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Factors Influencing Households Health Status in Machakos County, Kenya

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Abstract:
Health as a form of human capital is crucial in the production of market and non-market commodities. It is, therefore, imperative that individuals/households invest in health as it directly influences their capacity to be productive and generate wealth. Investment in health is achieved through use of market and non-market goods and individuals own time as inputs. This study aimed at establishing the ways through which households/individuals produce their health; effect of health knowledge on health and providing policy measures to improve the health of households. A 2SLS translog health production function was employed using primary data obtained from a sample of households in Kangundo and Matungulu Sub-Counties. The study found that, the residents had normal weight according to World Health Organization classification and hence good health status, though in every 100 residents three were obese, 31 overweight, and nine were underweight. According to the study, health status improved with the frequency of fruits and vegetables consumed by individuals/households. Moreover, moderate exercise was found to be good for improved health status though excessive exercising had deleterious effect on health capital. Health knowledge was negatively related to health status, whereas it was positively related with the quadratic term for health knowledge. The study recommends that households be encouraged to increase the intake of fruits and vegetables. This could be achieved by encouraging small-scale farmers to practice horticulture, by intercropping different types of fruits and green leafy vegetables. Further, households need to be empowered with more health knowledge, by integrating health education in school curriculum from early childhood to university levels, though; this should not be tested in the final national examinations. It would be appropriate to deploy couples in the same areas, not only to reduce HIV/AIDS incidence among married people, but also improve their health status as established by the study.

Keywords: Household, health production, health knowledge, health habits

1. Background

Human capital is regarded as a consequence of long-term education (*education* human capital), good health (*health* human capital) and good nutrition (Becker, 1965).Good health is demanded and supplied by households and individuals as a commodity. In the health production model, three outputs are produced sequentially. The first output produced using both market and non-market goods and services, and the individual's own time as inputs, is health capital. This accumulates to produce healthy days and prolonged life, which finally increases the amount of time available to produce money earnings and market and non-market commodities (Grossman, 2003; Humphreys & Ruseski, 2006; Mwabu, 2007; Tica & Smolic, 2007). Health is viewed as a current service derived from a depreciating stock of health human capital, formed by investments in health care, and also impacted by health-related behaviours, which interact with the individual's initial health stock(Schultz, 2004).

The global strategy for non-communicable diseases (NCD) Prevention and Control developed by the World Health Organisation (WHO), and endorsed by the World Health Assembly in May 2008, called for effective integrated prevention of major NCDs. The World Health Report identified a number of key risk factors[1] and quantified the contribution of each risk factor to the global burden of cardiovascular diseases. In Kenya, many families are struggling to cope with the devastating impact of heart disease, as an estimated eight people, middle-aged and elderly, die from heart-related complications every month. But that number only represents cases that are actually seen at a hospital (Biomndo, 2008).

The Kenyan Ministry of Health (2005) designed it's second National Health Sector Strategic Plan (NHSSP II 2005 – 2010), which puts emphasis on disease prevention and health promotion. The same is reflected in the Kenya vision 2030, in which one of the health sector's flagship projects for 2012, is to revitalize rural health facilities, in order to promote preventive health care and promote healthy individual lifestyles (Kenya GoK, 2007). The Kenya Essential Package for Health (KEPH) also defined that preventive and curative services health services are to be provided in a six- tier[2] structure.

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[1]These Risk Factors Are Tobacco Use, Alcohol Consumption, High Cholesterol Concentrations, High Blood Pressure Levels, Low Intake Of Fruit And Vegetables, Insufficient Physical Activity And Elevated Body Mass Index
[2] Level one is village/ households/ individuals; level two is dispensaries/ clinics; level three is health centres, maternities, nursing homes; level four is primary (district) hospitals; level five is secondary (provincial) hospitals; and level six is tertiary (national) hospitals.

The first three levels are described due to their relevance to this study. The first (community) level is the foundation of the service delivery priorities, while level two and three (dispensaries and health centres), will handle predominantly activities related to promotive and preventive care, provide the bulk of health services and form the first level of contact with the community (Kenya MoH, 2005).

Developing country literature is largely silent on policies to improve health, because health production is not properly linked to patterns of demand for market inputs and to behavioural changes(Mwabu, 2007). In the most general sense, "lifestyle" refers to all the factors over which individuals and households have some control, such as alcohol and tobacco consumption among other drugs and substances, physical exercise, personal hygiene, and dietary patterns(Backett, Davison, & Mullen, 1994; Or, 1997). The ministry's health sector strategic plan (NHSSP II, 2005) intends among other things, to enhance the promotion of individual and community health. Strategy to attain this objective is revitalising community health structures with an emphasis on prevention, health promotion and promotion of healthy life-styles (Kenya MoH, 2005).This health promotion is aimed at the prevention of communicable and non-communicable diseases (NCD), injuries and violence by helping people change their behaviour/lifestyle[3] to move toward a state of optimal health[4]. For health care policy to be efficient, it is important to understand the extent in which health is determined by health care and the effect of various non-medical influences such as income, age, education, health knowledge, place of residence or lifestyle on health.

1.1. Problem Statement

The second National Health Sector Strategic Plan (NHSSP II) incorporated among others, two principles. First, a shift from disease burden (curative and vertical) to human capital development, focusing on promotion of individual health and providing support to the various life cycles of a human being. Second, scale up interventions by re-orienting the emphasis from facility-based (curative) services, to increased preventive and promotive community-based care. During adolescence, new threats to the healthy development pose themselves in particular related to behavioural changes, like drug and substance abuse (alcohol, tobacco and other hard drugs); general professional development (school attendance) and sexuality (STI, HIV/AIDS and risk of early pregnancy). The health of the adults is threatened not only by the well-known infections (Malaria, TB, STI, HIV/AIDS), but also by non-communicable diseases (heart diseases, cancer, trauma/accidents and stress).

Changing the individual's (and by extension the household's) knowledge, attitudes and practices of health and health care will lead to significant changes in health status (Jarrett, 1995). Specifically, a behavioural change such as overcoming drug and substance abuse, alcohol, quitting smoking, changing a sexual practice or diet is associated with better health, just as is the use of market inputs such as health care, drugs and vaccinations(Mwabu, 2007). Thus, a behavioural change serves as input into health production. Indeed, health effects of changing behavioural inputs may be as important as effects of altering market inputs of health care(Mwabu, 2007). Hence, it is necessary to review the determinants of individuals/households health status.

1.2. Study Objectives

The general objective of this study is to analyze factors determining health status of households using a health production framework, with a view of producing policy relevant information. Specifically the study sets out to:
- Determine the effect of health knowledge on household health status;
- Determine the effect of health habits on health status of households;
- Provide policy suggestions and recommendations based on study findings.

2. Methodology

2.1. Theoretical Framework

In his theory of the allocation of time, (Becker, 1965) outlined a model where households are seen as producers of "commodities" instead of solely consumers of goods and services. Households are assumed to derive utility from the basic commodities they produce by combining their own time with market goods. Grossman (1972a; 1972b) used the household production framework to develop his model of the demand for health. He defined health as a durable capital stock, and hence implied that the end product is not health as such but the services this capital good yields. In Grossman's formulation, individuals derive utility from the services that health capital yields and from the consumption of other commodities. The stock of health capital depreciates over time and the consumer can produce gross investments in it according to a household production function using health care and their own time as inputs. It is assumed that the efficiency of the production process depends on individuals' stocks of other forms of human capital, especially education.

In Grossman's model the yield from the individual's stock of health capital is defined as the total number of healthy days in each year, which generates utility directly, when health is 'consumed' and indirectly, by determining income/ wealth which in turn can be used to purchase goods or to produce commodities which influence utility (Grossman, 1999; Kiiskinen, 2002; Swanepoel & Stuart, 2006; Vörk, 2000). But, according to Mwabu (2007), the number of

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[3] Lifestyle change can be facilitated through a combination of efforts to enhance awareness, change behaviour and create environments that support good health practices" (O'Donnell, 1986)

[4] Optimal health is defined as a balance of physical (fitness, nutrition, medical self-care, control of substance abuse); emotional (care for emotional crisis, stress management); social (communities, families, friends); spiritual (love, hope, charity); and intellectual (educational achievement, career development) health.

healthy days, can be zero without death occurring, since people can live for years in constant state of illness. He further added that the health capital accumulated by successful treatment of an illness in a previous period can be wiped out by a random illness in the next period, so that death can occur during a period of good health (Mwabu, 2007). In Grossman's model, as in household production models in general, the demand for health care, and other market goods, is indirectly derived from the demand for the commodities that households choose to produce.

Grossman's model is understandably simplified for the convenience of a basic analysis by assuming that the use of health care services is the most important input in the health production function. Other inputs such as housing conditions, diet, recreation, and tobacco and alcohol consumption can be included, but comprehensive modelling of joint production aspects would complicate the analysis (Grossman, 1975). The household production model offers a more comprehensive description of the relationships that this study will focus upon, and hence, it will be considered as the primary framework for the rest of the study.

In health education literature, relatively little emphasis has been given to the concept of health knowledge. Improving individuals' knowledge is the major objective of health education (Downie & Tannahill, 1996; Wardle & Steptoe, 1991). The difference is made between knowing one's body and how to keep it healthy, knowledge about the health care system and the efficiency of particular technologies, and knowledge about the health effects of public policies on different organizational levels to create health promoting environments (Kiiskinen, 2002). The first two types of knowledge are mainly concerned with the individual's knowledge base, while the third has more to do with public awareness and focus more on the knowledge of the decision makers on the health effects and relative costs of a wider range of policies.

The theoretical framework is built on the basic concepts and ideas of the household production theory (Becker, 1965) and its application to the analysis of the demand for health by Grossman (2004) as well as some of the further developments of his model by Mwabu (2007).

2.2. Analytical Framework

An individual's behaviour is assumed to reflect his desire to maximize utility as defined in equation 1. The utility is maximized subject to the household income and production technology.

$$MaxU = U\left(\varphi_i H_i, Z_i\right) \quad \text{... (1)}$$

Subject to

$$P_i M_i + V_i X_i + W_i\left(TL_i + TH_i + T_i\right) = W_i \Omega + A_i = R \quad \text{... (2)}$$

$$I_i = I_i\left(M_i, TH_i; E_i\right) \quad \text{... (3)}$$

$$I_i = \left(H_i - H_0\right) + \delta H_i$$

$$Z_i = z\left(X_i, T_i; E_i\right) \quad \text{... (4)}$$

Where H_i is the stock of health in period i (time period i = 1 for all variables); φ_i is the flow of services per unit of health stock so that $h_i = \varphi_i H_i$ is the total quantity of health services available for consumption in period i, measured in this case by the number of healthy days. $\varphi'_i > 0$ is the marginal product of the stock of health as measured by healthy days and $\varphi''_i < 0$ (McGuire, Henderson, & Mooney, 1995); Z_i is an aggregate of all commodities besides health; P_i and V_i are prices of health care (M_i) and other goods (X_i) respectively; W_i is the wage rate in the labour market; I_i is gross investment in health; TL_i is the time lost from market and non-market activities due to illness; TH_i and T_i are time inputs associated with the production of I_i and Z_i; E_i is level of education; A_i is non-labour income; Ω is the total amount of time available in any period; R is full income, the monetary value of assets plus the earnings an individual would obtain if he or she spent all of his or her time working; H_0 is inherited stock of health capital, δ is its depreciation rate in period I and X_i is composed of all other goods which provide utility to an individual but does not directly affect health.

In an attempt to causally connect usage of health inputs to changes in health status, a hybrid health production model is often estimated (Mwabu, 2007; Rosenzweig & Schultz, 1983).

$$H = \theta\left(Y_m, pl, F, \mu\right) \qquad l = 1,...,m-1,\ m+1,...,r \quad \text{...(5)}$$

Where H is health status, Y_m is a health input of type m such as health care, with F being treated as a proxy for health inputs other than health care, and with prices of health inputs, pl, serving as background variables μ is unobservable health endowment specific to each household. Y_m is endogenous because it depends on health status, H, the initial health status before Y_m is demanded. Thus, in estimating this equation the endogeneity of Y_m and the un-observability of μ should be taken into account (Mwabu, 2007). Equation (5) states that an individual's health status is influenced by a total of r purchased health inputs, of which m are of health care variety, and r-m belong to other types, such as food, shelter, and behavioural health production inputs such as smoking, recreation and alcohol consumption.

The health effects of input demands should be estimated using a functional form, that imposes a minimum of restrictions, on the way the inputs are combined to produce health (Mwabu, 2007). Hence, this study utilized the *translog production function*[5], which may generally be stated as in equation 6(Klacek, Vošvrda, & Schlosser, 2007; Lordan, 2008; Mishra, 2007; Mwabu, 2007; Rosenzweig & Schultz, 1983).

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[5] For a detailed discussion on the various functional forms see (Mwabu, 2007)

$$\log H = \gamma + \sum_{i=1}^{m} \beta_i \log Y_i + \frac{1}{2} \sum_{i=1}^{m} \sum_{j=1}^{m} \beta_{ij} \log Y_i \log Y_j + \delta C + \mu + \varepsilon \quad \ldots (6)$$

Where, log is a natural log operator; γ, β_i, β_{ij} and δ are health provision technological parameters to be estimated; Y_i is health inputs such as medical care; physical exercise; alcohol consumption; cigarette smoking; preventive health services and calorie intake; C is a vector of control variables such as socioeconomic characteristics (age, marital status, area of residence, number of children) of households. The term μ, represents unobservable household-specific health endowments known to the household, but not controlled by it, such as genetic traits of its members, while ε is the random error term.

2.3. Definition and Measurement of Variables

2.3.1. Health Status

Mwabu (2007)argued that health is an inherently personal phenomenon, for it is part and parcel of human beings, and hence can be properly measured only at the individual level. The health variable (SAH) was defined in response to: "how is your health status compared to people of your own age, would you say that your health is very good/ good/ satisfactory/ poor?" following Contoyannis et al. (2005). SAH should therefore be interpreted as indicating a perceived health status relative to the individuals' concept of the 'norm' for their age group.In this paper we used both self assessed health (SAH) measure and the body mass index (BMI).

2.3.2. Health Knowledge

Health knowledge includes all of the components an individual needs, to assess their current health status, expected health losses from certain behaviours, the effectiveness of changing relevant behaviours, and health care services available. Hence, it constitutes a basis for an individual's perceptions, relevant to most health-affecting decisions. An increase in knowledge capital raises the efficiency of the production process in the non-market or household sector, just as an increase in technology raises the efficiency of the production process in the market sector(Kiiskinen, 2002). The instruments for health knowledge included distance to the nearest primary school, distance to the nearest public health facility and distance to the nearest shopping centre. Also the cost of travelling to these destinations, measured in time taken in minutes and Kenya shillings, was included. Health knowledge was measured using four categories. The first was general health knowledge, second smoking knowledge, third knowledge about the effects of alcohol, and fourth the average health knowledge score computed from the scores for the first three categories.

2.3.2.1. Health Seeking Behaviour

These variables ideally capture all channels through which the health information can be forwarded to individuals and households. It can be assumed that the more often an individual searches these channels, the more likely (and earlier) it is that s/he receives the information released by health authorities. Hence, these are assumed to contribute to his/her health knowledge even if we cannot specify the quality of the information that has been made available. Households in possession of a television or radio are more likely to be informed on health education programmes[6] than those without. This was determined by the number of different health education programmes the respondents had watched on televisions (TV) and listened to in radio programmes, the frequency of reading health related articles in magazines and also the number of times a respondent participated in different types of group health education activities over the last 12 months.

2.3.3. Health Habits

Good/bad behaviour will make the production of health more/less efficient and will decrease/increase the rate of depreciation, and so, will deplete the already in stocked health capital slower/faster (Zhao, 2005). Life style such as smoking, alcohol drinking, and exercising regularly, affects health. Exercise brings benefits irrespective of whether it has been undertaken for fun and leisure or whether it is a "side product" of the physical activity at work or in the household duties (Kiiskinen, 2002). Different physical activities require different amounts of travel, equipment, time and effort on the part of the participant. Alcohol consumption is recognized as an important risk factor for most chronic illnesses, such as, diseases of the digestive system, cancer, cirrhosis, as well as for accidents and violent deaths (Or, 1997). Thus, we expect excessive alcohol use/abuse input to have a negative marginal product in the production of health (Grossman, 1999; Or, 1997). The decision to smoke or not to smoke is a conscious choice that directly affects the health status and ultimately the mortality of individuals (De Walque, 2004). Just like alcohol, tobacco consumption has been shown to be the intervening factor for deaths from cardio-vascular disease, heart attacks and chronic respiratory diseases (Or, 1997). This input has a negative marginal product in the production of health. They are purchased because they are inputs into the production of other commodities "smoking pleasure" that yield positive utility (Grossman, 1999).

In this study, the physical activity is primarily seen as an active choice to invest in one's physical fitness and health. This was captured by asking the respondent whether s/he participated in any physical activity[7] or exercises during

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[6] Like Healthy Living, body and spirit, family doctor, alternative health, chakula bora, stress solution, strong medicine among others.
[7] Adequate physical activity (i.e. ≥30 minutes of moderate intensity physical activity, ≥5 days per week) plays an important role in the prevention of these diseases(WHO, 2008)

the last four weeks, the frequency of participation and the time individuals spent in each activity on average in minutes[8]were used as the appropriate measure. For alcohol consumption, this study looked into the different types of alcohol (ranging from industrial spirits to homemade traditional brews) and the intensity of consumption measured in litres per week. The instruments for alcohol included among others, the local price of the different kinds of alcohol both home-made and commercially-branded, time taken travelling to and in alcohol consumption, and the amount of fare by a vehicle or a bodaboda[9] to and from your residence and common drinking place. The brand-type and number of cigarettes[10] smoked per day and rolls of traditional tobacco sniffed or chewed per week, were used to measure the intensity of tobacco used. The price for a pack of 20 cigarettes, distances to the nearest shopping centre, and time taken to and from the shopping market, were among the instruments used. This, however, is not meant to underestimate the fact that household health production is also affected through passive smoking. However, it fells to enter into the model as a variable since virtually everybody who is in a smoking environment, is a victim of passive smoking.

Calorie intake is discussed under the frequency in which the respondent consumes different types of fruits and vegetables. Not having a diet sufficient with fruits and vegetables has been identified as an independent risk factor for cardiovascular disease and cancer (including lung, stomach, colorectal and oesophageal). Hence, the local price of different fruits and vegetables was included. In addition, the distance to the nearest shopping centre and time taken walking and using a bodaboda were used as instruments.

2.3.4. Instruments

Mwabu (2007) noted that IV estimation methods should be used due to end ogeneity of health inputs and heterogeneity of patients. Generally, one choice of instrumental variable for explaining the independent variations in health input demands, according to Schultz (2004), is the market determined price of the health inputs in the area in which the individual resides, and thereby has access to health goods and services. Strauss and Thomas (1998) and Mwabu (2007) gave the specific instruments for health inputs. The instruments were identified as prices of the health inputs like local commodity prices and disease and community level infrastructure. The instruments include user fees at local clinics, distances and travel time to clinics, prices of staple foods, alcohol and cigarettes, distances to market centres, and to social infrastructure such as roads, schools and clinics.

2.4. Data

Two Sub-Counties (Kangundo and Matungulu) were purposively selected for the study. The study used primary data collected from households within the district. The data was collected in the months of March and April, 2009 using a structured questionnaire. The study targeted respondents aged 18 years and above, since they are assumed to produce their own health. The households and respondents were randomly selected, and 302 respondents were interviewed, of which 49.67 percent were from Kangundo Sub-County and 50.33 percent from Matungulu Sub-County.

3. Findings of the Study

3.1. Socio-Economic Variables

Majority 90.40 percent resided in rural areas and almost two thirds, 63.91percent were males. The average age for the respondents was 35 years with the youngest being 21 years old and the oldest 71 years old. The average household size was 4.99,almost the same as the average household size of 4.9 in the entire of Machakos County, established by the Kenyan Ministry of Finance and Planning (2008).In every 100 households, there were 66 households with a child aged zero to five years. The average number of schooling years completed by the respondents in primary school, secondary school, University and TIVET was 7.45, 2.76, 0.21 and 0.29 respectively. Generally, the average number of years completed by the respondents was 10.71 with some having not completed even one year in a school. Females had average schooling years of 10.46 while males had 10.85 and they were statistically the same. The mean number of years in school for respondents from Kangundo of 12.09 was statistically more than in Matungulu of 9.36. Respondents living in urban areas had an average number of schooling years of 13.38, which was statistically more than in rural areas with 10.43. This implies being in rural area is a deterrent for schooling.

3.2. Health Status

In using the SAH, 8.94 percent had poor health, 26.49 percent satisfactory, 58.94 percent good and 5.63 percent very good. The body mass index (BMI) was calculated as weight in Kgs divided by height in metres squared. This gave an average BMI of 23.22, with the minimum and maximum being 13.68 and 40.28, respectively. Hence, according to World Health Organization (WHO)[11] definition, 8.61 percent were underweight, 57.28 percent had normal weight, 31.46 percent overweight, while 2.65 percent were obese. This implies that, 42.72 percent of the respondents had poor health status.

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[8] To estimate the duration of participation, we shall add the amount of time spent in both primary and secondary physical activity.

[9]Bicycle or motorcycle used for commercial transport.

[10]"Cigarette means any product which consists wholly or partly of cut, shredded or manufactured tobacco, or of any tobacco derivative or substitute, rolled up in paper or any other material and capable of being used immediately for smoking" ((Kenya RoK, 2007))

[11]According to WHO if BMI <18.5 underweight, 18.5 < BMI < 25 Normal weight, 25 < BMI < 30 overweight and BMI >30 Obesity

Variable Name and T-statistics	Body Mass Index (BMI)
Sex (T-statistics)	2.61***
Female mean	23.94
Male mean	22.81
Current district of residence (T-statistics)	11.05***
Matungulu mean	21.26
Kangundo mean	25.20
Current area of residence (T-statistics)	2.17**
Urban mean	24.61
Rural mean	23.07
Current marital status (T-statistics)	2.56***
No spouse mean	22.44
Living with spouse mean	23.58
Ever used tobacco (T-statistics)	2.54***
Never used mean	23.66
Ever used mean	22.58
Ever used cigarettes (T-statistics)	2.34**
Never used mean	23.60
Ever used mean	22.64
Use cigarettes everyday (T-statistics)	2.15**
Do not use mean	23.58
Use everyday mean	22.66
Ever drunk alcohol (T-statistics)	3.45***
Never consumed mean	23.85
Ever consumed mean	22.41
Consume alcohol everyday (T-statistics)	4.30***
Do not consume daily mean	23.92
Consume daily mean	22.12
Consumed more than six drinks on one occasion in the past 12 months (T-statistics)	3.31***
Never consumed mean	23.81
Ever consumed mean	22.42
Exercise (T-statistics)	4.62***
Do not exercise mean	22.12
Exercise mean	24.03

Table 1: Two Sample T-Test with Equal Variance
*Note: ***, **, * Indicates 1 Percent, 5 Percent and 10 Percent*
Level of Significance Respectively

Females had an average BMI of 23.94, which was statistically greater than male's at 22.81. Individuals who were currently living with their spouse had a mean BMI of 23.58, which was statistically higher, compared to 22.44 for those without. Implying, those living with their spouses, had better health status than those living without spouses. This could be due to poor healthy practices, like poor eating habits coupled with extra-marital affairs for the latter group. The mean BMI for respondents from Kangundo of 25.20 was statistically higher than 21.26 in Matungulu. Urban area respondents had an average BMI of 24.61 which was statistically higher than in rural areas with 23.07. This showed that, without controlling for other variables, individuals from urban areas had better health compared to those in rural areas.

Two sample t-tests revealed that the mean BMI for those who ever used alcohol was 22.41, those who consumed alcohol everyday was 22.12 and for the respondents who have had six or more drinks on one occasion in the past 12 months had a mean BMI of 22.42. These mean BMI's were statistically lower than the means of 23.85, 23.92, and 23.81 respectively for those in their respective base categories. Hence, it implies not only does alcohol consumption adversely affect the health status of an individual, but also the intensity and frequency of alcohol consumption had detrimental effects on individual's health status. Individuals who ever used tobacco, smoked cigarettes and those who smoked everyday had an average BMI of 23.6 and it was statistically higher compared to those who did not engage these three cases with a BMI of 22.6. Thus, similar to alcohol consumption; usage, frequency and intensity of cigarette smoking had adverse effects on individual's health status. The average BMI for those who exercised was 24.03and it was statistically higher, than for those who did not with a BMI of 22.12. This showed that, exercise is good for health improvement as it strengthens the bones, aids in quick digestion of food, increases the oxygen circulation and absorption capacity, and quest for food, hence better health. Thus, the computed means reveals individuals with normal weight except those from Kangundo Sub-County who were on average overweight.

3.3. Health Knowledge

The mean percentage scores for these categories were 82.06, 96.42, 77.59 and 85.36, respectively. Two sample t-test statistics produced no significant differences between the respondents who had watched health education

programmes and those who did not in the four categories on health knowledge. A significant statistical difference was deduced in knowledge about the effects of alcohol score and total health knowledge score, between respondents who listened to health education programmes through radios and those who did not, with the former scoring statistically higher. Individuals who are currently living with their spouses scored higher than those without a spouse, in all the categories except knowledge on smoking. The score in Matungulu division for knowledge about the effects of alcohol of 66.67 percent was statistically lower compared to Kangundoof 88.67 percent. However, on knowledge about smoking, respondents from Matungulu scored 99.80 percent and were statistically higher than 93.00 percent for those from Kangundo. Respondents who had read health related articles on magazines in the previous four weeks, scored statistically higher on knowledge about the effects of alcohol, and total health knowledge, than those who did not. Knowledge on smoking and overall health knowledge score was statistically higher for rural residents compared to urban residents.

3.3.1. Health Seeking Behaviour

The respondents identified a number of TV programmes on health education, which they had watched. This included healthy living 7.62 percent, body and spirit 7.28 percent, cardiac programs 4.97 percent, family planning programs 4.64 percent, diabetic programs 4.30 percent and herbal medical 2.65 percent among others. Some of the radio programs listened to were herbal medical 32.45 percent, Malezi bora(good nurture) 14.2 percent, Mapishi bora(good catering) 13.2 percent, high blood pressure programs 3.97 percent and family planning programs 3.31 percent among others. The herbal medical included programs like Asali (honey) herbal, Bakika herbal and Makini(cautious) herbal.

The four categories of information seeking activities were statistically higher for females than for males. In addition, the information seeking activities were higher for urban residents, compared to rural residents, though as expected, only the number watched on TV and articles read from magazines were statistically significant. Moreover, those who were living with their spouses sought higher health information, than those who had no spouse; though, only the number of health education programmes listened to on radio and articles read on magazines, were statistically significant. Hence, for these three binary variables, the number of health related articles read on magazines differed by sex, marital status and the remoteness of a place. The frequency of participating in group health education activities only differed by sex; the number of health education programmes listened to on radio differed by sex and marital status; while the number of health education programmes watched on TV differed by sex and remoteness of the place of residence.

The numbers of health related articles read, health education programs watched on television (TV) and health education programs listened to from radio were positively related to BMI, though not statistically significant. However, the number of health education programs listened on radio, was negatively and statistically significantly related to smoking. In addition, the number of health education watched on TV was positively and statistically significantly related to calorie intake and outpatient visits. As expected, the number of health education programs watched on TV was negatively related to minutes spent exercising, since TV watching is regarded as a passive activity. The number of health education programs listened to on radio and group health education activities, an individual participated in the last twelve months was positively related to exercise, with the former being significant at 10 percent level. Thus, the number of health education programs listened to on radio and group health education activities an individual participated was positively related to exercise, calorie intake and health knowledge. The number of health education programs watched on TV negatively affected the body mass index, the level of exercise and the number of years smoked. In addition, it positively increased the level of health knowledge, the number of outpatient visits and calorie intake. Thus,it was generally good for health status improvement.

3.4. Health Habits

3.4.1. Exercise/ Physical Activity

The respondents who exercised were 57.28 percent while those who participated in some physical activity or exercises during the previous four weeks were 55.63 percent.Forty six percent of the respondents exercised five or more days per week, while 11.91 percent exercised for 30 or more minutes in a day, though, only one in every 10 spent the recommended 30 minutes and above in a day exercising five or more days per week. Respondents identified a number of activities in which they spent their time exercising. Such activities included, going for gymnastics 19.2 percent; cycling 17.21 percent; doing manual work like digging, stone lifting and loading 15.56 percent; running 11.59 percent; jogging7.28 percent; participating in ballgames 5.63 percent; walking 5.63 percent; dancing 4.97 percent, and doing house chores like washing or cooking 4.30 percent. However, it should be noted that whereas 73.18 percent of the respondents knew how to cycle, only 17.21 percent saw this as an active way to exercise. Respondents who ever exercised or participated in some physical activity earned Kshs 10,054.30 per month, with their households earning an average Kshs 16,484.40 and this were statistically higher compared to Kshs 6,140.30 and Kshs 8,749.60 respectively for those who never had. Hence, household monthly income was positively and significantly related to exercise.

3.4.2. Alcohol

Forty four percent had consumed alcohol,42.38 percent drunk alcohol in the last 12 months and39.07 percent drunk alcohol daily. The average years of alcohol consumption, for those who have been drinking alcohol was 15.5 years, while for the entire sample it was 6.3 years. Whereas the minimum age in which the respondents started alcohol consumption was seven years and the maximum age 31, the average initiation age was 20.1 years. In the past 12 months, 6.29 percent have had six or more drinks on one occasion, and have been taking this amount, two to three times a week,

3.64 percent taking four or more times per week, 14.57 percent two to four times a month and 17.88 percent took this number of drinks monthly or less.

Individuals who ever drunk alcohol, earned a statistically higher monthly income of Kshs 7,265.40 on average compared to Kshs 9,261.55 for those who had not. Their corresponding total household monthly earnings of Kshs 10,739.10 and Kshs 15,101.80 respectively, were statistically different. Individuals, who consumed alcohol daily, earned monthly income of Kshs 7,227.10 while those who do not drink daily, earned Kshs 9,123.40, with the same being reflected in their households, who earned Kshs 10,693.20 and Kshs 14,775.50 per month respectively and they were statistically different. Respondents who ever consumed more than six drinks on one occasion in the past 12 months earned per month Kshs 6,947.65 with their households earning on average Kshs 9,709.40,while those who never had, earned Kshs 9,437.90 and the households Kshs 15,733.90. The mean difference was statistically significant. Hence, alcohol consumption was found to be negatively correlated with monthly income earnings and low cadre workers drank alcohol more often and intensively than higher cadres.

3.4.3. Tobacco Use

The number of respondents who ever used tobacco was 40.73 percent and this was done through three ways namely cigarette smoking 39.74 percent, 1.32 percent sniffed tobacco and 0.33 percent chewed tobacco. The average number of cigarettes smoked daily in the entire sample was 3.7 while considering only those who smoke; the average was 9.3 with the least being two and 40 the most. One of those who ever smoked quit in the last 12 months, however, the rest 39.40 percent of the respondents smoked in the last 12 months and even in the last four weeks but again one of the respondent did not smoke in the last one week and also does not smoke every day. The average number of years the smokers has been smoking cigarettes was17 years, while for the entire sample it was 6.6 years. Whereas the minimum age in which the smokers started cigarette smoking was 10 years and the maximum age 30, the average age for being initiated was 19.2 years. As expected, males smoked more than females. Increase in the prices of cigarettes and alcohol had a negative effect on smoking and the relationship was nonlinear. Three of the health information seeking activities negatively affected the quantity and intensity of smoking. However, though in the Cobb-Douglas models, smoking was negatively and significantly related to health status as expected, this input had a positive marginal product in the production of health, as shown by a positive and insignificant coefficient, in the 2SLS translog model, contrary to expectations. They are purchased because they are inputs into the production of other commodities "smoking pleasure" that yield positive utility (Grossman, 1999).

Regressors	Log of Body Mass Index	Log of Health Knowledge Score	Log of Number of Minutes Exercise Weekly	Log of Number of Years Smoked Cigarettes	Log of Number of Days Eat Fruits and Vegetables Weekly
Sex (1 if male)	- 0.0522 (3.02)***	0.0064 (0.55)	1.5179 (4.92)***	1.1913 (8.31)***	- 0.1478 (1.44)
Age in years	- 0.0005 (0.08)	0.0039 (0.99)	0.0097 (0.09)	0.1228 (2.53)**	- 0.0266 (0.77)
Age squared	0.0022 (0.31)	- 0.0050 (1.03)	- 0.0786 (0.61)	- 0.1198 (2.02)**	0.0339 (0.80)
Marital status (1 if current married)	0.0371 (2.08)**	0.0122 (1.01)	0.0597 (0.19)	- 0.0110 (0.07)	0.1818 (1.72)*
Residence area (1 if rural)	0.0052 (0.18)	0.0317 (1.60)	0.5456 (1.04)	0.2332 (0.96)	0.1255 (0.72)
No. of schooling years	0.0022 (0.71)	- 0.0042 (2.03)**	0.0363 (0.66)	- 0.0312 (1.23)	0.0219 (1.21)
Log of household monthly income	0.0016 (0.14)	0.0178 (2.26)**	0.6726 (3.24)***	0.0452 (0.47)	0.2375 (3.45)***
Household size	- 0.0049 (1.25)	- 0.0008 (0.31)	- 0.0695 (0.99)	0.0147 (0.45)	- 0.0439 (1.88)*
No. of children under 5 years	0.0190 (1.63)	- 0.0042 (0.54)	- 0.1775 (0.85)	- 0.1869 (1.93)*	- 0.2492 (3.60)***
Price of 20 pack of cigarettes	- 0.0007 (0.26)	- 0.0011 (0.62)	- 0.0688 (1.44)	- 0.0072 (0.32)	- 0.0196 (1.24)
Price of 20 pack of cigarettes squared	0.0011 (0.74)	0.0006 (0.58)	0.0410 (1.49)	0.0082 (0.64)	0.0128 (1.41)
Price per liter of alcohol	0.0010 (0.75)	- 0.0001 (0.12)	0.0432 (01.87)*	- 0.0431 (4.01)***	- 0.0092 (1.20)
Price per liter of alcohol squared	- 0.0001 (0.14)	- 0.0004 (0.97)	- 0.0203 (1.72)*	0.0197 (3.58)***	0.0017 (0.43)
No. of health related articles read	0.0016 (0.89)	0.0011 (0.91)	- 0.0215 (0.67)	0.0118 (0.79)	0.0134 (1.26)
No. of group health education participated in the past 12 months	0.0007 (0.18)	- 0.0003 (0.12)	0.0391 (0.61)	- 0.0604 (2.03)**	0.0137 (0.64)
No. of Health education programs watched in TV	- 0.0055 (0.58)	0.0026 (0.41)	- 0.0853 (0.51)	- 0.0504 (0.65)	0.1075 (1.93)*
No. of Health education programs listened on radio	0.0103 (1.03)	0.0056 (0.83)	0.2986 (1.67)*	- 0.2396 (2.89)***	0.0898 (1.51)
Registration fee	- 0.0011 (0.68)	0.0000 (0.03)	- 0.0261 (0.87)	- 0.0069 (0.49)	0.0092 (0.92)

Regressors	Log of Body Mass Index	Log of Health Knowledge Score	Log of Number of Minutes Exercise Weekly	Log of Number of Years Smoked Cigarettes	Log of Number of Days Eat Fruits and Vegetables Weekly
Consultation fee	- 0.0003 (0.95)	- 0.0002 (0.79)	- 0.0112 (1.71)*	0.0038 (1.26)	- 0.0046 (2.13)**
Amount paid for prescribed medicine	- 0.0002 (0.69)	0.0000 (0.24)	0.0054 (1.00)	0.0031 (1.26)	0.0027 (1.52)
Waiting time in minutes for service	- 0.0002 (0.82)	0.0003 (1.91)*	- 0.0130 (2.93)***	- 0.0051 (2.46)**	- 0.0018 (1.21)
Distance to the nearest public health facility (Km)	- 0.0179 (2.53)**	- 0.0163 (3.41)***	0.2152 (1.70)*	0.0691 (1.18)	- 0.0111 (0.27)
Time to the nearest public health facility (mins)	0.0007 (0.80)	- 0.0012 (2.01)**	- 0.0096 (0.60)	- 0.0114 (1.52)	- 0.0070 (1.30)
Fare to the nearest public health facility	- 0.0006 (1.20)	0.0013 (3.71)***	0.0017 (0.18)	- 0.0008 (0.18)	0.0000 (0.01)
Distance to the nearest market centre (Km)	- 0.0267 (1.61)	0.0018 (0.16)	0.0003 (0.01)	0.0047 (0.03)	- 0.0933 (0.95)
Time to the nearest market centre (minutes)	0.0017 (1.38)	0.0014 (1.66)*	- 0.0241 (1.07)	0.0101 (0.97)	0.0080 (1.07)
Distance to the nearest all season weather road (Km)	- 0.0169 (0.76)	- 0.0169 (1.12)	- 0.4944 (1.24)	- 0.3654 (1.98)**	- 0.0694 (0.53)
Time to the nearest all season weather road (min)	0.0012 (0.74)	0.0017 (1.49)	0.0150 (0.51)	0.0461 (3.37)***	0.0065 (0.67)
Distance to the nearest primary school (Km)	- 0.0711 (1.98)**	- 0.0228 (0.94)	- 0.2265 (0.35)	0.2608 (0.87)	- 0.2567 (1.20)
Time to the nearest primary school (minutes)	- 0.0009 (0.52)	0.0035 (3.02)***	- 0.0212 (0.69)	0.0073 (0.51)	- 0.0019 (0.18)
Distance to the nearest secondary school (Km)	0.0742 (2.08)**	0.0119 (0.50)	- 0.4903 (0.77)	- 0.3504 (1.18)	0.1951 (0.92)
Time to the nearest secondary school (minutes)	- 0.0006 (0.35)	- 0.0016 (1.30)	0.0398 (1.24)	- 0.0239 (1.61)	0.0088 (0.83)
Price of fruits	0.0007 (0.74)	0.0015 (2.59)***	0.0222 (1.41)	- 0.0183 (2.51)**	0.0050 (0.97)
Distance to fruit & vegetable vendor (Km)	0.0049 (0.51)	0.0005 (0.07)	0.2231 (1.32)	0.0561 (0.72)	- 0.0385 (0.69)
Price of vegetables	- 0.0018 (2.97)***	- 0.0023 (5.58)***	- 0.0123 (1.14)	0.0027 (0.54)	- 0.0016 (0.45)
Time to the nearest maize flour, maize and beans shop (minutes)	- 0.0038 (2.13)**	- 0.0018 (1.51)	- 0.0277 (0.87)	- 0.0126 (0.85)	- 0.0067 (0.63)
Price of maize flour per Kg	0.0005 (0.23)	- 0.0035 (2.47)**	0.0153 (0.40)	0.0338 (1.92)*	0.0224 (1.78)*
Price of maize per Kg	0.0010 (0.49)	- 0.0001 (0.10)	0.0077 (0.22)	- 0.0235 (1.46)	0.0021 (0.18)
Price of beans per Kg	0.0027 (2.22)**	- 0.0005 (0.57)	- 0.0471 (2.17)**	- 0.0018 (0.18)	0.0087 (1.20)
Distance to the nearest milk dairy (Km)	0.0670 (3.16)***	0.0081 (0.57)	0.1069 (0.28)	- 0.1017 (0.58)	0.1044 (0.83)
Time to the nearest milk dairy (minutes)	- 0.0001 (0.05)	0.0000 (0.05)	0.0286 (0.74)	0.0162 (0.91)	- 0.0019 (0.15)
Price of milk per liter	- 0.0030 (2.99)***	0.0002 (0.30)	- 0.0116 (0.65)	0.0047 (0.57)	- 0.0096 (1.64)
Intercept	3.2334 (11.40)***	4.4710 (23.35)***	2.3314 (0.46)	- 1.5416 (0.66)	- 0.9704 (0.58)
Adjusted R²	0.4085	0.4175	0.2902	0.4407	0.2609
F	5.93	6.12	3.92	6.63	3.52

Table 2: Estimates of Log-Linear Input and Health Demand Equations

3.4.4. Calorie Intake (Diet/ Nutrition)

The respondents who consumed fruits and vegetables at least once per week were 69.21 percentand 32.45 percentate daily. Females consumed fruits and vegetables on average 3.8 days per week, and this was statistically higher than the average number of days of 3.2, for fruits and vegetables consumed by males. Respondents who were currently married during the data collection process, consumed fruits and vegetables for on average 3.5 days per week and this was statistically the same as of 3.2 for respondents who had no spouse. Respondents from urban in a week, consumed fruits and vegetables on average for four days, while those from rural areas consumed on average for 3.3 days, though

statistically the consumption was the same. However, respondents from Kangundo consumed on average 4.1 days and this was statistically higher than the average consumption of 2.7 by Matungulu respondents.

After controlling for other explanatory variables in the log-linear input and health demand functions, it turned out that males consumed less fruits and vegetables than females though not statistically significant. Respondents who were currently married consumed significantly more fruits and vegetables, than those who had no spouse. Household monthly income was positively and significantly related to calorie intake, whereas, the household size and number of children under five were negatively and significantly related to calorie intake. The four health information seeking activities were positively related to fruit and vegetable consumption with the number of health education programmes watched on TV, by the respondent being statistically significant. The number of day's respondents consumed fruits and vegetable was positively related to fruits prices but negatively related to vegetable price sceter is paribus.

Estimates from the 2SLS translog model in Table 3 showed that, fruits and vegetables consumed was positively related to BMI at levels, and positively and significantly related to BMI in the quadratic term. In addition the interactive terms between fruits and vegetables with smoke and outpatient visits was positively and significantly related to BMI. However the interactions of fruits and vegetables and both health knowledge and exercise was negative though not statistically significant related to BMI.

The frequency of fruit and vegetable consumption was the same irrespective of the sex and among rural and urban residents. However, those who were living with their spouses and reside in Kangundo, with a smaller size of household and less number of children under five, and higher income cadres, consumed fruits and vegetables more often than their counterparts. Health status improved with the frequency of fruits and vegetables consumed and excessive use had a positive marginal product on the production of health.

The average distance to the nearest public health facility was 3.06km and an individual would take on average 43 minutes. To travel to the nearest market centre which on average is 2.16km from the respondents' residence, one had to take 32 minutes on average. In accessing the nearest all season weather road, an individual took on average 18 minutes as the road was 0.95km away. The average distance to the nearest primary and secondary schools was 1.85km and 1.76km respectively, where by someone took 31 minutes and 28 minutes to travel to these schools. The nearest fruit and vegetable vendors are 2.16kilometres away and one had to take 33 minutes. The fruits cost a mean price of Kshs 26 while the vegetables sell for Kshs 45 a bunch.

The price of vegetables and distance in kilometres to fruit and vegetable vendors negatively affected the calorie intake. Distance to the nearest public health facility was on average 3.05 kilometres, though in rural areas it was 3.13 km and this was longer compared to an average of 2.36 km in urban areas. Moreover, the longest distance to a health facility in urban areas was six kilometres whereas in rural areas, some individuals had to cover a distance of 20 km. This was established to have negative effect on body mass index, health knowledge and calorie intake, though positively related to exercise and number of outpatient visits.

3.5. Estimates of Health Production Functions

From the log-linear input and health demand equations reported in Table 2, income elasticity for all the four endogenous health inputs was relatively greater than for the body mass index. The adjusted R^2 for health knowledge, cigarette smoking and body mass index were above 0.40 whereas that for exercise and calorie intake was slightly below 0.30. Thus, the socioeconomic characteristics, local commodity prices, and local-area infrastructure variables explained between 26 and 44 percent of the variations in the behavioural and health inputs. As expected, the number of schooling years was positively related to health status, exercise and calorie intake but negatively related to smoking. However, surprisingly schooling years was evidently negatively and significantly related to health knowledge.

	Translog		Cobb- Douglas	
Regressors	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)
Score on health knowledge (LHK)	-20.0974 (4.34)***	- 22.9950 (1.69)*	0.0925 (1.12)	0.1623 (1.30)
Minutes spent exercising in a week (LEXERCISE)	- 0.0035 (0.02)	0.5802 (1.04)	0.0099 (2.87)***	0.0193 (3.20)***
No. of smoking years (LSMOKE)	0.2759 (1.07)	0.4921 (0.59)	- 0.0149 (2.25)**	- 0.0172 (1.72)*
No. of days consume fruits & vegetables in a week (LFRUITVEG)	0.5082 (1.29)	0.3552 (0.35)	0.0232 (2.16)**	0.0623 (3.13)***
$1/2LHK^2$	4.6732 (4.39)***	5.4984 (1.76)*	...	...
$1/2LEXERCISE^2$	- 0.0068 (1.29)	- 0.0073 (0.41)	...	...
$1/2LSMOKE^2$	0.0385 (1.89)*	0.0622 (1.37)	...	...
$1/2LFRUITVEG^2$	0.1103 (2.44)**	0.3808 (2.98)***	...	...
LHK* LEXERCISE	0.0085 (0.24)	- 0.1223 (0.98)	...	...
LHK*LSMOKE	- 0.0824 (1.43)	- 0.1456 (0.79)	...	...
LHK* LFRUITVEG	- 0.1335 (1.52)	- 0.1560 (0.68)	...	...
LEXERCISE* LSMOKE	- 0.0009 (0.37)	- 0.0005 (0.06)	...	...
LEXERCISE* LFRUITVEG	- 0.0094 (2.38)**	- 0.0113 (0.64)	...	...
LSMOKE* LFRUITVEG	0.0232 (3.04)***	0.0518 (1.95)*	...	...
Intercept	46.2731 (4.59)***	51.0321 (1.71)*	2.6935 (7.32)***	2.0525 (3.97)***
R^2	0.2644	...	0.0848	0.0727

	Translog		Cobb- Douglas	
F	5.05	4.77	5.48	6.80
n	302	301	302	301
n	302	301	302	301

Table 3: Estimates of Household Production Functions for Human Health (LBMI)
Note: Absolute Value of T-Ratios in Parentheses, ***, **, and * Denotes One Percent, Five Percent and 10 Percent Levels of Significance Respectively

3.6. Ways of Health Production by Individuals and Households

Results from Table 2,indicate that males had statistically less BMI compared to females. Individuals who were currently living with their spouses had a greater BMI than those without. In both OLS and 2SLS estimates using the Cobb-Douglas and Translog model specification, calorie intake as measured by the number of days an individual consumed fruits and vegetables per week, had a positive and statistically significant effect on health status. Health status improved with the frequency of fruits and vegetables consumed, though an extra day of consumption did not improve the health status like the previous one. Hence, there exists diminishing marginal benefits. Moreover, moderate exercise was good for improved health status though excessive exercising had deleterious effect to the already existing stock of health capital. This was evident from the positive sign for exercise in levels and negative sign on the quadratic term and all the interactive terms for exercise. This implied individuals produced better health through increasing the weekly number of days they did consume fruits and vegetables; moderate exercising; additional health knowledge.

The number of health education programs listened on radio was negatively and statistically significantly related to smoking. In addition, the number of health education watched on TV was positively and statistically significantly related to calorie intake. As expected, the number of health education programs watched on TV was negatively related to minutes spent exercising, since TV watching is regarded as a passive activity. The number of health education programs listened to on radio and group health education activities an individual participated in the last twelve months was positively related to exercise. Thus, the number of health education programs listened to on radio and group health education activities an individual participated was positively related to exercise, calorie intake and health knowledge, while the number of health education programs watched on TV negatively affected the body mass index, the level of exercise and the number of years smoked. In addition, it positively increased the level of health knowledge, and calorie intake. Hence, generally was good for health status improvement.

Waiting time in minutes at the health facility was also positively related to health knowledge score indicating that in the process of waiting for service, an individual may have gathered health knowledge by reading some health information from the notice boards, health pamphlets or even discussing with other health service seekers.The preferred 2SLS translog specification showed health knowledge at levelwasstatistically negatively related to health status, whereas it was statistically positively related with the quadratic term for health knowledge. This implies that, empowering respondents with more health knowledge improves their health status. As expected the number of minutes an individual exercised per week was positively related to the body mass index, whereas the quadratic term for exercise was negatively related to the body mass index. This confirmed moderate exercise was good for improved health status, while excessive or strenuous exercise would not work positively in improving individuals' health, as it may lead to wearing of body muscles especially if coupled with poor calorie intake or cigarette smoking.

4. Conclusions and Policy Recommendations

4.1. Conclusions

Machakos County residents had normal weight according to WHO classification and hence good health status, though in every 100 residents three were obese, 31 overweight, and nine were underweight. Residents from Kangundo Sub-County were overweight whereas those from Matungulu Sub-County had normal weight.Married individuals had better calorie intake and greater BMI compared to those who were not currently married. Males did more exercise, smoked more cigarettes and had greater BMI compared to females. The area of residence whether rural or urban had no significant effect on the health inputs and on BMI. The number of children under five years in a household was statistically negatively related to calorie intake.

4.2. Policy Measures to Improve Health of Households

In the health arena, some health interventions -affects health directly and requires a behavioural change from the households for them to have an impact. In general household characteristics do not affect health directly but indirectly through health behaviours. For health interventions to have any impact, health policy analysts must know what determines households' decision to seek care and engage in health-improving behaviours. They need therefore to understand behavioural and cultural influences on health. The household production of health model assumes that people value good health and their behavioural choices affects health status. The choices are influenced by personal, cultural, social economic characteristics among others. Research based on the household production of health can inform health policy by providing information on how behavioural choices affect health, what determines choices and how policy makers can and/or do influence these choices through targeted health promotion interventions.

Understanding the determinants of why and how households employ behaviours that can affect health like smoking is critical in coming up with policies to increase the likelihood that the households will use the interventions.

Policy makers can therefore influence households' behaviour by changing the factors that influence their health seeking behaviour. For instance, developing and improving access to health-promoting interventions, adjusting the price and location of health services, increasing the cost of behaviours that have a negative effect on health e.g. price of cigarettes and providing information on health promoting behaviours.

There is need to empower individuals hence households, with more health knowledge to improve their health status. In order to improve the level of health knowledge, health education ought to be integrated in school curriculum and be examinable starting from early childhood, primary, secondary and university levels of education. Though, it need not be tested in the final national examinations, as the average number of schooling years completed by the respondents in primary school and secondary school was 7.45 and 2.76 respectively, which considering the 8.4.4 system, fall short of the final nationally examinable year for both primary and secondary school levels.

Health knowledge can also be increased through, increasing and tailoring to consumer demand, the number of health education programs broadcasted on radio and television, in addition to encouraging and supporting participation in group health education activities more so in rural areas. This would significantly reduce unhealthy habits, like smoking and promote healthy behaviour, like increased calorie intake, and exercise.

Health knowledge may also be facilitated, by the government through the ministry of public health and sanitation, by producing weekly health related magazines addressing issues on behavioural aspects like smoking, alcohol consumption, exercise, nutrition and the same placed to the public health facilities mostly in dispensaries and health centres.

In improving the health status of individuals and households, there is need for creating lanes for cyclists, in every road. This would encourage cycling which has been identified as a form of exercise. It would make individuals to exercise for 30 or more minutes in five or more days per week and in turn improve the health status of the individuals, as they would have met the standard (moderate exercise) requirement, which has been established to positively and significantly improve health status.

Since, health status improved with the frequency of fruits and vegetables consumed, and excessive use had a positive marginal product on the production of health, households should be encouraged to increase the intake of these commodities. This could be achieved by encouraging small-scale farmers to practice horticulture, by intercropping different types of fruits and green leafy vegetables. In this case, the government in consultation with the farmers and/or their representatives can design tax and non-tax incentives to promote fruit and vegetable production by households. In addition, household access to affordable bundles of fruits and vegetables can be enhanced, reducing the distance between households and fruits and vegetable vending locations, and providing general knowledge to households on the significance of consuming fruits and vegetables to household health production.

Cigarette smoking and excessive alcohol consumption negatively affected the body mass index, which is a measure of health status. To control cigarette smoking and excessive alcohol consumption, the government needs to increase the prices of cigarettes and alcohol. This would have a negative effect on smoking and significantly increase the marginal product in the production of health, hence improving health status of individuals/households.

There is need to deploy married couples in the same areas, decentralize industries for employment creation in rural areas, reduce the income disparities between rural and urban areas, improve road and transport infrastructure, or even provide incentives, like travelling allowances to people residing in rural areas, so that married couples can conveniently, stay together. This will not only reduce HIV/AIDS incidence among married people, but will also ease congestion and pollution in urban areas, and lead to improved health status, through increased fruits and vegetable consumption. It would also increase the household combined income, as some expenses, like renting would have been curtailed, and the fact that, there will now be economies of scale in terms of basic wants like food and water. In addition, once they live together, their information seeking activities, hence, health education and health knowledge would significantly increase. All, this will lead to health status improvement and enhance productivity.

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