldman and Bird, 2010 (8)

No: 37 (13M, 24F)
Age: 58 to 85 years (mean 70 years)
Inclusion: of Anglo-Celtic, Macedonian, Serbian or Maltese background
Exclusion: those dependent upon a community bus excluded from analysis (older)

One quarter of participants reported cost (but not money), health, mobility and intrapersonal factors as barriers to food choice. In addition, foods regarded as nutritious or for addressing particular health needs were perceived to be more expensive, and ability to access preferred foods (eg. culturally specific foods/ingredients) was problematic for some groups. Many participants preferred simple foods, selected within their financial means. Health and physical capacity to shop, prepare and eat meals were identified as significant barriers to food choice, leading many to resort to creative strategies to overcome them. Public transport was perceived inadequate and unreliable, and concerns expressed over the suitability and cultural applicability of Meals on Wheels and similar services.

Authors suggest: (1) local governments should play a greater role in the provision of community health, social support and transport services, with integration of these policies (2) consideration be given to the changing nature of the modern family and its ability to support older family and community members (3) the views and

Limitations: sample size; voluntary participation; limited ethnic diversity; small sample size; subjective data and self-report; males and those most at-risk for food insecurity under-represented

IV

Not representative of all older Australians from different cultural backgrounds.
Strengths: cross-cultural sample
Limitations: voluntary participation; limited ethnic diversity; small sample size; subjective data and self-report; males and those most at-risk for food insecurity under-represented

IV
resourcefulness of older people should be acknowledging and valued (4)
experts should recognise the dynamic, ever-evolving nature of the
elderly population and their needs.

<table>
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<tr>
<th>Study</th>
<th>Sample Size</th>
<th>Inclusion</th>
<th>Exclusion</th>
<th>Findings and Limitations</th>
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<tr>
<td>Shatenstein et al, 2013 (19) [Canada; 2003-2005]</td>
<td>No: 1793 (853M, 940F) Age: 67 to 84 years Inclusion: aged 67 to 84 years, community-dwelling, in good general health, cognitively and functionally intact at recruitment Exclusion: not stipulated</td>
<td>Further research is required to clarify factors shaping food choice with aging, and how this impacts upon dietary quality. Longitudinal studies are further recommended to ascertain whether dietary quality is maintained or changes with time. Interventions specific to ensuring good dietary quality with age will be needed, since dietary knowledge was an important determinant of dietary quality for men and women in this age group.</td>
<td>Findings not generalisable Strengths: sample size Limitations: variability in income, health status and functional capacity limited within sample; many factors which could have better informed the analyses were not ascertained</td>
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<td>Vesnauer et al, 2012 (20) [Canada; 2009]</td>
<td>No: 30 (6M, 24F) Age: 68 to 86 years (mean 74.87 years) For NuAge: Inclusion: age 7-84 years, speak English or French, community-dwelling, free from cognitive impairment and disabilities which limit ADLs Exclusion: ≥ class II heart failure, COPD requiring O2 therapy or oral steroids, inflammatory digestive diseases, cancer treated by chemotherapy, radiation or surgery within past 5 years. For this study: Inclusion: Exhibit 2+ nutritional risk factors at baseline; maintenance or improvement of diet quality</td>
<td>Several challenges in relation to shopping for and preparing food were identified, and apathy toward eating was common. Adoption of strategies to overcome problems faced was reported, demonstrating different degrees of resiliency amongst individuals, however these did not always result in a high quality diet. Four key themes of resiliency emerged: prioritising eating well (decisions relating to money, time and energy), doing whatever it takes to keep eating well (relating to understanding of eating well), being able to do it yourself (importance of independence) and getting help when you need it (formal and informal support networks). Results indicate that elderly people are able to successfully manage their diet in response to age-related obstacles encountered, even at advanced ages, however, resilience was dependent upon having food-related motivation as well as access to personal and collective resources. Practitioners and health professionals may need to help older people to appreciate the importance of food for health, to build strategies to maintain pleasure in eating, counsel in ways to improve self-efficacy and encourage an acceptance of support measures.</td>
<td>Results not generalisable to the whole population. Strengths: qualitative focus Limitations: under-representation of males, people living as a couple or in facilitated care, and those with chronic disease or mobility limitations, and possibly cultural and ethnic diversity; voluntary participation and sustained participation over 4 years may be due to a high interest in nutrition (bias)</td>
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<tr>
<td>Study</td>
<td>Sample Characteristics</td>
<td>Risk Factors Identified</td>
<td>Inclusion</td>
<td>Exclusion</td>
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<td>Wham and Bowden, 2011 (9) [New Zealand; 2006-2007]</td>
<td>No: 12 (all M) Age: 79 to 87 years</td>
<td>Eating alone, low intake of meat or alternatives, not enjoying meal preparation and belief that weight was either too high or too low. General knowledge about nutrition and an awareness of the diet-disease relationship was lacking.</td>
<td>Aged 75+ years, living alone for at least 3 months, residing in the community and involved in food shopping and preparation.</td>
<td>Recruitment exclusively from clubs, literacy skills dependent, questionnaire not validated for this population</td>
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<td>Wolfe, Frongillo and Valois, 2003 (24) [New York, USA; 1999-2000]</td>
<td>No: 53 (M:F not stated) Age: 53 to 88 years, mean 71 years</td>
<td>Lack of income, inability to access food (due to lack of transport, physical mobility limitations, and functional or health limitations hampering preparation), lack of motivation or energy, lack of appetite, loneliness</td>
<td>Recruitment through subsidised housing, churches, congregate and home-delivered meal services and a community worker</td>
<td>Participants paid $10 for interviews; results not representative of whole population</td>
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and depression. Authors suggest that the accepted definition of food security is insufficiently broad for the aged population. A new tool incorporating 14 new measures was developed which takes into account issues pertinent to an elderly population, however, this requires more rigorous testing with larger and more diverse samples. Authors contend that food assistance programmes for the elderly need to find ways to deliver the right types of food (including culturally and socially appropriate foods) in an efficient and socially acceptable manner.

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<th>Authors</th>
<th>Wylie, Copeman and Kirk, 1999 (10) [Leeds, UK; Year not specified]</th>
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<tr>
<td>No:</td>
<td>15 (3M, 12F)</td>
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<tr>
<td>Age:</td>
<td>67 to 91 years (mean 80.6 years)</td>
</tr>
<tr>
<td>Inclusion:</td>
<td>community living, restricted mobility</td>
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<td>Exclusion:</td>
<td>not specified</td>
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This study highlighted three areas affecting nutritional intake in older people: social (loneliness and bereavement), economic (budget, access to Social Services) and physical (difficulties with shopping for, preparing and cooking food). It is proposed by the authors that public policy should consider the adequacy of resources made available to elderly people to help them to remain independently living in the community for longer. Public transport is one area of concern, since current forms are not always suited to the needs of elderly people. In addition, some elderly people are unaware about access to home delivery services or else avoid them due to loss of opportunity for socialisation. In addition, those with physical limitations (e.g. arthritis) need to be identified and provided with access to aids.

Results not generalisable to whole population
Strengths: qualitative data
Limitations: small sample size; males and people living as couples under-represented; voluntary participation; limited to people with restricted mobility

and those with low income; does not include an ethnically and racially diverse population

VI