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# Do Remittances Increase Obesity-Related Behaviours and Attitudes? A Case Study of Nepal

Master's thesis in Global Health

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## Abbreviations

<b>BMI</b>	Body Mass Index
<b>GBD</b>	Global Burden of Disease
<b>GDP</b>	Gross Domestic Product
<b>GPAQ</b>	Global Physical Activity Questionnaire
<b>ISCED</b>	International Standard Classification of Education
<b>LMIC</b>	Low- and Middle-Income Country
<b>MET</b>	Metabolic Equivalent of Task
<b>NCD</b>	Non-Communicable Disease
<b>NPR</b>	Nepali Rupee
<b>PAS</b>	Physical Activity Score
<b>STEPS</b>	Stepwise Approach to Surveillance
<b>TSCS</b>	Time-Series Cross-Sectional (data)
<b>WENAO</b>	Western Europe, North America, Oceania
<b>WHO</b>	World Health Organization

## Abstract

**Background:** Developing countries have entered the stage of dietary and physical activity transition led by a phenomenal economic growth in recent years. It is reasonable to make an inference that the answer lies in socioeconomic changes over the years. Changes in nutrition and physical activity, that derive from increasing household income, become an emerging health hazard.

**Objectives:** To examine the relationship between remittances and non-communicable disease-related health behaviours and attitudes of the Nepali youth, with a focus on nutritional consumption and physical activity. Nepal provides a unique case study due to the country's changes in financial structures with increasing remittances per capita, in societal structures and the rapid development of infrastructures.

**Methods:** Time-Series Cross-Sectional data from the Global Burden of Disease Study and the World Bank was analyzed to give a global perspective. An individual-level data in Nepal was collected employing a community-based survey questionnaire.

**Results:** The findings from the macro-data analysis show that both on a global scale and within the least developed countries, remittances have a significant but very small negative effect on the prevalence of obesity among the youth. In support of these findings, survey data revealed that remittances were positively associated with physical activity levels in the studied population. However, findings from the analysis of behaviours and attitudes contradict this theory. Remittance receivers report caring about and participating in sport activities less frequently compared to non-receivers. The analysis of the relationship between remittances and BMI did not arrive at conclusive statistical evidence.

**Conclusions:** There is not enough evidence to indicate that the remittances are driving the increasing obesity rates. There is some suggestion of promotive health effects of remittances, but these effects are small and inconclusive. Further research should be focusing on cumulative effects of migration proxies rather than an individual effect of remittances.

## Background

Global Burden of Disease (GBD) data has shown that many countries exhibit tendencies of their populations becoming heavier each year (1). Being overweight or obese poses risk factors for many non-communicable diseases (NCDs), such as diabetes, hypertension, and cardiovascular disease. As a result, obesity and its indicators have been in a spotlight for many research projects in the last two decades. The prevalence of obesity in adults, measured as the percentage of adults aged 18 years and older with a body-mass index (BMI) greater than 30, has increased more than twice since 1990 (2).

Children are an especially vulnerable group, which is a group that most likely to be affected by environmental, economic, societal, and technological changes. Obesity among children has increased by 10-fold since 1975, implying a failure to provide healthy life to future generations while commercial hazards continue to intensify. Global scientific agencies have called for a new movement where children and adolescents are placed at the center of research in efforts to achieve Sustainable Development Goals (3). Although obesity has been considered a disease burden in high-income countries, the recent trends of double burden of malnutrition in low- and middle-income countries (LMICs) suggests a widening gap between food insecurity and overconsumption. With social changes taking place at an earlier stage of economic and human capital development and more rapidly compared to high-income countries, the developing world requires more research in order to understand driving factors behind the issue of weight gain and the future prevalence of NCDs.

## Globalization

One of the theories that explains the rapid changes taking place in developing countries lays within the concept of globalization. Globalization has facilitated economic growth of many nations but its impact on social, environment, equity and health cannot be ignored. Globalization is a broad term that encompasses multiple aspects of economic and social life. The most important and abundantly found in the literature is an economic aspect. Globalization drives an increase in the exchange of goods and services and foreign investments. Evidence shows that the trade liberalization is linked to alleviated availability of processed food (4). Exposure to global markets is also linked to the adoption of obesogenic habits, changes in lifestyles and consumption (5) within (urban versus rural) and among (by region, social

development, human capital, income etc.) populations. Not less important, however, are socio-cultural aspects of globalization.

With blurring borders, people acquire the power of movement that lead to unprecedented rates of migration and urbanization. An increasing trend towards urbanization presents many health-related challenges. It has been shown that urbanization tends to shift both dietary and physical activity habits and acts as an obesogenic environment (4, 6). Migration, on the other hand, has mixed effects on the health of households and those effects are driven by both the ones that leave homeland and the ones that stay. One of the channels that migration may act as an obesity driver is improved income and wealth, which could be either invested or consumed (7). However, the availability and affordability of food products are not enough to steer the patterns of behavioural risk factors in populations (8). Therefore, other socio-cultural shifts such as in family and workforce system structures, with the increasing involvement of women, should also be considered in the light of globalization in LMICs.

Moreover, alongside the spread of digital technologies and social media - another element of globalization - the flow of information, whether detrimental or protective, also increases. While some researchers argue that greater connectivity does not have a positive correlation to increasing body weights in developing nations (5), others show evidence that social media, among other things, provide a niche for promotion and advertisement of processed food and promote unhealthy, sedentary lifestyles (8). Findings from high-income regions strongly suggest that advertisements on television programs are associated with child obesity. Moreover, it shows that the content also matters – advertisements of fat-dense and nutrient-poor food items appear to be significantly more influential compared to those advertisements aimed at nutritional health promotion (9).

### Nutritional and physical activity transition

Global health researchers are at an advantage since the dietary transition is well documented in the developed countries. The trends of LMICs in recent years are resembling those seen in high-income countries a few decades ago, providing a platform for comparison, a faster response by public health systems and adaptation of successful programs and policies. Retrospective data shows that the shift from home-based food preparation to mass preparation of food had major impacts on households and lifestyles of adults in the United States from 1965 to 1995 (10). Data suggests that the time spent on the preparation of food and clean-up had

decreased by half during that period, contributing to the decrease in calorie expenditure. The shift from labour into mechanization also influenced markets on the national level, resulting in cheaper prices and increased provision of goods. These economic outcomes, in turn, resulted in the increase of consumption. The unknown, however, was how the consumption is expressed within the households. Is consumption increasing through additional meals or more calories per meal? In fact, the most evident increase in consumption was through snacks. When it comes to the decreased expenditure of calories, wealth and technologies were found to be the main contributors to a widespread of a sedentary lifestyle, which was expressed mainly through the means of the television watching and commuting by car. However, the more recent trends in high-income countries show a turnover of curves. A negative relationship between socioeconomic status and obesity is expressed through affordability - healthy living is becoming unaffordable for households with low income (11).

The rates of obesity, however, are now growing faster in the developing countries compared to the industrialized world (12). In addition, the socioeconomic and technological transformation in the developing countries took place not only at the earlier stages of countries' development but also more rapidly than in the US and other high-income countries (13). Thus, considering LMICs, we can hypothesize that the pace of economic growth and globalization may move households beyond just meeting food security and widening health inequalities within populations. Therefore, the effects and spatiotemporality of this transformation need a closer look.

In fact, body weight and nutritional shifts have already been documented in some developing countries. The People's Republic of China (referred to as China) provides a well-studied example of a developing country which experienced a sudden increase in a population's body weight, especially among children (14). China has become a focus of interest also due to the large rural to urban migration, growing middle class and a steep economic growth and development over the last few decades. While moving away from labour-intensive markets and adapting urban, sedentary lifestyles where television is found in about 89% of households and motorized transportation is a common mean of commute, the Chinese population has experienced a significant shift in calorie expenditure. Studies in China also have shown that higher-income households are at a higher risk of an unhealthy decision making compared to lower-income households (13-18), such as amounts of edible oils consumed (13). Consequently, the odds of being obese are increased in higher income quantiles (16). The

reason why higher-income households are affected more may possibly be explained by the adoption of more Westernized lifestyles, in addition to other factors. With an increase of income, it allows individuals the ability to consume foreign products associated with sophistication, modernity, and novelty, often sought out and consumed by the youth (18). Moreover, studies have shown that not only the ability to purchase foreign products but coming from a low-income country itself presents a likelihood of higher rates of unhealthy decisions. Those decisions are being driven by a myriad of social and economic factors (19). For example, foreign obesogenic food consumption is perceived as a way to enhance the socioeconomic status and has become an important trend, despite the obesity risks of increased fast food consumption. Increased preferences for Western over local brands, regardless of significant price differences in developing countries, are explained not by the taste qualities, but rather by milieus, such as the presence of air conditioning and clean facilities – an environment that is associated with higher social status (20).

India also has experienced a significant nutritional transition. Although the nation has experienced a rapid economic growth, it is still a leading country by the number of undernourished people. The rate of decline in child undernutrition is half the rate of economic growth, which naturally raises questions about what is happening in the population. In fact, it was found that in the last three decades calorie intake in India has been decreasing. The rate of obesity, on the other hand, has been increasing. Pragmatic explanation is that with increasing wealth people decrease their physical activity since strenuous tasks are handed over to durable goods and home-grown food items are substituted with purchased ones. As a result of decreased energy requirements, individuals consume less calories. However, this explains India's trends only partially because there is still a large calorie deficit in the country (21).

From a nutritional perspective, as per capita intake of most food groups declines, the increase in fat consumption still remains. Dietary shifts in the South-East Asian countries are marked by the reduction of cereals, vegetables and legumes, and the increase of dairy, fish, meat, and processed meat products consumed (4). Cereals are substituted mainly with rice and wheat, which means a more nutrient-poor diet. Socioeconomic status again becomes one of the possible explanatory indicators - affluent groups are more likely to be exposed to foreign and processed food items, influenced by the mass media advertisements, and shift to a sedentary lifestyle. India is not an exception - richer people and urban residents are exhibiting obesogenic behaviours more commonly. Higher income households are found to consume more fattier and

sweeter food items, such as edible oils, meat, and sugar, compared to less prosperous households. The reduction in physical activity levels is also more frequently seen in better-off households. This seems to act mainly through the channels of reduced requirements of labour due to domestic mechanization, ownership of motorized vehicles, and mode of entertainment, such as television watching (21).

## Remittances

Accelerating rates of migration in LMICs resulted in an increasing prevalence of both countries and individuals relying on remittances. Remittances are monetary earnings of migrants sent back to their relatives in the homeland through official or informal channels (22). Indeed, currently, remittances form the major source of capital transfer from rich to poor countries, dwarfing even Foreign Direct Investment and development aid by a large margin (23). Remittances play a large role in many nations around the world, and they contribute evidently towards national economic growth and income per household. Azam and Raza (24) name two main ways how income, increased explicitly due to remittances, can be re-allocated. Remittances can either boost savings and cause investment in different shapes such as children's enrolment in schools or ownership and improvement of properties, or it can result in the increased consumption. Literature evidence on the health impacts of remittances shows that there is a positive correlation between increased remittances and decreased infant and child mortality in developing countries. However, households do not show increasing spending on healthcare with an increase in received remittances. Instead, households seem to invest in nutrition and better sanitary care, preventing infant and child mortality (25). Remittances also have a strong contribution on human capital development in lower income countries (26) by increasing enrollment in higher education (27) and decreasing poverty. Consequently, some governments are actively applying remedial measures to promote overseas employment (28). However, epidemiological data shows evidence of a transition towards the double burden of malnutrition - symbiosis of undernutrition and obesity alongside diet-related NCDs across households and individual's lifetime.

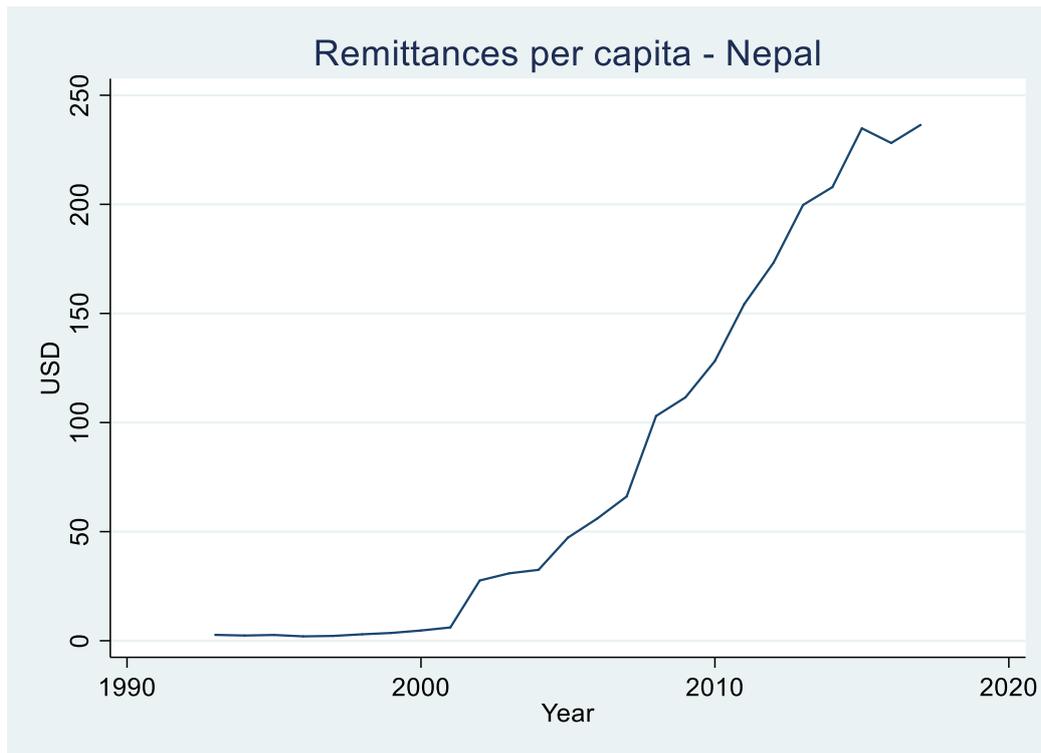
Remittances are considered a short-term, inconsistent, and unreliable source of income. This indicates that it may establish unique patterns of use compared to common sources of income. They might be directed differently in respect to diets and physical activity. While they ensure that households, which experience catastrophic expenditures, cross over the line of poverty and reduce vulnerability to crises and food insecurity, remittances may also increase access and

affordability of less healthy food items (29). In fact, it was found that in Mexico, a country with a long history of migration to the United States, money remitted to families was allocated predominantly towards financing consumption and household expenditure (30). As a result, it may have an association with nutritional shifts observed in LMICs. On the other hand, remittances may allow individuals to purchase higher nutritional quality food, creating nutritional benefit, and support recreational activities. Existing evidence shows that households benefiting from additional income due to remittances consume significantly more calories than households not benefiting from remittances. However, the quality of evidence available to this date is low to moderate (29).

In addition to possible health effects of remittances, it is also important to understand the characteristics of households that are possibly predisposed to poorer health. It is believed that the prevalence of migration is not randomly distributed across populations. Those individuals who do not exhibit good health are unlikely to endure the relocation and to keep up with labour. Meanwhile, those who are from higher socioeconomic classes are not likely to profit from migration (29). Consequently, migration and remittances may contribute to further widening health gaps in LMICs. Due to unsatisfactory quality of current evidence, the effect of remittances on nutritional and physical activity transitions should be investigated at a greater scope.

## Nepal

In low- and middle-income countries, such as Nepal, the increase in remittances is a recent phenomenon and is very prominent. Political and economic instability since the Maoist Insurgency in Nepal drives migration further, leading to an increasing dependence on remittances. Remittances as a share of Gross Domestic Product (GDP) in Nepal has reached 30.1% in 2018, which is the fourth highest rate in the world after Kyrgyz Republic, Tonga and Tajikistan (31). As remittances per GDP grow, they become a larger financial source in Nepali households (Figure 1), thus it is important to understand the ways it is being used. Although a majority of the population in Nepal still resides in rural areas, along with the economic changes, there has been a significant increase in urbanization. Increasing trends toward urbanization, as established previously, promotes health behaviours associated with obesity. Even though Nepal is seen as a country which has a lower average body weight compared to the rest of the world, the increase in obesity among adolescents and young adults sends alarming signals about a possible double burden of malnutrition and about the future NCDs epidemics.



*Figure 1. Trends of remittances received per capita in Nepal, distributed by year.*

It is very common to study the dietary impact of remittances and other forms of additional income or monetary incentives on adult, especially female, populations. However, what is being lost in that case is an unadulterated effect of a socio-economic factor on behaviours and attitudes because they can more likely be confounded by habits established prior to the phenomena. The young adult generation of Nepal is the generation to be the most likely affected by the rapid changes in how family financial structures function, with increasing remittances nationwide almost every year since 2001. Therefore, young adults are the focus of this study.

Children are highly susceptible to changes connected to economic development of the country and adaptation of lifestyle and habits that are associated with obesogenic environments. Current nutritional trends in Nepali children are indeed worrisome. A cross-sectional survey in Nepal showed that 74.1% of children aged 6-23 months old were fed commercially produced, high in sugar content snacks such as candies, chocolate, or biscuits on the day of the survey. Almost all the children in the study (91.2%) consumed those snacks within the last week (32). These findings are in line with current nutritional habits developed by older children in Nepal. Two thirds of children consume fast food items such as burgers and pizza daily. 86% of children aged 6-11 years old and 87% of 12-16 years of age children report not going for a walk even occasionally. 58% of the latter group of children also report not performing any physical

activity or outdoor games. Meanwhile, 73% of children aged 6-11 years old and 77% of 12-16 years of age children play computer and/or videogames daily (33). These are important findings because evidence shows that eating habits established during childhood shape subsequent eating habits and preferred food properties later in life (34). Consequently, unhealthy dietary habits during early years of life may also contribute to rising numbers of NCDs (35).

Although Nepal has a low prevalence rate of obesity compared to many higher income countries, it presents vulnerability to diseases associated with obesity in higher income countries due to poor public health focus on NCDs. According to WHO Progress Monitor Report, Nepal has failed to address the importance of dietary regulations, shown in more details in Figure 2, in order to stymie or reduce the increasing rates of obesity (36). Nepalese efforts to contain growing NCDs rates are often constrained by the organizational, human, and financial capacity of the public health sector and are limited to curative aspects, while preventive measures are mostly focusing on infectious diseases (37).

**Unhealthy diet reduction measures:**

salt/sodium policies	○
saturated fatty acids and trans-fats policies	○
marketing to children restrictions	○
marketing of breast-milk substitutes restrictions	●

● = fully achieved ○ = partially achieved ◊ = not achieved

NR = No Response

**World Health Organization - Noncommunicable Diseases Progress Monitor 2017**

*Figure 2. Evaluation of Nepal's progress and the government's intervention on addressing unhealthy dietary factors, from 2017.*

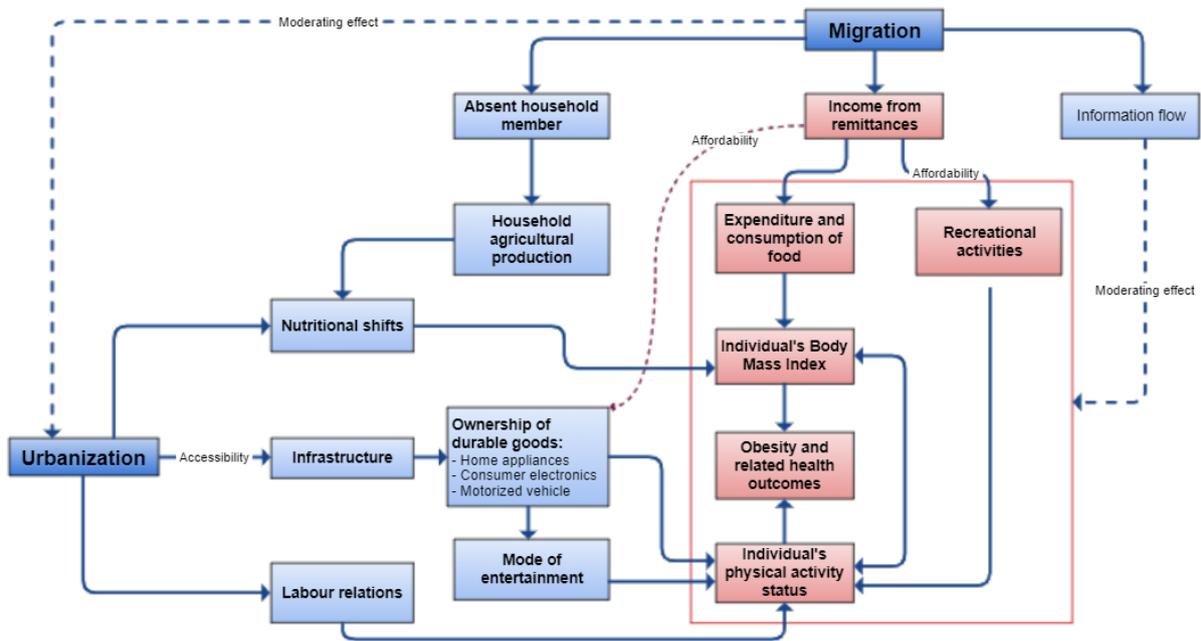
Continuing increase of migration and incoming remittances rates in Nepal do not seem reaching a plateau. However, there are no current studies that look at how additional income due to received remittances shape behaviours, related to nutrition, consumption and physical activity of individuals and households in Nepal. Evidence from other LMICs predominantly shows a detrimental effect of additional income on NCD-related health. However, the most recent trends from high-income countries show a turnover of trends - it is the low-income individuals who make the unhealthy decisions because they cannot access and afford healthy diets or recreational activities. This may suggest an inverted-U shape relationship between remittances and population mean body weight. Due to the rapid changes in household financial structures

with increasing remittances per capita, societal structures and the rapid development of infrastructures, Nepal provides a unique case study.

That being the case, the aim of this study was to evaluate the role of remittances on the health behaviours and attitudes of the Nepali youth, with a focus on nutritional consumption and physical activity. The specific objectives of this study were (1) to critically evaluate the literature and to establish theoretical framework of the current knowledge of the pathways through which remittances may act on nutritional and physical activity transitions; (2) to assess empirical relationship between remittances and obesity on a global scale using the Global Burden of Disease (GBD) data; (3) to undertake a case study and establish quantitative evidence addressing the question of whether or not and to what extent remittances matter in nutritional and physical activity transitions in Nepal.

## **Conceptual framework**

Globalization has empowered people with mobility. Increasing migration and urbanization has irreversible effects on population health. This paper lays out an explicit framework, shown in Figure 3, to conceptualize the relationship between certain aspects of globalization, obesity, and related health outcomes. The framework is based on published evidence and existing frameworks, tailored to the specific purpose of this paper (8, 29, 38). It depicts the intercorrelation of sub-components of globalization and its impacts on obesity and related health outcomes as linked through nutritional and physical activity transitions. Although those transitions are brought about by multilevel factors, such as international trade, national policies and broader socioeconomic factors, this current framework focuses on the individual-level changes, driven by the increasing movement of people associated with globalization.



*Figure 3. Conceptual framework of the relationship between the increased movement of people, obesity, and related health outcomes. Synthesized based on the frameworks developed by García-Dorado, Cornselsen (8), Fox, Feng (38) and Thow, Fanzo (29).*

Migration in LMICs often means the loss of a male-driven manual work at home. In rural areas, it generally means difficulties in maintaining agriculture (29). Therefore, migration may further drive urbanization of families left behind who seek social and domestic support in more densely populated cities. In addition, repatriated savings allow families to move to bigger cities in order to provide better education for children and to be closer to amenities such as healthcare centers because they can meet the increased expenses.

It has been shown that urbanization tends to shift both dietary and physical activity habits (38). Firstly, urban residency is associated with an obesogenic environment where food promotion has a much bigger role compared to rural areas. Urban populations are more likely to be exposed to foreign and processed food items. Due to the changes in composition, type and availability of food, individuals relocating to urban areas experience unhealthy nutritional transformation. Urban livelihood also comes with extensive infrastructures, such as delivery of energy and water, development of roads and accessibility of networks. Therefore, households can become owners of durable goods, such as electronic home and entertainment appliances and personal transport. The expansion of infrastructures and its provision of such opportunities contribute to a widespread of sedentary lifestyles and decreasing physical activity levels. Urbanization also determines labour relations, which encompass a type of work and degrees of physical strains endured (8).

Nevertheless, out of components highlighted in the framework, the focal point of this study is more proximal behaviour transitions that might predict changes in body composition and physical activity over time. Accelerating rates of migration in LMICs have resulted in an increasing flow of remittances. Additional income by means of remittances, as established previously, is considered a short-term, inconsistent, and unreliable source of income. Given the framework and current limited literature evidence, we hypothesize that individuals receiving remittances may use them to cover food expenses that arise by increased consumption. Alternatively, individuals may invest in nutritional quality of food and recreational activities. The effects of remittances on nutrition and physical activity are tightly intertwined with other aspects of migration, such as the information flow generated by returning migrants who introduce new attitudes and knowledge (29). We are aware that these external forces may be moderating the results.

## Methods

This study consisted of two distinct stages. The first step was to perform an empirical secondary data analysis of publicly available Time-Series Cross-Sectional (TSCS) data from the systematic analysis for the Global Burden of Disease (GBD) Study (1) on obesity in children and adults. Independent country-level variables were obtained from the World Bank data of the World Development Indicators, which was available online (31). The quantitative analysis aimed to assess the relationship between remittances and obesity on a global scale and among the developing countries, as well as to identify countries largely affected by remittances. However, the World Bank data only provides aggregated numbers of remittances received against a value of a body size, therefore there is a need to improve understanding of the mechanisms and effects that remittances, as a socio-economic indicator, have on the health and behavioural shifts. This was achieved by performing a case study, which explored the mechanisms of the use of additional income, in the form of remittances, and the role of remittances in behavioural and attitudinal characteristics that shape the future NCD trends. The case study was executed in Nepal because it is the leading country in remittance inflow. The study employed a survey questionnaire to quantitatively assess the role of remittances on biological indicators and health-related behavioural and attitudinal characteristics of the youth with a focus on nutrition and physical activity.

## Macro-data analysis

This preliminary analysis aimed to assess the relationship between remittances received as a share (%) of GDP and obesity as a share (%) among 15-24 age group among developing countries and Nepal separately. In addition, the relationship between remittances per capita and obesity was assessed. Remittances per capita is believed to possibly be a better parameter due to its robustness in time series data. Per capita remittance value is less likely to be influenced by annual fluctuations due to economic, political reasons or by force majeure, while GDP might be a volatile parameter.

Besides GBD data, additional country-level variables were added to control for factors that remittances could be dependent on, using publicly available data from the World Bank. The global Time-Series Cross-Sectional (TSCS) data was comprised of 172 countries while developing world data comprised of 149 countries<sup>1</sup>, distributed over the time period from 1991 to 2013. The outcome variable of interest was obesity as a share (%) among the 15-24 years old individuals. The main explanatory variables of interest were remittances per GDP and remittances per capita, however, population size, income per capita and trade as a share per GDP were put into the model to control for factors that remittances could be dependent on, as well as for wealth and poverty, development and demographic differences and exposure to the outside world. These variables were logged due to non-parametric properties of distributions. In a separate analysis, obesity trends in Nepal were reviewed to provide a context of the country's standing in the face of global trends.

As TSCS data is susceptible to heteroscedasticity and correlation of the error term and is non-normally distributed over time, the data was tested for autocorrelation. The data was autocorrelated, therefore the Newey-West method for regression, which is robust to autocorrelation and heteroscedasticity, was employed. We use a fixed-effects model to reduce issues related to TSCS data. Adjusting for time- and country-fixed effects allows us to account for biases from trending data, where variables are not constant over space and time.

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<sup>1</sup> A list of high-income WENAO countries, including Japan, that were excluded during the analysis in order to study the trends in the developing world can be found in the Appendix 4.

## A case study – survey analysis

### Ethical considerations

A protocol was developed prior to the study, and it was granted ethical approvals by both the Norwegian Regional Committee for Medical and Health Research and Kathmandu University School of Medical Sciences. Respondents received no monetary incentives. All participants gave informed consent, and privacy was maintained during the interview process. To also maintain confidentiality, all data were secured in enclosed envelopes and kept locked. Extracted data were stored digitally on an encrypted, password-protected hard-drive and accessible only to a research supervisor and a fieldwork conductor.

### Study site

We conducted our quantitative, community-based, cross-sectional study between September and November 2019 in the Dhulikhel city of Kavre district, which is located in the Kathmandu Valley, and is situated 30 km from Kathmandu. A total population size of Dhulikhel is just over 32 thousand and it can be considered a semi-urban environment. More specifically, the recruitment of participants took place in Dhulikhel hospital outpatient wards. Only accompanying persons of patients were eligible for recruitment.

### Study population

Only participants between ages 18 and 24 were recruited. Participants aged less than 18 years were excluded from this study due to the requirement of parental consent. The desired number of participants was acquired from the flow of accompanying persons of the hospital patients. Study population exclusively consists individuals who do not have co-morbidities or traumas limiting their physical activity, affecting their dietary choices or biometrics. Study population also excludes anyone who is pregnant or illiterate.

### Survey design

In order to quantitatively assess the role of remittances on biological indicators and health-related behaviours and attitudes of the youth in Nepal, the framework and methods used by the World Health Organization (WHO) STEPwise approach to noncommunicable disease (NCD) surveillance (STEPS) were adapted (39). STEPS was developed by WHO to establish a standardized but flexible framework for countries to monitor the main NCD risk factors

through questionnaire assessment, physical and biochemical measurements. It is normally a household-level survey, which is administered in an interview-style (40). The survey questionnaire of the present study was tailored to reflect the following topics: 1) demographic and socioeconomic information, 2) physical activity, 3) risk factor, 4) behaviours and attitudes and 5) anthropometric measurements. The survey questionnaire can be found in Appendix 1.

Demographic information is important for statistical analysis in order to account for possible confounding effects and genetic predisposition. Gender, age, education, and other factors have the potential to influence the consumption, physical and dietary behaviours due to biological differences or social determinants. Also, it is commonly believed that women are more likely to be remittance receivers since male outmigration is dominating over female outmigration by a large share (41).

Socioeconomic information was obtained in order to differentiate between remittance receivers and non-receivers. However, how those remittances are received, whether or not they are shared with the remainder of the household and the presence of other income may create noise in the effect of remittances on variables of interest, thus it was important to obtain such information. Also, factors, such as longevity of monetary transfers, may indicate stronger correlations between the status of remittance-receiving and the development of certain health-related behaviours and attitudes. Besides information on remittances, details on employment and occupation were collected.

Physical activity questions were collected in order to calculate individual Physical Activity Score (PAS). Questions focused on three different physical activity intensities - vigorous, moderate, and walking. Besides intensity, information on frequency and duration of physical activities were recorded. Participants were asked to recall the activities that they had done in the last 7 days and to think only about those physical activities that lasted at least 10 minutes at a time. The questionnaire also provided practical examples defining each intensity, for example, vigorous physical activities were described as “*activities that take hard physical effort and make you breathe much harder than normal ... [such as] heavy lifting, digging or running*”.

Risk factors may contribute to differentiated behaviours and attitudes towards diet and physical activity, hence, it is important to control for them. The survey includes a question on whether respondents have any health conditions or impairments that affect their physical activity. In the

analysis participants with a reported illness were excluded. In addition, smoking and alcohol consumption frequencies were obtained.

The core of the survey was a series of statements about participants' behaviours and attitudes towards lifestyles related to dietary consumption and physical activity. This part of the questionnaire was developed outside the STEPS framework. A focal point was placed on behaviours and attitudes related to NCDs, mainly obesity. Therefore, questions revolved around consumption of calorie-dense foods and drinks, eating patterns, participation in sports and means of transport. The first table, which aimed to observe self-reported behaviours, had five categories: '*never/rarely*', '*less than once/week*', '*1–3 times per week*', '*4–6 times per week*', '*every day*'. The second table, which investigated the attitudes of participants, was provided with Likert scale options: '*strongly agree*', '*agree*', '*not sure*', '*disagree*', '*strongly disagree*'. Some of the questions from the first table were designed to correlate to the questions in the second table. For example, someone that *never* consumes sweet drinks is expected to *disagree* or *strongly disagree* with a statement that "*You are more likely to drink soft drinks than water*". Therefore, each participant acted as his/her own control when matching behaviour and attitudes. Such a strategy was chosen in order to account for response bias. Additionally, remittance receivers were asked to answer supplemental questions on the importance of remittances on certain factors, such as the nature of commute and a current diet.

The survey was translated into a local language and made available in paper copies.

### Data collection

Prior to the recruitment of participants to this study, a two-day pilot study was performed in order to train a research assistant (KS), refine survey administration methods, and identify any changes to the questionnaire required.

The process of recruitment and administration of surveys was carried out by the local research assistant who performed the task in the Nepali language. The recruitment process followed a purposive sampling technique. The research assistant approached individuals who appeared to fit the inclusion criteria by age. Next, individuals were asked whether they were patients in the hospital, or they arrived to accompany someone else and whether they had any existing health burdens that might have interfered with their physical activity (diabetes, physical traumas etc.). Only patient attendants and individuals with uncompromised health continued in the recruitment process. In addition, due to the real-time data monitoring we were able to observe

an unintentional oversampling of non-receivers, thus the last 15 samples were purposely recruited to represent remittance receivers only.

All potential participants were briefed on the purpose of the study and were asked to sign two copies of consent forms (one to keep, another to leave with the researchers) before participating, see Appendices 3. The consent forms were also translated into the Nepali language. As an extension of informed consent, Participant Information Sheet was provided to each participant for them to keep and it included the contact details, aims of the study, expected procedures during participation, risks and benefits, data collection and use, and the means of confidentiality, see Appendix 2. Once a participant familiarized oneself with the information within the Participant Information Sheet and upon the agreement to participate in the study, the research assistant continued with the administration of the survey in an interview style.

While completing the survey questionnaire, the researcher(s) sat down with the participant in a waiting room. Within each recruitment, a discrete location to administer the survey was aimed to be arranged, however, while working in a hospital outpatient setting it was not always possible. Therefore, upon the start of the data collection, it was decided to leave the conditions of privacy dependent on the participants' needs and wishes. At the end of survey administration individuals participated in weight and height measurements. The researcher assistant recorded these measures. Upon completing these measures, the questionnaire was returned to the participants and they were asked to review the survey questionnaire sheet for any missing fields or potential changes. Afterwards, respondents were debriefed and asked to seal their answer sheets into the envelope provided. The entire process was always supervised by the project conductor (DS). Discrepancies were resolved by discussion with the fieldwork supervisor.

### Analysis approach

To test the effects of remittances on biological traits, we decided to use body mass index (BMI). Research suggests that weight is ultimately a function of a lack of energy balance or taking in more calories than are expended through physical activity (42). Therefore, any changes in lifestyles in terms of nutrition, consumption and physical activity are retrospectively captured within BMI. The BMI was calculated using a standard formula:

$$BMI = \text{Body weight} / (\text{Body height} * \text{Body height})$$

A second outcome variable was PAS, which in contrast to BMI looks at current self-reported behaviours. Respondents' PAS was calculated according to the Global Physical Activity Questionnaire (GPAQ) Analysis Guide (43). However, we did not follow the recommendation to truncate activity bouts that were greater than 3 hours. Due to a country's setting, there was an expected large share of participants working in agriculture who reported high values for moderate-intensity physical activities. We did not wish to lose the meaning of those values by truncating the numbers. The score is a combined measure of frequency, duration and intensity of physical activities performed, as specified below:

$$PAS = (frequency\_vigorous \times duration\_vigorous \times 8) + (frequency\_moderate \times duration\_moderate \times 4)$$

While frequency (number of days in the last 7 days) and duration (minutes) were straightforward to measure, the intensity of physical activities had to be given standardized coefficients - metabolic equivalent of task (MET). MET measures the ratio of the rate that the body expends energy during a specific physical task compared to a resting metabolic rate, relative to a body weight. MET values were applied to the time variables according to the intensity of the activity. Moderate physical activities were given a value of 4 and vigorous activities a value of 8. Throughout a week, adults are recommended to do an equivalent combination of moderate- and vigorous-intensity physical activities achieving at least 600 MET-minutes.

Physical activity and BMI were compared between remittance receivers and non-receivers, and across the different sizes of remitted earnings received, using linear regression models, adjusting for socioeconomic variables known to have confounding effects on population health and physical activity, such as gender, education and other income (44). Education, BMI, and PAS were treated as continuous variables. Remittance-receiving status is a binary variable. Quantity of remittances received and other income were logged due to non-parametric distributions.

To supplement PAS, we also used data from the first table in the survey on behavioural characteristics. Answers from the Likert-type scale on *eating fast food*, *consuming soft drinks*, *taking part in sport activities* and *commuting by a motorized vehicle* were coded into ordinal variables. To report the effect of remittances on the attitudinal characteristics of participants, we employed statements from the second Likert scale table in the survey. The statements on

attitudes were chosen in such a way that they would correlate with the statements on behaviours. We have expected response bias on the behavioural habits of participants and believed that attitudes are a more trustworthy measure when assessing the mechanisms between remittances and obesity.

To test how well the pairs of behaviour and attitude statements correlate, Spearman's rank correlation was employed. To complement, Cronbach's  $\alpha$  was computed for complete sets of both behaviour and attitude statements, as well as for physical activity data and anthropometric measurements.

To test whether remittances matter for dietary and physical activity behaviours and attitudes of the studied population, a series of ordinal logistic regressions were computed, adjusting only for those socioeconomic variables that were found statistically significant in a univariate analysis.

The percentage change of a standard deviation of an outcome variable by the change of a standard deviation of an independent variable was chosen as an effect size measure. Using a standard deviation to compare across impact evaluations provides with a comprehensive tool to illustrate the effects of the phenomena. For instant, what would happen if a country or an individual receiving an average amount of remittances started receiving remittances that are one standard deviation higher than the average.

Survey data were coded and entered into a password-protected Microsoft Excel sheet. Data were analyzed with STATA V.16.0.

## Results

### The global picture

Table 1 describes the relationship between remittances and the share of the obese population aged 15-24 years in the period between 1990 and 2013. The table displays the coefficients obtained from regression models. A preliminary analysis found that the change in the proportion of obese individual is significantly associated with the remittance inflow. Globally (Column 1), a negative relationship between remittances received by a country as a share per GDP and the mean percentage of obese youth (coef. -0.08, 95% CI [-0.11; -0.04]) was observed. This translates into a decrease of the share of obese individuals in the targeted age group by 3.2% of a standard deviation with increasing remittance as a share of GDP by its

standard deviation<sup>2</sup>. Although highly significant, this relationship is very weak. The trends among the least developed countries (Column 2) are consistent with the ones observed globally. The relationship between remittances received as a share per GDP and the mean percentage of obese youth is highly significant but weak (coef. -0.05, 95% CI [-0.08; -0.02]). Similarly, a more robust measure of per capita remittance (Column 3) shows a statistically significant but tenuous association with the mean percentage of obese youth (coef. -0.04, 95% CI [-0.07; -0.01]).

In addition, the obesity data for Nepal was extracted to provide context of the country's standing in the face of developing world trends. The Nepalese coefficient suggests that Nepal has lower prevalence of obesity among youth by 3.2% of a standard deviation compared to all the other countries in the sample.

*Table 1. Relationship between remittances and the share of obese population aged 15-24 years in the period 1990–2013.*

	(1) Full Sample % Obese 15-24	(2) Least Developed Countries Only % Obese 15-24	(3) Least Developed Countries Only % Obese 15-24
Remittances per GDP	-0.08*** (0.02)	-0.05*** (0.01)	
Remittances per capita			-0.04*** (0.01)
Income per capita	-0.43*** (0.11)	-0.39*** (0.11)	-0.33*** (0.11)
Population size	-1.58*** (0.22)	-1.24*** (0.22)	-1.21*** (0.22)
Trade per GDP	-0.16** (0.07)	-0.17*** (0.07)	-0.18*** (0.07)
Constant	33.90*** (3.84)	28.16*** (3.87)	27.36*** (3.88)
Number of countries	172	149	149
Observations	3,337	2,804	2,806

Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Note: data is adjusted for time- and country-fixed effects.

<sup>2</sup> The effect size was measured by multiplying the coefficient of an independent variable by a standard deviation of the within variation of an independent variable and then dividing the product by a standard deviation of the within variation of dependent variable, expressed as a percentage.

## The case of Nepal

A total of 127 participants filled in the questionnaire. One participant was excluded from the analysis due to pregnancy and another four participants were excluded due to reported present illnesses. As a result, the final sample comprised of 122 individuals. Further, two participants had physical activity frequency data missing, thus PAS analysis contains 120 individuals.

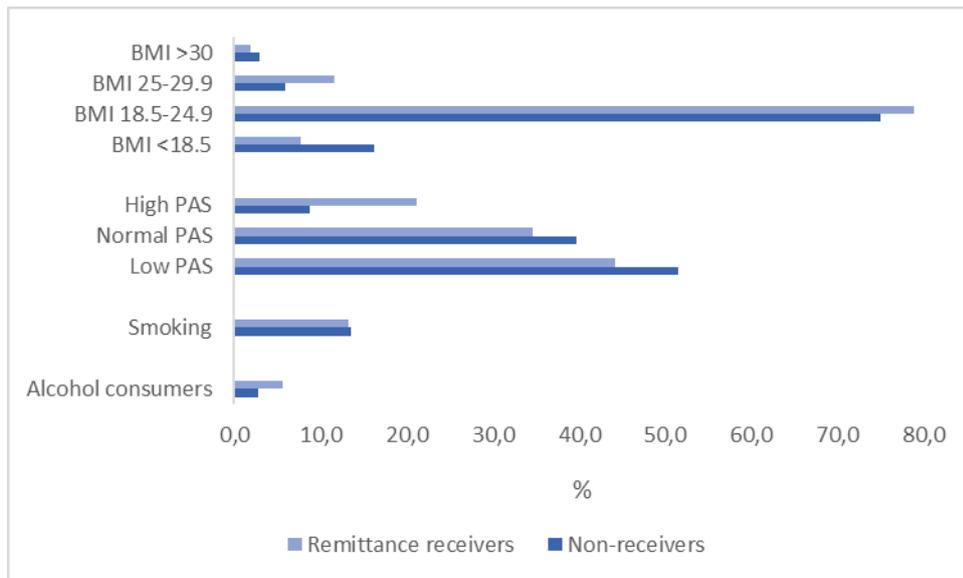
Table 2 describes the demographic characteristics of respondents according to their remittance-receiving status. The sample contains responses from 69 non-receivers (56.6%) and 53 receivers (43.4%). Among those receiving remittances, 23 (43.4%) had a direct access to remittances and 30 reported not being a primary person collecting remittances. Forty-eight percent of all participants were males. Thirty-five percent of respondents were enrolled into or attained education above high school level and two out of five participants reported completion of 11 to 12 years of schooling. The distribution of educational attainment seems to skew towards the higher educational achievement levels when compared to previous nation-wide studies in Nepal (45, 46). The higher proportion of individuals with high school and higher educational attainment could be attributed to the research site. Dhulikhel hospital is also a teaching Kathmandu University hospital, which may have caused an excessive presence of students and those who graduated from school compared to a general population. This could also justify a high proportion of students compared to other occupational categories.

*Table 2. Demographic characteristics of the study population*

<b>Demographic variable</b>	<b>Non-receivers (n=69) Number (%)</b>	<b>Receivers (n=53) Number (%)</b>	<b>Total (n=122) Number (%)</b>
<b>Gender</b>			
Male	31 (44.9)	27 (50.9)	58 (47.5)
Female	38 (55.1)	26 (49.1)	64 (52.5)
<b>Age (years)</b>			
18	8 (11.6)	10 (18.9)	18 (14.8)
19	6 (8.7)	3 (5.7)	9 (7.4)
20	17 (24.6)	7 (13.2)	24 (19.7)
21	14 (20.3)	6 (11.3)	20 (16.4)
22	7 (10.1)	4 (7.5)	11 (9.0)
23	6 (8.7)	12 (22.6)	18 (14.8)
24	11 (15.9)	11 (20.8)	22 (18.0)
<b>Education*</b>			
Primary school (1-5 years)	2 (2.9)	1 (1.9)	3 (2.5)
Secondary school (6-10 years)	14 (20.3)	14 (26.4)	28 (23.0)
High school (11-12 years)	29 (42.0)	19 (35.8)	48 (39.3)
University and above (≥13 years)	24 (34.8)	19 (35.8)	43 (35.2)
<b>Occupation</b>			
Agriculture	5 (7.2)	3 (5.7)	8 (6.6)
Government employee	2 (2.9)	2 (3.8)	4 (3.3)
Non-government employee	17 (24.6)	8 (15.1)	25 (20.5)
Self-employed	9 (13.0)	8 (15.1)	17 (13.9)
Student	26 (37.7)	23 (43.4)	49 (40.2)
Unemployed (able to work)	10 (14.5)	9 (17.0)	19 (15.6)

\* Education is categorized based on The International Standard Classification of Education (ISCED 2011) mapping (47).

Figure 4 shows the prevalence of NCDs risk factors in the study population in relation to remittance-receiving status. Mean BMI of the study population was 21.7, which is slightly below the national average of 22.2, as reported by the World Health Organization (48). The prevalence of overweight and obesity was 8,3 and 2,5, respectively. In comparison, the national data in Nepal reports that the prevalence of overweight is at the rate of 16.2 percent and obesity – 2.7 percent (36). The total prevalence of underweight in the sample was 12.5 percent. However, it is twice higher for non-receivers compared to remittance receivers. Almost half of the total sample reports a low-physical activity. Overall, alcohol consumption and smoking rates in the studied population was low but there is a significant difference in the prevalence rate between men and women.



**Figure 4.** Distribution of non-communicable disease risk factors in the study population. A positive smoking status included those who smoke daily. Alcohol consumers included respondents who consume a drink that contains alcohol once a week or more often. PAS categories were based on WHO recommendations (43). Throughout a week, adults are recommended to do an equivalent combination of moderate- and vigorous-intensity physical activity achieving at least 600 MET-minutes. Physical activity above 3000 MET-minutes per week is considered excessive.

Table 3 shows the effects of becoming a remittance receiver and the size of this monetary inflow on population BMI. This dataset indicates that there might be a slightly positive effect of both being a receiver and receiving more additional income on increasing the BMI. However, these effects are not statistically significant, and inferences cannot be drawn. On another hand, gender was found to be significantly associated with BMI. Being a female in this particular sample meant a higher BMI by 20.4 percent of standard deviation – i.e. 0.16 kg/m<sup>2</sup> compared to men.

*Table 3. The effects of remittances on the Body Mass Index (BMI).*

Variables	Body Mass Index (BMI)							
Remittance-receiving status	0.13 (0.58)	0.21 (0.56)	0.22 (0.56)	0.22 (0.56)				
Gender		1.28** (0.55)	1.36** (0.56)	1.36** (0.56)		1.28** (0.55)	1.35** (0.56)	1.35** (0.56)
Other income (NPR)			0.07 (0.06)	0.07 (0.06)			0.07 (0.06)	0.07 (0.06)
Education				0.00 (0.08)				0.00 (0.08)
Quantity of remittances (NPR)					0.02 (0.06)	0.02 (0.06)	0.02 (0.06)	0.02 (0.06)
Constant	21.67*** (0.38)	20.96*** (0.42)	20.64*** (0.46)	20.60*** (1.09)	21.65*** (0.37)	20.96*** (0.41)	20.64*** (0.45)	20.59*** (1.09)
Observations	122	122	122	122	122	122	122	122
R-squared	0.000	0.043	0.053	0.053	0.001	0.043	0.053	0.053

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 4 describes the association of physical activity levels with remittances. In the sample studied, becoming a remittance receiver seems to increase physical activity. Holding all other control variables constant, moving from remittance non-receivers to receivers by a standard deviation, physical activity increases by 17 percent of the standard deviation of the dependent variable. Similarly, every additional 32 000 NPR (an equivalent of roughly 265 United States dollars) received increases physical activity by 13.9% of PAS standard deviation. In this set of regressions, the control variables of interest are not statistically significant at all tested levels.

**Table 4.** The effects of remittances on the Physical Activity Score (PAS).

Variables	Physical Activity Score (PAS)							
Remittance-receiving status	0.64**	0.62*	0.62*	0.61*				
	(0.32)	(0.32)	(0.32)	(0.32)				
Gender		-0.40	-0.38	-0.35		-0.42	-0.40	-0.37
		(0.33)	(0.33)	(0.32)		(0.33)	(0.33)	(0.32)
Other income (NPR)			0.02	0.02			0.02	0.02
			(0.03)	(0.03)			(0.03)	(0.03)
Education				-0.06				-0.06
				(0.10)				(0.10)
Quantity of remittances (NPR)					0.06*	0.06*	0.06*	0.05*
					(0.03)	(0.03)	(0.03)	(0.03)
Constant	6.15***	6.37***	6.27***	7.02***	6.18***	6.41***	6.31***	7.06***
	(0.23)	(0.33)	(0.35)	(1.27)	(0.23)	(0.32)	(0.35)	(1.27)
Observations	✓ 120	✓ 120	✓ 120	✓ 120	✓ 120	✓ 120	✓ 120	✓ 120
R-squared	0.032	0.044	0.048	0.056	0.025	0.039	0.042	0.050

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

In order to analyze to what extent remittances matter for the reported behaviours and attitudes towards nutritional consumption patterns and physical activity levels among the studied population, we ran a number of ordinal logistic regressions. Prior to analyzing these relationships, a number of separate ordinal regressions was run to check for any possible confounding effects of gender, years of education completed, and other sources of income<sup>3</sup>. Male gender was found to be positively associated with the higher frequencies of commuting by a motorized vehicle and participating in sport activities. Females were more frequently consuming sweets and reported a greater importance to look slim compared to men. Interestingly, education was found to be a significant positive factor in reported behaviours such as the frequency of consuming fast food and sugar containing food items and drinks. It was also positively associated with respondents' reporting a greater emphasis of exercising and looking slim. The size of other income received outside remittances had a significant negative effect only on the consumption of sweets. In the analysis of what effects remittances received and the size of remitted earnings have on the behavioural and attitudinal characteristics regarding nutritional consumption and physical activity, we adjusted for the control variables accordingly.

<sup>3</sup> The results are available upon request.

Substantially, remittances had no significant effects on most of the responses from the Likert-scale survey statements, evaluating behaviours. However, two statements from the self-reported behaviour tables caught our attention. A frequency of commuting by motorized vehicles was significantly associated with being a remittance receiver, the size of remittance income, BMI, and PAS. Independent from gender, moving from remittance non-receivers to receivers by a standard deviation, decreases the frequency of participating in sport activities by 16.5 percent of a standard deviation of the dependent variable. Remittance quantity also matters in how frequently one participates in sport activities. In a total sample, the chances of having an active leisure lifestyle decreases by 28.1 percent of a standard deviation when increasing remittance quantity by 32 000 NPR. This effect becomes even larger when extracting the association among receivers only – a 77.3 percent reduction in the participation by the change of the standard deviation of the quantity of remittances received. Participation in recreational activities and other types of sports was also influenced by person's BMI. Heavier people reported lower involvement in sport activities by 29.2 percent of standard deviation. As could be expected, PAS and involvement in sport activities outside daily routines had a strong association. Increasing PAS by its standard deviation also increased the involvement in sport activities by 46 percent of a standard deviation of the dependent variable.

A frequency of the use of motorized vehicles was positively associated with both BMI and PAS, independently from gender. As far as this dataset is considered, both heavier individuals and those that are more physically active increase their use of motorized transportation by 18 and 15.1 percent of their standard deviations, respectively. Access to remittances and their size had statistically significant effects that are negative on the use of motorized transport. However, the effect sizes are very small – a reduction of 5 and 1.4 percent of standard deviations of dependent variables, respectively. Among remittance receivers, walking instead of using a car or motorbike as a mean of transport was preferred at greater rates along an increasing remittance income.

Regarding attitudes, the sample does not exhibit significant relationships between remittances and their views for the most part. Nevertheless, a likelihood to choose a soft drink compared to water and personal view on the importance of exercising was found to be negatively associated with remittances and their size. When adjusted for educational attainment, receiving remittances and the amount received contributed to lower preference for sweetened drinks by 27.3 and 25.3 percent of a standard deviation of the responses from the Likert-scale survey

statements on attitudes. However, every additional 32 000 NPR received also reduced the importance of exercising in the studied population by 17.9 percent of a standard deviation. By contrast, individuals with higher BMI were 2.6 times more likely not to care about exercising. This is in line with the current literature – BMI seems to predispose lower physical activity and sedentary lifestyles (49). This could also justify the increased importance of exercising among individuals with higher PAS levels.

Although remittance receivers reported less likely to participate in sport activities and they also considered the importance of exercising to a lesser extent compared to non-receiver, it is contradicting that remittance receivers exhibited positive attitudes towards looking slim at greater rates compared to non-receivers, independently from gender and education. Receiving remittances and their size significantly contributed to an increase of reported importance of looking slim by 23.1 and 20.2 percent of a standard deviation, respectively. BMI had a statistically significant effect that is positive on the attitudes towards looking slim with the effect size of 40.6 percent of a standard deviation of the within variation of the dependent variable.

However, these results should be taken with some reservation. The statements on attitudes were chosen in such a way that they would correlate with the statements on behaviours. For example, individuals who consume soft drinks frequently should also report that they are more likely to drink soft drinks than water, and thus, responses from these Likert-type items should correlate at least to some extent. However, there was very little correlation between pairs. In accord with Spearman's rank correlation, Cronbach's  $\alpha$ , which measures reliability of responses, for the overall behaviour and attitude was 0.432 and 0.450, respectively. Cronbach's alpha for physical activity questions was also very low – 0.201, but for the biometric data it was 0.7145, which is within the recommendations on the level of reliability (50).

## **Discussion**

The WHO reports that globally in 2016 approximately 124 million children and adolescents were obese (3). Elevated body weight is a major risk factor for many NCDs. Developing countries, although experienced rapid economic growth, are now facing a double burden of disease. It is common, thus, to observe undernutrition and obesity prevalent side-by-side within the same community or even household. These trends are driven by inadequate child nutrition accompanied by diets that are high-fat, energy-dense and micro-nutrient poor, as well as

decreased physical activity levels (51). While globalization has reduced income and wealth gaps between countries, increased information exchange and boosted economic growth of many developing countries, inequalities have often risen within countries (3). In addition, the global south has undergone a rapid social transformation followed by nutritional and physical activity transitions.

Obesity and related chronic diseases impose a great financial burden on the country's health care systems due to costly treatments and other resources needed. Nevertheless, the obesity crisis currently seems to be represented by LMICs - 7 out of 10 countries with the highest rates of diabetes are accumulated in the developing world (51). However, most LMICs continue to focus their preventive efforts within communicable diseases and undernutrition and often limit their NCDs measures to curative aspects only (37). Therefore, these chronic conditions are projected to prevail within poorer populations at a greater incidence and to impact at earlier stages of life within populations (51). Consequently, these countries present a greater vulnerability to the loss of Quality-Adjusted Life Years.

We joined efforts in establishing a body of evidence on the key factors contributing to such health transitions in LMICs. Migration is one of the indicators of globalization, which is a focus of the present study. Given that migratory patterns are creating large income shocks in LMICs, we take remittances as a focal point from the conceptual framework of the relationship between the increased movement of people, obesity, and related health outcomes.

Remittances evolved into a major source of capital transfer from low- to high-income countries. Nepal is one of the most affected countries, where remittances constitute one-third of the country's GDP. We hypothesize that changing financial structures of households due to the reliance on repatriated savings remitted by migrated family members may be attributed to growing obesity prevalence and NCD burden.

In this study, we investigated the role of remittances on nutritional and physical activity transitions globally and in Nepal. First, using secondary data from GBD and the World Bank, this study assessed the empirical relationship between remittances and a share of obese youth on a global scale and among the least developed countries. The findings show that both on a global scale and within the least developed countries, remittances have a negative effect on the percentage of obese youth within countries in the models. The data also suggests that Nepal has a population with a lower prevalence of obesity among youth relative to the rest of the

globe. However, given the fact that macro-data sets contain aggregated country-level data and that effect sizes observed are very low, findings are not cogent and continue to fuel a controversial debate.

The next step in this study was to conduct a community-based, cross-sectional case study, where we focused more narrowly on the potential contextual influences of remittances on nutritional and physical activity transitions in Nepal. Survey data revealed that remittances were positively associated with physical activity levels in the studied population. However, we did not have sufficient statistical evidence to come to conclusions on the association between remittances and BMI.

Finally, we assessed behavioural and attitudinal differences between remittance receivers and non-receivers. Unlike with PAS, remittance receivers showed decreased frequencies of participating in sport activities. In accord with behavioural outcomes, attitudinal differences also pointed towards the detrimental effects of remittances on the importance of physical activity. On the other hand, remittances were associated with healthier attitudinal choices of beverages. The quantity of remittances received also mattered in all the associations discussed.

Overall, empirical evidence in this study is not conclusive and competing theories arrive at different inferences. There is enough evidence from the global to show that remittances do not have detectable adverse effects that a number of studies argue (29, 30). Microdata suggests that perhaps in Nepal there is not enough evidence to indicate that the remittances are actually driving the increasing obesity rates. In fact, the case study data is somewhat supportive of global data findings that remittances may promote health. For example, tests show that remittance receivers score more on physical activity. However, these effects are not unilateral and are masked by negative impacts of remittances that are asserted through behavioural and attitudinal characteristics of the sample population. Therefore, accentuating remittances from the conceptual framework of the relationship between the increased movement of people, obesity, and related health outcomes ultimately might not be fruitful.

Apart from the empirical data analysis, observations of common community behaviours were noted while on fieldwork. Overall, a traditional Nepali meal, called Dal Bhat consists of steamed rice and a bowl of lentil soup. It is often served with seasonal vegetables or meat curries. Although traditionally regularly exchanged with maize or cereals, rice dominates daily

calorie intake of the Nepali population today. These observations are supporting dietary transitions observed in India (21).

To varying degrees, dietary routines in Dhulikhel city, which in this study is considered a semi-urban environment, were noticeably different compared to rural areas. Families observed in neighbouring Dhunikharka and slightly more distant Listikot villages, with population sizes of around 4 thousand individuals, sustained their daily meals mainly from a local or even domestic agricultural production. These families, except sherpas, often practiced vegan or vegetarian diets. Meanwhile, the population in Dhulikhel, albeit exhibiting varying degrees of consumption, showed a considerable intake of meat and dairy products. Urban households also seemed more frequently to own modern household appliances such as electric or gas cookstoves, fridges, washing machines and centralized water systems. In comparison, rural households often used traditional biomass cookstoves, did not store food, used filtered rainwater and hand-washed their laundry. As a consequence, families in rural villages demonstrated higher physical activity levels associated with household and agriculture maintenance compared to city residents. Moreover, spatial planning and sociocultural forces in the urban community did not support recreational sports activities. These observations concur with wide the literature evidence (4, 6, 37).

### Strengths and limitations

The present study is the first to conduct a detailed analysis of the relationship between remittances and biometric evidence associated with obesity as well as physical activity levels in a semi-urban setting in Nepal. To our knowledge, this is also a first attempt to assess behavioural and attitudinal differences between remittance receivers and non-receivers. This is what most distinguishes the originality of this study. Although often benefiting in social science research, behavioural and attitudinal analysis is not regularly considered in public health research. Lifestyle choices and attitudes result from complex interactions taking place on individual, household and community levels. For example, dietary choices take place in context to public and private sector agents such as availability of food items (e.g. trade and marketing) and affordability (e.g. pricing), while others depend on characteristics of individuals and civil societies (e.g. health education, food preferences, sociocultural practices). These interactions may create both opportunities and limitations. This makes behaviours and attitudes a powerful impetus for interventions towards healthier societies (52).

In addition to quantitative evidence, qualitative observations were integrated into this discussion. Mixed-methods research is relatively new and seldomly employed. Qualitative insights can both complement empirical findings and offer possible directions for interventions and further research. While recognizing that the present study is not systematically employing mixed-methods, qualitative observations are believed to be a useful outcome of fieldwork and a tool to discuss possible policy implementations. Finally, drawing an inference that remittance is a limited metric of migration and has no evident association with the prevalence of obesity is a valuable input in the existing knowledge gap.

Before we consider the implications of these findings, it is important to discuss the limitations of this study. There were some limitations identified prior conducting the study as a result of chosen methodologies. Firstly, cross-sectional data is inherent for the inability to infer causal associations and only allows for the generation of hypothesis on the pathways. The location of survey administration can also play a large part in the quality of the results. The recruitment site provided the logistic advantage. We employed an established collaboration between the Norwegian University of Science and Technology and Kathmandu University School of Medical Sciences. The recruitment of participants took place in Dhulikhel hospital outpatient wards and only patient attendants were administered. Queueing times often meant that participants were interested and willing to participate and were not rushed. Moreover, the need to collect biometric data made the hospital setting a convenient and controlled environment for the research. However, by consciously recruiting people that were not patients and had no ailment, the study population may consist of a favourable sample. It is likely that the healthiest and the most educated persons of a family are appointed to accompany a sick relative to a hospital. Besides, the location may have caused the sample to be represented by individuals with higher educational attainment than national averages because it the recruitment process took place in a teaching hospital. Higher education may influence better health practices and consequently may cause an effect modification. Therefore, there is a chance that the lack of inimical effects observed in the study population could be biased for the reasons discussed. On the other hand, considering the fact that the study sample presents a mean BMI, which is very close to national averages reported by WHO (36), we do not suspect sample biases. Nevertheless, household surveys or sibling-matched cohort studies may be a more coherent way to investigate such health outcomes.

Considering the age interval of the recruited respondents, the generation born between 1994 and 2001 was chosen in order to sift the habitual effects of remittances on nutritional and physical activity shifts from precipitated behaviours that would distort the impact. Children and adolescents are an important target groups also because they are the most amenable to change and develop sustainable health habits. However, while conducting the research on site it became clear that biological and social ages often differ in Nepal. Age fabrication is a common practice in South-Eastern Asian countries. These differences in reported ages mean that the sample of the present study may include individuals both younger and older than the intended age interval. However, we do not believe it affected the overall results of the association between remittances and obesity-related behaviours and attitudes.

The survey questionnaire is based on self-reported behaviours and attitudes. They are therefore subject to recall and optimism biases that may have confounded the effect estimates observed. The reliability question was strengthened by the outcomes of Cronbach's alpha test. Since this is inherent for survey type data and self-reported observations, reliability could be increased by performing studies with more rigid methodologies, such as observational cohort studies. Nevertheless, the accuracy of questions and Likert-type statements within the present methodology could be revisited.

Finally, all but two remittance receivers reported receiving remittances for less than a year. Although it confirms literature evidence that remittances are a short and unreliable source of additional income (29), this limits the analysis to only short-time effects of these financial changes within the households.

### Implementation of findings

Despite these constraints, the findings of the present study provide several implications for policymakers. The transience of remittances suggests that perhaps it is a limited proxy of globalization in measuring etiological effects on dietary and physical activity transitions. Circular migratory patterns certainly come with financial fluctuations within households. Therefore, remittances should be considered only as a cumulative effect instead of an individual effect on the prevalence of NCDs. Given the findings of the empirical analysis, it is reasonable to infer that remittances do not increase obesity-related behaviours and attitudes. In fact, it may present opportunities for health promotion.

In the case of Nepal, it seems that BMI and physical activity levels have little to do with the affordability of food items and an increased person's financial capabilities. Although the data suggests that remittances may help individuals move away from underweight and possibly meet food security, it is unlikely to drive further increase in the BMI. Therefore, policymakers should shift their focus from fiscal policies and financial incentives to other possible areas of change. The attention should be set on societal instead of individual approaches. Previous literature already provided evidence that NCD-related health knowledge, attitude and behaviour in Nepal are inappropriate (53). Inter-sectoral actions, thus, should include the education of healthy choices, labelling of food products and regulating their marketing, as well as ensuring adequate spatial planning of urban cities that support recreational sports. With the purpose of achieving improvements in practices and attitudes, measures must consider specific psychosocial characteristics of targeted communities since Nepal is a demographically diverse country. In addition, qualitative rather than quantitative aspects of nutrition should become central to the discussion on nutritional shifts. Besides health promotion and protection, the governing body should focus on closing the health gaps. Although we did not address this in detail, according to our data, gender and educational gradient play a significant factor in the individual's behavioural and attitudinal qualities, as well as BMI. This could be a starting point of focus on addressing the former issue.

## **Conclusions**

Globalization deeply transforms societies by interacting with economic, political and social relationships. These interactions are increasingly recognized being important for NCD-related health behaviours and outcomes. Transformations associated with globalization in LMICs happened at an earlier developmental stage and in a faster pace compared to high-income countries. Therefore, control over these relationships and driving forces in LMICs is frail if none.

This study analyzed global country-level, as well as individual-level data. Macro-level data examined the relationship between remittance inflow to countries and the share of obese individuals within populations. Individual-level data was collected during community-based, cross-sectional survey administration in Nepal. The focal point of the survey was the differences in behavioural and attitudinal characteristics between remittance receivers and non-receivers.

Nepal not only represents a country with immense political instability and demographic diversity but also is a country of rapidly changing household financial structures with one-third of GDP consisting of remittances. Although Nepal is an underperformer in BMI, according to the macro-data, the prevalence of obesity is rising annually and may become a public health crisis in the years to come. Our study demonstrated inconclusive evidence on the relationship between remittances and obesity-related biometric, behavioural and attitudinal characteristics. While global and physical activity data suggest promotive health effects, behavioural and attitudinal analysis arrives at competing theories. Nevertheless, overall picture of evidence suggests that remittances might not be the most appropriate proxy of migration. Migration does not only come with economic consequences. Therefore, it should be studied in a holistic sense, including the psychosocial effects on populations. Further research should also focus on gender and educational gradient differences observed in the behavioural and attitudinal characteristics of the young population of this study. In addition, research focusing on qualitative dietary assessment should be employed.

## **Funding**

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# Appendices

## Appendix 1 – Survey questionnaire

### PART A – Demographic Information

Participant Identification Number     

Mark your answer .

Q1. What is your gender?

Male       Female       Unspecified/Other

Q2. What old are you?

18       19       20       21       22       23       24

Q3. In total, how many years have you spent at school or in full-time study (excluding pre-school)?  
\_\_\_\_\_ years

Q4. What is your relationship status?

Married - spouse present       Married - spouse absent  
 Widowed       Separated/Divorced  
 Not married, in a relationship       Single

Q5. Do you have any children?

Yes  
 No

Q6. **For women:** are you currently pregnant?

Yes  
 No

**PART B – Socioeconomic Information**

Participant Identification Number     

Q7. Are you currently employed?

Yes

No

Q8. Which of the following best describes your main work status over the past 12 months?

Government employee

Non-government employee

Self-employed

Agriculture work

Non-paid

Student

Unemployed (able to work)

Unemployed (unable to work)

Q9. Are you a remittance receiver?

Yes

No

IF NO, SKIP TO Q16.

Q10. How much in remittances (or a share of remittances) do you receive on average, per month?

\_\_\_\_\_ NPR

Q11. Are remittances transferred directly to you before anyone else?

Yes

No

IF NO, SKIP TO Q14.

**PART B – Socioeconomic Information**

Participant Identification Number     

Q12. If you are a primary remittance receiver, do you share the remittances with anyone?

Yes

No

IF NO, SKIP TO Q14.

Q13. If yes, how much (average amount per month)?

                     NPR

Q14. What is the relationship of the remittance donor to you?

Spouse / partner

Father / mother

Brother / sister

Father / mother-in-law

Brother / sister-in-law

Other family relative

Other person, not a family relative

Q15. How long have you been receiving remittances (or a share of remittances) from another individual?

                     years

Q16. How much income do you receive, other than remittances, on average, per month?

                     NPR

## PART C – Physical Activity

Participant Identification Number 1111

Q17. Do you have any health conditions or impairments that affect your physical activity?

Yes

No

The next few questions will focus on different intensity physical activities.

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

Q18. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging or running?

\_\_\_\_\_ days per week

No vigorous physical activities

Q19. How much time did you usually spend doing vigorous physical activities on one of those days?

\_\_\_\_\_ hours per day

\_\_\_\_\_ minutes per day

Don't know/Not sure

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

Q20. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads or dancing? Do not include walking.

\_\_\_\_\_ days per week

No moderate physical activities

Q21. How much time did you usually spend doing moderate physical activities on one of those days?

\_\_\_\_\_ hours per day

\_\_\_\_\_ minutes per day

Don't know/Not sure

### PART C – Physical Activity

Participant Identification Number 1111

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

Q22. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

\_\_\_\_\_ days per week

No walking

Q23. How much time did you usually spend walking on one of those days?

\_\_\_\_\_ hours per day

\_\_\_\_\_ minutes per day

Don't know/Not sure

The following question is about the time you spent sitting during the last 7 days. Include time spent at work, at home, commuting, while doing course work and during leisure time. This may include time spent sitting at a desk or in a motor vehicle, visiting friends, reading, or sitting or lying down to watch television.

Q24. During the last 7 days, how much time did you spend sitting on a week day?

\_\_\_\_\_ hours per day

\_\_\_\_\_ minutes per day

Don't know/Not sure

**PART D – Behavior and Attitudes**

Participant Identification Number     

Q25. Concerning smoking tobacco cigarettes, which of the descriptions on this card best describes your smoking behavior?

- |  |   |
|--|---|
| <input type="checkbox"/> I smoke daily                   | <input type="checkbox"/> I smoke but not every day      |
| <input type="checkbox"/> I don't smoke now but I used to | <input type="checkbox"/> I have only smoked a few times |
| <input type="checkbox"/> I have never smoked             |   |

Q26. How often do you drink alcohol?

- |                                       |   |
|---------------------------------------|---|
| <input type="checkbox"/> Daily        | <input type="checkbox"/> Several times a week   |
| <input type="checkbox"/> Once a week  | <input type="checkbox"/> 2-3 time a month       |
| <input type="checkbox"/> Once a month | <input type="checkbox"/> Less than once a month |
| <input type="checkbox"/> Never        |   |

Q27. What type of oil or fat is most often used for meal preparation in your household?

- |   |                                       |
|---|---------------------------------------|
| <input type="checkbox"/> Vegetable oil      | <input type="checkbox"/> Lard or suet |
| <input type="checkbox"/> Butter or ghee     | <input type="checkbox"/> Margarine    |
| <input type="checkbox"/> None in particular | <input type="checkbox"/> None used    |
| <input type="checkbox"/> Don't know         | <input type="checkbox"/> Other _____  |

Q28. On average, how many meals per week do you eat that were not prepared at a home? By meal, I mean breakfast, lunch and dinner.

Number \_\_\_\_\_

- I don't know

### PART D – Behavior and Attitudes

Participant Identification Number

In the following tables, you will find statements. Please mark the answer with **X** that best represents your behavior and/or attitudes for each statement.

	Never/ rarely	Less than once/week	1–3 times per week	4–6 times per week	Daily
Eat breakfast					
Eat dinner at home					
Eat fast food/street food					
Consume sweets					
Consume soft drinks					
Observe fast food/street food advertising					
Commute by motorized vehicle					
Take part in sport activities					

	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
You are more likely to drink soft drinks than water					
You avoid eating oily and sugary foods					
Eating healthy food is important for you					
Fast food is cheaper					
Fast food is tastier					
Exercising is important for you					
It is important for you to look slim					
You are more likely choose walking than car/mot or bike					
For remittance receivers only					
Remittances are important to your sport activities					
Remittances are important for your choice of commuting					
Remittances are a deciding factor in your current diet					

**PART E – Anthropometric measurements**

Participant Identification Number     

Please make your way to a researcher for weight and height measurements.

---

*FOR USE BY RESEARCHER:*

HEIGHT \_\_\_\_\_ cm

WEIGHT \_\_\_\_\_ kg

---

*Your contribution to this effort is greatly appreciated. Please enclose the questionnaire in the envelop and drop it to the box.*

## Appendix 2 – Participant information sheet

### **Participant Information Sheet**

This information sheet is to be given to the research participants for detailed information about the study to take home and explained by the conducting researcher.

Please read this sheet carefully and ask questions about the study that you do not understand or want to know more about. This consent form may contain words that you do not understand. If anything is unclear as the conductor goes through the information, please ask the conductor to explain. If you have questions later, please find contact information below for co-investigator.

#### **1. TITLE OF RESEARCH**

The role of remittances and potential impacts on behaviour and attitudes, with a focus on consumption, nutrition and physical activity of the youth in Dhulikhel, Nepal

#### **2. WHO IS CONDUCTING THIS RESEARCH?**

##### **Principal Investigator**

*Name: Biraj Man Karmacharya*

*Designation: Professor*

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##### **Leading Co-investigator**

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##### **Co-investigator (on-site data collector)**

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*Designation: Master Student*

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#### **3. WHAT IS THIS STUDY ABOUT?**

This is a research study exploring how additional income due to received remittances may shape behaviours and attitudes, specifically related to nutrition, consumption and physical activity of the youth in Nepal. Nepal provides a unique case study due to the country's changes in financial structures with increasing remittances per capita, in societal structures and the rapid development of

infrastructures. The objectives of this study are to determine the differences, if any, between case and control groups (remittance receivers and non-receivers, respectively) on health perspectives related to obesity and the correlation of those perspectives to behaviours between and within groups. In addition, measures of height and weight will be collected in order to calculate body mass index. The purpose is to explore the patterns of remittance expenditure in relation to consumption and physical activities, to identify opportunities and challenges related to changes in individual financial structures with increasing remittances per capita, with a focus in particular on emerging life-style related health conditions and non-communicable diseases.

You are being invited to take part in this research because you fit the age criteria for this study. We look forward to your participation. The results of the project may potentially provide policy makers with a comprehensive analysis on how to address changes in health and consumption.

#### ***4. PROCEDURES***

While completing the survey questionnaire, the researcher(s) will sit down with you in a private room in the hospital. No one else apart from the researcher(s) will be present together with you, unless you would prefer someone else to accompany you. Names and other identifiable information will not be recorded. Only the researchers listed above will have access to the recordings and the documented information from the survey. The recorded information is anonymous, confidential and will be stored safely. Towards the end of the survey, you will participate in weight and height measurements. The researcher will record these measures. Upon completing these measures, the researcher will return the questionnaire to you and ask you to review for any missing fields, seal it in the envelope and drop it into the secure drop-box.

#### ***5. RISKS AND BENEFITS***

The only information recorded will be that from the questionnaire form. This information could present a possible risk that you may share some personal or confidential information by chance, or that you may feel uncomfortable answering some of the survey questions. However, we do not wish for this to happen. You are able to terminate/withdraw your consent at any point before submitting your questionnaire into the secure drop-box

There will be no direct benefit to you as a person, but your participation is most valuable to help us find out more about patterns, challenges and opportunities of remittance expenditure in relation to consumption and physical activity. The results of our investigation are expected to benefit local and national community once the findings of this research are integrated by policy makers, such as the Ministry of Health and Population, and health services in Nepal. It can also help lay the groundwork for future studies.

#### ***6. COSTS AND PAYMENTS***

You will not be provided any incentive to take part in the research.

#### ***7. CONFIDENTIALITY***

Study records will be anonymous and confidential. All the data collected from the surveys will be stored digitally on an encrypted, password-protected hard-drive. An anonymous ID code number will link these records. This information will only be accessible to the researchers listed above. All the information related to research will be handled in a confidential manner. You will not be specifically identified in any publication of research results. In addition, the data collected will only be used as described in the purpose of the project.

## **8. SHARING THE RESULTS**

The research findings will be shared more broadly, through publications, conferences, national and international news publications.

## **9. VOLUNTARY PARTICIPATION AND RIGHTS TO WITHDRAW**

Your participation is voluntary, and you have the right to withdraw from the study at any time for any reason. If you decide to take part in the study initially and later change your mind, you are free to withdraw at any time. You can do this by simply informing the member/s of the research project.

Your withdrawal from the study has no consequences for you, and you will have the same service at the hospital. Withdrawal will not be connected to your person.

You have the right to:

- know which information that is registered about you
- have corrected any information about you
- have any information about you deleted
- require a copy of all information registered about you
- file a complaint to the data protection officer at NTNU or the Norwegian Data Inspectorate about the conduct of your personal information (address below)

This study is approved by Institutional Review Committee of Kathmandu University School of Medical Sciences, Dhulikhel (IRC) and the Norwegian University of Science and Technology, NTNU, Norway. On behalf of the Norwegian University of Science and Technology, NTNU, the Data Protection Official for Research at NSD - Norwegian Centre for Research Data AS has confirmed that the project is in accordance with regulations for personal data protection. For more information with regard to your rights, contact the data protection officer: Thomas Helgesen (+47 93079038, Sluppenveien 12B/C, Møllenberg 4 etg, Trondheim, Norway) or NSD ([personvermtjenester@nsd.no](mailto:personvermtjenester@nsd.no), +47 55582117).

Your participation in this study is completely voluntary and you can decide whether or not to participate in this study.

**This information sheet is for you to keep.**

## Appendix 3 – Consent form

### **Certificate of Consent**

I have been invited to participate in a research study entitled “The role of remittances and potential impacts on behaviour and attitudes, with a focus on consumption, nutrition and physical activity of the youth in Dhulikhel, Nepal”. I have read the foregoing information and I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. The study has been explained to me by the researcher and I understand the purpose and implications of this research. I consent voluntarily to be a participant in this study.

Participant’s name: .....

Signature: .....

Date: .....

#### **Statement by the researcher/person taking consent**

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant has understood the information.

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this informed consent form has been provided to the participant.

Principal researcher’s name: .....

Signature: .....

Date: .....

#### Appendix 4 – The list of excluded countries in the model of the least developed countries, macro-data analysis

<b>Europe</b>	<b>North America</b>	<b>Oceania and East Asia</b>
Austria	Canada	Australia
Belgium	United States of America	Japan
Czechia		New Zealand
Denmark		
Finland		
France		
Germany		
Great Britain		
Greece		
Iceland		
Ireland		
Italy		
Lichtenstein		
Luxemburg		
Monaco		
Netherlands		
Norway		
Portugal		
Spain		
Sweden		

