

# Food Insecurity among Senior Citizens in High Out-migration Areas: Evidence from Western Nepal

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## Research article

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# Abstract

**Background:** Food insecurity is a critical public health challenge, in particular in low and middle-income countries. Nepal, a low-income country, is undergoing rapid demographic and epidemiological transitions with a growing population of senior citizens. However, the determinants of food security status among Nepali senior citizens are still unknown. This study aims to fill this gap focusing on the elderly populations in the far-western region, one of the poorest regions of the country. The study also aims to assess the potential impact of adult child migration on the food security status of the left behind elderly parents.

**Methods:** A community-based cross-sectional study was conducted among 260 randomly selected senior citizens in the Kanchanpur district in far-western Nepal. The short form of the household food security scale, originally developed by the United States Department of Agriculture, was used to measure household food security. Associations were examined by means of logistic regression.

**Results:** The prevalence of food insecurity, in senior citizens' households, was 41.1%. Senior citizen households with their adult children's migration (AOR= 0.49, 95% CI: 0.24- 0.98) had lower odds of being food insecure and households with lower family income (<\$100 compared to  $\geq$  \$100) (AOR= 2.24, 95% CI: 1.08 - 4.65) had two times higher odds of being food insecure. Also, households owning a cultivable land/farm (AOR= 0.14, 95% CI: 0.05-0.37) and involved in agriculture (AOR= 0.29, 95% CI: 0.09-0.99) or business (AOR= 0.20, 95% CI: 0.05-0.74) had lower odds of being food insecure.

**Conclusion:** The prevalence of food insecurity among households with senior citizen in Kanchanpur district was high and associated with migration status of adult children, household income and ethnicity. This calls for a greater policy response focused specifically on the households with elderly citizens and integration of gerontological evidence into the existing food security and nutrition strategies.

## Background

Food insecurity is a global public health challenge and is associated with poor nutritional outcomes and health status [1]. Food security of individuals or households refers to "the situation when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preference for an active and healthy life"[2]. While overnutrition is increasingly a major public health issue in many developed countries [3], most of the low and middle-income countries are still struggling to overcome hunger and undernutrition [4]. About 11% of the world population is currently affected by hunger and the world will have to feed an additional 2.3 billion people by the year 2050 [4]. Considering this imminent challenge, the United Nations (UN) has set a goal to end hunger, achieving food security and improved nutrition, and promoting sustainable agriculture as the second goal of its Sustainable Development Goals (SDGs) agenda to be achieved by the year 2030[5].

Nepal is one of the poorest country, with less than US\$1,000 gross domestic income per capita[6]. Although agriculture is the main occupation among the Nepali population, the rapid global climate

change paired with seasonal natural disasters such as flood and landslides have severely affected the Nepalese agriculture system[7]. Consequently, food prices have increased, and access to food has become more difficult, in particular for the poorest segments of the society. Nearly five millions Nepalese are directly affected by severe hunger and malnutrition[8]. Globally, Nepal ranks 72nd in the Global Hunger Index (GHI) [9]. The newly promulgated constitution of Nepal of 2015 has established the provision of food security as the right of every Nepali citizen. Specifically, to address the issue of food insecurity in the country, the Government of Nepal has drafted the Food and Nutrition Security Plan of Action (FNSC) [10] and a High Level Nutrition and Food Security Steering Committee (HLNFSSC) has been established to monitor the food insecurity status in the country [11]. Despite the numerous commitments, more than half (54%) of the population in Nepal suffers from chronic food insecurity; and the far-western region is one of the most affected regions in the country [12].

In Nepal, demographic transition has resulted in a burgeoning population of older adults, which comprised about 8% of the total population in the latest census of 2011 and is projected to further increase [13]. Consequently, the population growth rate of senior citizens (3.5%) is greater than the overall population growth rate (2%) of the country [13]. Nepal's Senior Citizen Act defines people aged 60+ as senior citizens [14]. Older adults are already at increased risk of chronic health problems, which can be further, exacerbated by food insecurity and poor nutritional status [15]. Many factors such as financial constraints, functional limitation and disability, social isolation, community characteristics (e.g. rural vs. urban areas, availability of transportation, food stores) affect the older individuals' ability to prepare, access, and consume nutritious food [15].

Furthermore, in addition to the biological, physiological and emotional changes accompanying the aging process, older adults in Nepal are currently facing socio-structural changes in Nepali society[16]. Nepalese communities have a long established culture and tradition of staying together in a joint/extended family, wherein multiple generations reside together and adult sons are morally obliged to provide care and support to elderly parents [16]. Recently, both in rural and urban modern Nepali society, the conventional joint/extended family system is being replaced by nuclear families [16], creating challenges regarding the care and support of older adults. Moreover, the high rates of adult children out migration, internal and external, resulted in many older parents being left alone, making them more vulnerable to negative health consequences, such as feelings of loneliness, helplessness, frustration, and increased household and social burdening [17,18]. However, adult children's migration may contribute to greater food security of the left behind older parents. It can be hypothesized that the remittance from labor migration may uplift households' food purchasing power and thus increase food security, although no previous studies have examined the patterns and determinants of food insecurity of the elderly population in Nepal in the context of adult children's migration.

Existing research shows that food insecurity is associated with multiple factors including climate change, agricultural productivity, geographic vulnerability as well as geopolitical, economic and socio-demographic factors [19,20]. However, as to the best of our knowledge, none of previous studies have assessed the food insecurity status among senior citizens, neither focused nor investigating the factors

affecting food security status of the elderly specifically in the context of high out-migration. The present study aims to fill this gap by using newly collected primary data from one of the most vulnerable regions in Nepal, far-western region. The findings of this study will contribute to future provincial and local level social security policies for senior citizens. Therefore, the objectives of this study were (1) to assess the household food insecurity status of senior citizens; and (2) identify the factors associated with households' food insecurity among senior citizens of far western Nepal.

## Methods

### Study design and setting

A community based cross-sectional study was conducted in the Kanchanpur district of the far-western region of Nepal from June to September 2017. The overall prevalence of food insecurity in this district, measured in terms of food poverty was 28% [21]. The district has high labor migration; almost 94% of households have at least one family member who has migrated in search of labor jobs [22]. There is a high outflow of seasonal labor migrant workers to the neighboring country of India, which borders the district in the south and west [23]. The Gulf nations and Malaysia are popular destinations for long-term labor migration for youth and adults of this district [23]. These conditions make the district an appropriate site for the study of food insecurity in the context of migration.

Of the total seven municipalities and two rural municipalities (locally called Gaupalika in new federal structure) in the Kanchanpur district, Krishnapur municipality composed of urban and semi-urban areas was randomly selected for the study sites[24]. According to the most recent census, the Krishnapur municipality had 6,723 households with a total population of 36,706 (17,552 males and 19,154 females); of which the population of senior citizens was 2,505 (1,184 male and 1,321 female) [25]. Krishnapur municipality had 1,861 (27.68%) households with an absent family member (absent for employment or study or business purpose), with a total of 3,026 absent people (2,549 male and 477 female) [25].

### Sample and inclusion criteria

The required sample size of 260 for this survey was estimated by R language-based Decision Analyst software, considering 24% prevalence of malnutrition among Nepalese senior citizens [26], 95% confidence intervals, 5% precision level, and a total population of 2,505 older adults in the study area [25].

In this survey, respondents were the community-dwelling senior citizens. Criteria for eligibility included being at least 60 years old, a permanent resident of Krishnapur municipality (defined as at least one year of residence), and having at least one biological, step, or adopted adult child ( $\geq 18$  years old). Every fifth alternate household was selected by systematic sampling. One eligible senior citizen respondent was selected from each household; therefore, the number of households in the study was similar to the number of the elderly participants. If two or more eligible participants were in one household, as is common in Nepal, the eldest was chosen. If an eligible participant was not present in the selected house,

then data was sought from an eligible participant in the adjacent house. This study is a second part of previous study that aimed to measure the association of adult children's migration with overall well-being of the left behind elderly parents in Nepal[27].

## Data collection, study instruments and variables

The study team collected data visiting elderly residents of Krishnapur municipality. Interviewers conducted the face-to-face interviews with individual participants to solicit information. The enumerators were public health students and they were provided two days in-person training on study objectives, data collection procedures, sample choice, tool contents, eligibility criteria, and consent process. The enumerators were familiar with the study objectives, procedure and research ethics. The quality of the data was ensured through regular supervision of enumerators in field, cross checking of the collected data and recollection of the initially missing data.

## Household food insecurity

The Six-Item Short Form of the Food Security Survey Module, originally developed and validated by the United States Department of Agriculture, was used to quantify the main outcome of this study i.e. food insecurity of the households with senior citizen [28]. It is a continuous, linear scale variable that measures the degree of severity of food insecurity or hunger experienced in the last 12 months by a household in terms of a single numerical value [28]. The tool has been validated and used in similar cultural setting and geographical context [29,30]. The original tool was translated into the Nepali language and pretested before use. Cronbach's alpha of the tool in this study was 0.76.

A series of six questions focused on the affordability of food in the senior citizen living households in the last 12 months. The aim was to collect the information regarding 1) concerns about food scarcity, 2) lack of resources for preferred food, 3) lack of variety of food/balanced meals, 4) eating different meals than needed/skipping meals due to lack of resources, 5) eating less meals than required due to lack of resources, and 6) not having a meal as a result of unavailability of food[28]. Each item in the food security scale was reduced to the categories of affirmative or not, as per the recommendation [28]. The sum of affirmative responses to the six questions in the module is the household's raw score on the scale. The food security status of households with raw score 0–1 was coded as food secure and two categories " low food security" (raw score 2–4) and "very low food security" (raw score 5–6) were coded as food insecure [28].

## Socio-demographic variables

The study participants were also interviewed to generate information on demographic and socio-economic variables. The demographic variables included age, sex, ethnicity, family structure, adult

childrens' migration, and ever having smoked. Participants' ethnicity was classified into three major groups: Upper Caste, Janajati, and Dalit, to reflect Nepalese society's ethnic/caste hierarchical system. Generally, Upper Caste referred to the most advantaged group, Janajatis referred to medium and Dalit referred to the most disadvantaged group [31]. Family structure was classified as nuclear (elderly participant living by themselves or with a spouse), joint (elderly participant living with an adult child and their family), and extended family (elderly participant living with more than one adult child and their family in the same household). Adult children's migration was defined as living away from the home district for the sole purpose of employment or income generation, for a period of at least six months, excluding the occasional visits. Socio-economic variables included self-reported family monthly income and primary income source, owning a cultivable land, and recipient of geriatric allowance. Under the state social protection system, Government of Nepal provides a monthly equivalent to US\$19 old age allowance to senior citizens who are above 70 years of age[32]. However citizens older than 60 from *Dalit* ethnic group and residents of Karnali region are entitled to additional senior citizen monthly allowances[32].

## Data management and analysis

The collected data were entered into EpiData software v3.1 and transferred into IBM SPSS 21 for statistical analyses. Based on the nature of the data, measures of central tendency and spread and frequencies were calculated. Differences in mean values and frequency distributions between food secure and insecure households were assessed using independent t-tests and Pearson's chi-square ( $\chi^2$ ) or Fisher's Exact tests, respectively. Binary logistic regression model was used to analyze the presupposed association between food insecurity status and demographic and socioeconomic variables. Variables significant in the unadjusted models were adjusted for each other in the adjusted model.

## Results

### Demographic and socio-economic characteristics

Table 1 shows the demographic and socio-economic characteristics of the households with senior citizens by food security status (Table 1). Mean age of the participants was  $68.9 \pm 7.6$  years. More than half of the participants were aged 60–69 years, male, from Upper Caste ethnicity, lived in a joint family, and had at least one migrant adult child. About one-third of the participants smoked and 84% had at least one health problem. The average monthly income of the family was  $\$95.7 \pm 65.9$ ; 65% of the households had less than \$100 monthly income. Agriculture was the primary income source for more than half of the households and more than 85% of the households owned a cultivable land. About 41% of the senior citizens received geriatric allowance. Approximately 41% of the households with senior citizens were food insecure.

# Food insecurity status of the households with senior citizens

Based on the results of the adjusted binary logistic regression (Table 2), having adult migrant children (AOR = 0.49, 95% CI = 0.24–0.98), not smoking (AOR = 0.05, 95% CI = 0.02–0.12), having a farm (AOR = 0.29, 95% CI = 0.09–0.99) or business (AOR = 0.20, 95% CI = 0.05–0.74) as primary income source, and owning a cultivable land (AOR = 0.14, 95% CI = 0.05–0.37) were significantly associated with reduced odds of being from a food insecure household. Compared to upper caste, Janajati ethnicity (AOR = 2.63, 95% CI = 1.13–6.08) had higher odds of being food insecure. Compared to a family with equal or above US\$100 monthly income, a family with less than US\$100 monthly income had significantly higher odds of being food insecure (AOR = 2.24, 95% CI = 1.08 - 4.65).

## Discussion

This study was conducted to identify the determinants of food insecurity among households with senior citizens in far-western Nepal. The study found that 41.1% of such households were food insecure. Factors such as having an adult migrant child, not smoking, having a higher family income, having agriculture or business as a primary income source, and owning a cultivable land were associated with reduced odds of being food insecure. High prevalence of food insecurity in this study was expected given that Nepal is one of the poorest country, with less than US\$1,000 gross domestic income per capita[6]. In the global stage, Nepal ranks 72nd in the Global Hunger Index (GHI) [9] with nearly five millions Nepalese being affected by severe hunger and malnutrition[8]. Further, the far-western areas of the country are least developed compared to eastern and or central parts and most severely affected by chronic food insecurity[12]. Moreover, older adults are at increased risk of food insecurity due to several factors such as financial constraints, functional imitation and disability, social isolation[16].

In this study, adult children's migration was associated with greater food security. We believe that the remittance from labor migration may have uplifted the households' food purchasing power and thus increased the food security. Previous studies also provide evidence that migration of adult family members for jobs and family receiving remittances back home were found to be positively associated with household food security[33–35]. For example, a recent study by Szabo et al. on the impacts of remittance income on human-wellbeing in tropical delta regions found that households which were receiving remittances were significantly more likely to be food secure and had greater access to clean drinking water and sanitation [35]. Another study focusing on Bangladesh, also showed that receiving remittances was positively associated with household food security, measured by calorie intake [36].

The links between low-income status and food insecurity are well-documented [37]. Given that family's income impacts their purchase capacity and food affordability, the association between low-income status and food insecurity observed in this study was expected and is consistent with similar studies conducted in both resource rich and poor settings[37–39]. In this study, households having a farm as a primary income source were found to be less food insecure. This finding was expected in the Nepalese

context, since agriculture is mostly subsistence-based whereby the produced food is used to meet the family needs first. This result is analogous with the study from Ethiopia, which found that small scale own agriculture land has a positive effect on the household food security [40].

Interestingly, smoking status was positively associated with food insecurity status. Previous studies, among nationally representative sample of Nepalese households [41], among rural and poor families in Indonesia [42], and among low income families in the US [43], also provide evidence of a positive association between household food insecurity and parental or family members' smoking. This finding is concurrent with the assumption that family members' use of tobacco products affects the household's expenditure on food and health services in resource poor settings [44]. However, due to lack of total household expenditure data, this study could not explain the actual effect size of expenditure on tobacco consumption and food insecurity household food insecurity. The evidence that Nepalese households spend an average about 5% of their annual expenditure on tobacco products [45] supports this result.

The results from this study should be viewed in light of its limitations. First, the cross-sectional design of this study does not allow for the establishment of a temporal association between food insecurity and the various demographic and socio-economic variables analyzed and thus no causality should be inferred. Second, the tool was developed by the United States Department of Agriculture for the assessment of food insecurity in the American households. Future studies may be needed to further assess the validity of this tool in Nepalese context. Third, the study setting included an urban area in the far west of the country, which may limit the external validity of the study's findings, especially in terms of similar households in rural areas and /or other parts of the country. It can be assumed that food insecurity rates might be higher in rural areas because, in general, households in rural Nepal are more likely to be poorer than urban households [46]. However, in this study, given that cultivatable land, which is more common in rural Nepal, was associated with higher food security, it is also possible that households in rural areas are likely to grow their own food and thus may have better food security status than urban. Additional studies among senior citizens in different regions of the country should be conducted for a comprehensive understanding of food insecurity; more specifically those evaluating the hypothesized bi-directional relationship between urban-rural residency and food security status.

## Conclusion

This study aimed at examining the determinants of food insecurity among households with senior citizens in the context of high out-migration. Our study is one of the pioneering studies to shed light on this important but understudied topic. It provided evidence that economic migration of adult children may benefit left-behind elderly parents and reduce their food insecurity risks. Other key determinants of food security status amongst the household with elderly citizens included household income and ethnicity. These results highlight persisting inequalities in the Nepali society and in particular among the elderly population. While our results can be generalized in the Western Nepal, the study findings illustrate a pressing need to conduct further research on food security status among the Nepali elderly citizens—at the national level and accounting for multiple aspects inequality. The results of this study also calls for

immediate action from stakeholders to support food insecure senior citizens, especially those from low-income families. As the Government of Nepal is in a preconception phase of devising national plans and policies for senior citizens, food insecurity issues should also be given priority within the agenda.

## **Abbreviations**

AOR: Adjusted Odds Ratio; CBS: Center Bureau of Statistics; FAO: Food and Agriculture Organization; GHI: Global Hunger Index; HLNFSSTC: High Level National Food Security Steering Committee; NPC: National Planning Commission; USDA: United State Department of Agriculture

## **Declarations**

## **Ethics approval and consent to participate**

This study was granted ethical clearance from ethical review board of Nepal Health Research Council (Ref no: 540/2017). Permission was also granted by the local Municipality Office. Written informed consent was obtained from all the participants. Participation was voluntary, and participants' identity were kept confidential.

## **Consent for publication:**

Not applicable.

## **Competing interests:**

The authors state that they have no competing interests.

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None

## **Availability of data and material:**

All data analyzed during this study are available from corresponding author on reasonable request.

## **Authors' contributions:**

Devendra Raj Singh (DS), Saruna Ghimire (SG), Eva M Jeffers (EJ), Sunita Singh (SS1), Dharendra Nath (DN), Sylvia Szabo (SS2). Conceived and designed the study: DS and SG. Tool translation to Nepali: DS,

SG, DN and SS1. Facilitated data collection in the field: DS, SS1 and DN. Analyzed the data: DS, SS1 and DN. Drafted the manuscript: DS, SG, EJ, DN and SS2. Critical revision of the manuscript: DS, DN, SS1, EJ, SS2 and SG. Approval of the final version of the manuscript: DS, SG, SS1, EJ, DN and SS2.

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## References

1. Lee JS, Frongillo EA. Nutritional and Health consequences are associated with food insecurity among U.S. elderly persons. *J Nutr.* 2001;131(5):1503–9.  
<https://doi.org/10.1093/jn/131.5.1503>
2. Food and Agriculture Organization of The United Nations. Trade Reforms and Food Security Conceptualizing The Linkage. Rome, Italy; 2003.  
<http://www.fao.org/3/a-y4671e.pdf>
3. Seidell JC, Halberstadt J. The Global Burden of Obesity and the Challenges of Prevention. *Ann Nutr Metab.* 2015;66(2):7–12. <https://doi.org/10.1159/000375143>
4. Food and Agriculture Organization of the United Nations. The future of food and agriculture: Trends and challenges. Rome; 2017. <http://www.fao.org/3/a-i6881e.pdf>
5. Griggs D, Stafford-Smith M, Gaffney O, Rockström J, Öhman MC, Shyamsundar P, et al. Sustainable development goals for people and planet. *Nature.* 2013;495:305.  
<https://doi.org/10.1038/495305a>
6. Schwab K. The Global Competitiveness Report 2017–2018. World Economic Forum. Geneva; 2017.  
<http://www3.weforum.org/docs/GCR2017->

[2018/05FullReport/TheGlobalCompetitivenessReport2017%E2%80%932018.pdf](#)

7. Central Bureau of Statistics. National Climate Change Impact Survey 2016: A Statistical Report. Kathmandu, Nepal; 2016.

<http://cbs.gov.np/national-climate-change-impact-survey-2016-report-2/>

8. Ministry of Agriculture and Development. Nepal: Zero Hunger Challenge National Action Plan (2016-2025). Kathmandu, Nepal; 2016.

[https://www.npc.gov.np/images/category/ZHC\\_NAP\\_\(2016\\_-\\_2025\).pdf](https://www.npc.gov.np/images/category/ZHC_NAP_(2016_-_2025).pdf)

9. Patterson WF, Sonntag A, Zimmermann S-M, Author G, Hossain N. Global Hunger Index The Inequalities of Hunger. Washington DC; 2017.

<https://www.globalhungerindex.org/pdf/en/2017.pdf>

10. Ministry of Agricultural Development (MOAD). Nepal, Food and Nutrition Security Plan of Action (FNSP): A National Programme for Food and Nutrition Security. Kathmandu, Nepal; 2013.

<http://www.nnfsp.gov.np/PublicationFiles/d405d609-bb00-4708-831c-149dea4b4f49.pdf>

11. Karki R, Adhikari B. A Review Report on Policies and Practices on Food Security and Right to Food in Nepal, Rural Reconstruction Nepal. 2016.

[https://www.rrn.org.np/phocadownloadpap/Research\\_Reports/review\\_report\\_right2food.pdf](https://www.rrn.org.np/phocadownloadpap/Research_Reports/review_report_right2food.pdf)

12. MoAD/CBS/FAO. Food And Nutrition Security In Nepal: A Status Report. Kathmandu, Nepal; 2016.

<http://moad.gov.np/public/uploads/201721855-final Food NS 2015.pdf>

13. Central Bureau of Statistics. National Population and Housing Census 2011. Vol. 01. Kathmandu, Nepal; 2014.

<https://unstats.un.org/unsd/demographic-social/census/documents/Nepal/Nepal-Census-2011-Vol1.pdf>

14. Government of Nepal. Senior Citizens Act, 2063 (2006). Kathmandu, Nepal; 2006.

15. Lee JS, Fischer JG, Johnson MA. Food Insecurity, Food and Nutrition Programs, and Aging: Experiences from Georgia. J Nutr Elder. 2010;29(2):116–49.

<https://doi.org/10.1080/01639366.2010.480895>

16. Geriatric center Nepal. Status Report on Elderly People ( 60 + ) in Nepal on Health , Nutrition and Social Status Focusing on Research Needs Government of Nepal Ministry of Health and Population Geriatric Center Nepal Ramchandra Marg , Battisputali-9 Kathmandu Nepal. Heal (San Fr. 2010;1–57.

17. Gautam TR. Migration and the Problem of Old Age People in Nepal. *Dhaulagiri J Sociol Anthropol*. 2008;2(0). <https://doi.org/10.3126/dsaj.v2i0.1361>
18. Ghimire S, Baral BK, Karmacharya I, Callahan K, Mishra SR. Life satisfaction among elderly patients in Nepal: Associations with nutritional and mental well-being. *Health Qual Life Outcomes*. 2018;16(118)  
  
<https://doi.org/10.1186/s12955-018-0947-2>
19. Lee JS, Frongillo EA. Factors Associated With Food Insecurity Among U.S. Elderly Persons: Importance of Functional Impairments. *Journals Gerontol Ser B Psychol Sci Soc Sci*. 2001;56(2):S94–9.  
  
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.518.5336&rep=rep1&type=pdf>
20. Vermeulen S, Zougmore R, Wollenberg E, Thornton P, Nelson G, Kristjanson P, et al. Climate change, agriculture and food security: a global partnership to link research and action for low-income agricultural producers and consumers. *Curr Opin Environ Sustain*. 2012;4(1):128–33.
21. Government of Nepal/World Bank Group/ World Food Program/Unicef. Small Area Estimation of Food Insecurity and Undernutrition in Nepal. Kathmandu, Nepal; 2014.
22. Sharma JR, Sharma S. Enumerating Migration In Nepal: A Review. Kathmandu, Nepal; 2011.  
  
<https://www.ceslam.org/files/Enumerating Migration in Nepal.pdf>
23. Government of Nepal. Labour Migration for Employment A Status Report for Nepal: 2014/2015. 2016.
24. Election Commission Nepal. District Wise Constituency Map [Internet]. 2017. Available from: <http://www.election.gov.np/election/en/district-wise-constituency-map-154.html>
25. Central Bureau of Statistics. National Population and Housing Census 2011. Vol. 03. Kathmandu, Nepal; 2012.  
  
<https://unstats.un.org/unsd/demographic-social/census/documents/Nepal/Nepal-Census-2011-Vol1.pdf>
26. Ghimire S, Kumar Baral B, Callahan K. Nutritional assessment of community-dwelling older adults in rural Nepal. 2017;12(2) <https://doi.org/10.1371/journal.pone.0172052>
27. Ghimire S, Singh DR, Nath D, Jeffers EM, Kaphle M. Adult children’s migration and well-being of left behind Nepalese elderly parents. *J Epidemiol Glob Health*. 2018.  
  
<https://doi.org/10.1016/j.jegh.2018.07.004>
28. Bickel G, Nord M, Price C, Hamilton W, Cook J. Guide to Measuring Household Food Security. USDA Econ Res Serv. 2000;1–82.

<https://fns-prod.azureedge.net/sites/default/files/FSGuide.pdf>

29. Sethi V, Maitra C, Avula R, Unisa S, Bhalla S. Internal validity and reliability of experience-based household food insecurity scales in Indian settings. *Agric Food Secur.* 2017;6(1):21.

<https://doi.org/10.1186/s40066-017-0099-3>

30. Gulliford MC, Mahabir D, Rocke B. Reliability and validity of a short form household food security scale in a Caribbean community. *BMC Public Health.* 2004;4(22).

<https://doi.org/10.1186/1471-2458-4-22>

31. Bennett L, Ram Dahal D, Govindasamy P. Caste, Ethnic and Regional Identity in Nepal: Further Analysis of the 2006 Nepal Demographic and Health Survey. 2008.

32. Knox-Vydmanov C. Work, family and social protection: Old age income security in Bangladesh, Nepal, the Philippines, Thailand and Vietnam. Chiang Mai, Thailand; 2016.

<http://ageingasia.org/eaprdc0045/>

33. Kiawu JAF, Jones KG. Implications of food aid and remittances for West African food import demand. *African J Agric Resour Econ Vol.* 2013;8(1):30–44.

34. Nguyen, Minh Cong; Winters P. The impact of migration on food consumption patterns: The case of Vietnam. *Food Policy.* 2011;36(1):71–87.

<https://doi.org/10.1016/j.foodpol.2010.11.001>

35. Szabo S, Adger WN, Matthews Z. Home is where the money goes: migration-related urban-rural integration in delta regions. *Migr Dev.* 2018;2324:1–17.

<https://doi.org/10.1080/21632324.2017.1374506>

36. Szabo S, Hossain MS, Adger WN, Matthews Z, Ahmed S, Lázár AN, et al. Soil salinity, household wealth and food insecurity in tropical deltas: evidence from south-west coast of Bangladesh. *Sustain Sci.* 2016;11(3):411–21.

<https://doi.org/10.1007/s11625-015-0337-1>

37. Goldberg SL, Mawn BE. Predictors of Food Insecurity among Older Adults in the United States. *Public Health Nurs.* 2015;32(5):397–407.

38. Ramsey R, Giskes K, Turrell G, Gallegos D. Food insecurity among adults residing in disadvantaged urban areas: potential health and dietary consequences. *Public Health Nutr.* 2012 Feb 7;15(02):227–37.

• <https://doi.org/10.1017/S1368980011001996>

39. Endale W, Mengesha Z, Atinafu A, Adane A. Food Insecurity in Farta District, Northwest Ethiopia: a community based cross-sectional study. *BMC Res Notes*. 2014 ;7(1):130. doi: [10.1186/1756-0500-7-130](https://doi.org/10.1186/1756-0500-7-130)
40. Shone M, Demissie T, Yohannes B, Yohannis M. Household food insecurity and associated factors in West Abaya district, Southern Ethiopia, 2015. *Agric Food Secur*. 2017;6(1):2.  
<https://doi.org/10.1186/s40066-016-0080-6>
41. Sreeramareddy CT, Ramakrishnareddy N. Association of adult tobacco use with household food access insecurity: results from Nepal demographic and health survey, 2011. *BMC Public Health*. 2017;18(1):48.  
<https://doi.org/10.1186/s12889-017-4579-y>
42. Semba RD, Campbell BS AA, Sun KM, de Pee S, Akhter NM, Moench-Pfanner R, et al. Paternal smoking is associated with greater food insecurity among poor families in rural Indonesia. Vol. 20, 618 *Asia Pac J Clin Nutr*. 2011.  
<https://pdfs.semanticscholar.org/dc46/7f56f2a1fc73eadedd6742063df31ea853b5.pdf>
43. Armour BS, Pitts MM, Lee C-W. Cigarette Smoking and Food Insecurity among Low-Income Families in the United States, 2001. *Am J Heal Promot*. 2008;22(6):386–90.  
<https://doi.org/10.4278/ajhp.22.6.386>
44. Efroymsen D, Ahmed S, Townsend J, Alam SM, Dey AR, Saha R, et al. Hungry for tobacco: an analysis of the economic impact of tobacco consumption on the poor in Bangladesh. *Tob Control*. 2001 Sep;10(3):212–7. <http://dx.doi.org/10.1136/tc.10.3.212>
45. Karki YB, Dev Pant K and, Raj Pande B. *A Study on the Economics of Tobacco in Nepal*. Washington DC; 2003.
46. National Planning Commission and Central Bureau of Statistics. *Nepal Thematic Report on Food Security and Nutrition 2013*. Kathamndu, Nepal; 2013.  
<https://documents.wfp.org/stellent/groups/public/documents/ena/wfp256518.pdf>

## Tables

**Table 1: Demographic and socioeconomic characteristics of senior citizens by household food security status**

Characteristics	Total Sample n=260	Food Security status		p-value
		Food Secure	Food Insecure	
		n= 152 (58.5%)	n=108 (41.5%)	
	n (%)	n (%)	n (%)	
<b>Migration of adult children</b>				0.020*
No	127 (48.8)	65(42.8)	62(57.4)	
Yes	133 (51.2)	87(57.2)	46 (42.6)	
<b>Age (mean ± SD)</b>	68.9 ± 7.6	69.4± 6.9	68.1± 8.4	0.192 <sup>a</sup>
<b>Age Category</b>				<0.001*
60-69	148(56.9)	72(47.4)	76(70.4)	
≥70 years	112(43.1)	80(52.6)	32(29.6)	
<b>Sex</b>				0.739
Male	150 (57.7)	89(58.6)	61(56.5)	
Female	110 (42.3)	63(41.4)	47(43.5)	
<b>Ethnicity</b>				0.12
Upper Caste	174 (66.9)	109(71.7)	65(60.2)	
Janajatis	53 (20.4)	25(16.4)	28(25.9)	
Dalit	33 (12.7)	18(11.8)	15(13.9)	
<b>Family structure</b>				0.599
Nuclear	11(4.2)	8(5.3)	3(2.8)	
Joint	154 (59.2)	90(59.2)	64(59.3)	
Extended	95(36.5)	54(35.5)	41(38.0)	
<b>Smoking Status</b>				<0.001*
No	176(67.7)	124(81.6)	52(48.1)	
Yes	84(32.3)	28(18.4)	56(51.9)	
<b>Family's monthly income (US\$)</b>				
< 100	170(65.4)	87(57.2)	83(76.9)	0.001*
≥100	90(34.6)	65(42.8)	25(23.1)	
<b>Family's monthly income (US\$) (mean±SD)</b>	95.7 ± 65.9	103.1 ± 63.3	78.5 ± 62.4	0.002 <sup>b</sup> *
<b>Primary income source of family</b>				0.012*
Agriculture	145 (55.8)	77(50.7)	68(63.0)	
Business	29 (11.2)	23(15.1)	6(5.6)	
Service /Pension/Allowance	34 (13.1)	25(16.4)	9(8.3)	
Wages-based labor	52 (20.0)	27(17.8)	25(23.1)	
<b>Own cultivable land</b>				<0.001*
No	38 (14.6)	10 (6.6)	28(25.9)	
Yes	222(85.4)	142(93.4)	80(74.1)	
<b>Geriatric allowance recipient</b>				0.001*
No	153(58.8)	76(50.0)	77(71.3)	
Yes	107(41.2)	76(50.0)	31(28.7)	
a: p-value from independent t-test; b: p-value from Fisher's Exact Test; and others are from Chi-Square test				
*: p<0.05				
SD: standard deviation				

**Table 2: Factors associated with food insecurity of households with at least one senior citizen**

Characteristics	Unadjusted	Adjusted <sup>a</sup>
	OR (95%CI)	OR (95%CI)
<b>Migration of adult children</b>		
No	Ref	Ref
Yes	0.55 (0.33-0.91)*	0.49(0.24-0.98)*
<b>Age Category</b>		
60-69	Ref	Ref
≥70 years	2.63 (1.56-4.44)*	0.24 (0.02-2.62)
<b>Sex</b>		
Male	Ref	-
Female	1.08 (0.66-1.79)	-
<b>Ethnicity</b>		
Upper caste	Ref	Ref
Janajati	1.87 (1.01-3.49)*	2.63(1.13-6.08)*
Dalits	1.39 (0.66-2.96)	0.91(0.34-2.42)
<b>Family structure</b>		
Nuclear	Ref	-
Joint	0.93 (0.55-1.57)	-
Extended	0.49 (0.12-1.97)	-
<b>Smoking status</b>		
No	0.21(0.12-0.36)*	0.05 (0.02-0.12)*
Yes	Ref	Ref
<b>Family's monthly income (US\$)</b>		
< 100	2.48 (1.43-4.30)*	2.24 (1.08-4.65)*
≥100	Ref	Ref
<b>Primary income source of family</b>		
Agriculture	0.38(0.15-0.99)*	0.29(0.09-0.99)*
Business	0.28 (0.09-0.80)*	0.20(0.05-0.74)*
Service/Pension/Allowances	0.95 (0.50-1.79)	0.54(0.23-1.26)
Wages-based labor	Ref	Ref
<b>Own a cultivable land</b>		
No	Ref	Ref
Yes	0.20 (0.093-0.436)*	0.14 (0.05-0.37)*
<b>Geriatric allowance recipient</b>		
No	Ref	Ref
Yes	0.40 (0.23-0.68)*	0.38 (0.03-4.36)
*p<0.05; Ref: reference category; OR: Odds Ratio; CI: Confidence Interval		
<sup>a</sup> Adjusted for variables significant in the unadjusted model.		

## Supplementary Files

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- [STROBEchecklistcrosssectional.doc](#)