The Impact of Demographic Factors on Poverty and Reproductive Health in Bangladesh: A Multivariate Analysis

Thesis submitted to the University of Dhaka in fulfillment of the requirements for the award of the degree of

DOCTOR OF PHILOSOPHY

Department of Statistics
University of Dhaka
Bangladesh

December 2020

The Impact of Demographic Factors on Poverty and Reproductive Health in Bangladesh: A Multivariate Analysis

Thesis submitted to the University of Dhaka in fulfillment of the requirements for the award of the degree of

DOCTOR OF PHILOSOPHY

Registration No: 85
Session: 2014-2015
Department of Statistics
University of Dhaka
Bangladesh

December 2020

DECLARATION

The following research herewith submitted as the thesis in fulfillment of the requirements for the degree of Doctor of Philosophy (Ph.D.) in Demography at the Department of Statistics, University of Dhaka, Bangladesh. The research is an original one.

_____

Dhaneswar Chandro Sarkar

CERTIFICATE

Forwarding herewith **Dhaneswar Chandro Sarkar**'s thesis titled 'THE IMPACT OF DEMOGRAPHIC FACTORS ON POVERTY AND REPRODUCTIVE HEALTH IN BANGLADESH: A MULTIVARIATE ANALYSIS' in fulfillment of the requirements for the degree of Doctor of Philosophy (Ph.D.) in Demography under the Department of Statistics at University of Dhaka, Bangladesh. I hereby certify that he has complied with the regulations of the Doctor of Philosophy examination in completing his thesis.

_____

Supervisor

Professor Dr. Md. Belal Hossain

Department of Statistics

University of Dhaka

Bangladesh.

ACKNOWLEDGEMENT

Firstly, I consign my limitless thanks to the Almighty Allah giving me strength, endurance and ability to complete this study.

It gives me a great pleasure to offer my profound gratitude to my reverend Supervisor, Department of Statistics, University of Dhaka, Bangladesh, for his willingness to accept me as a research student and for introducing me into the field of 'demography, poverty and reproductive health in Bangladesh'. The completion of the thesis has possible only for providing me his constant support, helpful guidance, thoughtful encouragement, outstanding suggestions and enlightened discussion during my entire phase of this study.

I am deeply indebted to the Chairman and all the respectable teachers of the Department of Statistics, University of Dhaka, for their nice co-operation allowing me to use the seminar and enjoying the various books facilities for this purpose.

I would like to extend my thanks to all my colleagues for their co-operation and encouragement at all stages of the research work. My earnest and heartiest gratitude go to my reverend and affectionate parents and other family members for their affection, encouragement, and inspiration throughout the whole period of my student life.

In fine, I am alone responsible for the errors and shortcomings in this study if any.

December, 2020 **Author**

ABSTRACT

Poverty and reproductive health are important issues in Bangladesh as well as in the developing countries around the world. The number of reproductive health study is increasing day by day. On the aspect of socio-economic, demographic and reproductive health related characteristics, the present study investigates the impact of demographic factors on poverty and reproductive health among ever married women in Bangladesh based on Bangladesh Demographic and Health Survey (BDHS) 2014 data. In this study univariate analysis, bivariate analysis and multivariate analysis such as logistic regression analysis (multinomial logistic regression analysis and ordinal logistic regression analysis), multiple classification analysis (MCA), factor analysis (FA) and structural equation modeling (SEM) have been used to identify and examine the impact of demographic factors on poverty, reproductive health and health of ever-married women. To fulfill the objectives of this study, three main determinants have been considered: Standard of living status of ever-married women, reproductive health status of ever-married women at the time of last pregnancy and health status of ever-married women.

The results of univariate analysis revealed that the current age of 36.4% ever-married women are in the age group 20-29 years, 30.0% in 30-39 years, and remaining 22.3% ever-married women age in 40 years or above. Early age at marriage for women is a serious concern in Bangladesh. The percentages distribution of the respondents according to their age at marriage 71.3% respondents have married within 18 years of age and only 29% women have married after age of 18 years. This is one of the major issue in women's health and poor pregnancy-related outcome in Bangladesh. Literacy rate, especially among the women in Bangladesh is very low (66.3%). A countable part of total respondents 23.5% are illiterate and second largest number of respondents 29.3% completed their primary level and secondary education level are 37.6% and only 9.6% of the ever-married women have higher education.

It has been found that a substantial proportion of ever-married women included in the study have started childbearing before age at 20 years, thus it might happen that they have a high number of children born. More than 48% ever-married women have one or two children ever born, 41.4% ever-married women have three or more children, and only 10% ever-married women have no children ever born. And, also about 26% ever-married women have only one living children, 32.5% have two living children, and 40.9% ever married women have three or more living children in Bangladesh.

Bivariate analysis has been used in this study to determine the association or relationship between the variables and also measures the strength of relationship. The chi-square test shows that current age, marital status, age at marriage, children ever born, number of living children, place of residence, religion, and family size are significantly ($p < 0.01$) associated with standard of living status of ever-married women. Again, variables current age, age at marriage, children ever born, number of living children, and place of residence are significantly ($p < 0.05$) associated with reproductive health status of ever-married women and remaining variables marital status, religion and family size are insignificantly associated with reproductive health status of ever-married women in Bangladesh. In the case of health of ever-married women, chi-square test shows that women's current age, marital status, children ever born, number of living children, place of residence and family size are significantly ($p < 0.01$) associated with health status of ever-married women of reproductive age group in Bangladesh.

Multinomial logistic regression model shows that current age of ever-married women has significant ($p < 0.05$) influence on their health status in Bangladesh. The reproductive women aged before 20 years, women belonging to the reproductive age group 20-29 years and age group 30-39 years are 2.70 times and 1.33 times more likely and 0.83 times less likely to be underweight whereas the likelihoods of being overweight or obese are 0.23 times and 0.55 times less likely and 1.02 times more likely among ever-married women aged before 20 years, women belonging to the reproductive age group 20-29 years, and 30-39 years than those women aged 40 years or above with normal health status respectively. Women's marital status seems to have highly significant ($p < 0.001$) influence on health status of ever-married women in Bangladesh. Married women are less

likely to be underweight (OR = 0.54, 95% CI: 0.43 - 0.69) while more likely to be overweight or obese (OR = 1.74, 95% CI: 1.33 – 2.27) than those women who are divorced or separated having normal health status. Another demographic factor such as children ever born have significant ($p < 0.01$) influence on ever-married women health status. Among the women having one to two children ever born are less likely to be under weight (OR = 0.67, 95% CI: 0.50 – 0.89) and more likely to be overweight or obese (OR = 1.42, 95% CI: 1.09 – 1.85) than those women who have three or more children ever born with normal health status. From these findings, it is observed that the relative chance to the health problem of ever-married women increases with the increasing of their children ever born in Bangladesh. Women's place of residence has highly significant ($p < 0.001$) influence on their health status. With regards to the place of residence, urban ever-married women are less likely to be underweight (OR = 0.73, 95% CI: 0.64 – 0.85) while more likely to be overweight or obese (OR = 2.22, 95% CI: 1.98 – 2.49) relative to rural women having normal health status in Bangladesh.

For the ordinal response, it is also necessary to use ordinal logistic regression model to get precise and efficient estimates of the regression coefficients. The proportional odds model has been used in this study to estimate the odds ratios. Women current age below 20 years are significantly 0.38 times ($p < 0.001$) less likely to being high standard of living compared to those women aged 40 years or above and women belonging to the age group 20-29 years are significantly 0.56 times ($p < 0.001$) less likely to deserve high standard of living than those women aged 40 years or above but women age group belonging to 30-39 years are significantly 0.92 times ($p < 0.01$) less likely to being high standard of living than those women aged 40 years or above. This study also shows that the married women are significantly 1.47 times ($p < 0.001$) more likely to expect higher standard of living compared to those women who are divorced or separated.

Ordinal logistic regression model also shows that the early married women (age below or at age of 18 years) are significantly 0.73 times ($p < 0.001$) less likely to being high status of living than those women who married after age of 18 years in Bangladesh. Mothers who have one to two children ever born are significantly 1.79 times ($p < 0.001$) more likely to being high standard of living compared to women with three or more children

ever born. The women who have one and two living children are insignificantly 1.27 times (p = 0.055) and 1.13 times (p = 0.229) more likely to deserve high standard of living compared to the women with three or more living children respectively. Women who live in urban areas are significantly 0.48 times ($p < 0.001$) more likely to deserve higher standard of living than those women who live in rural areas in Bangladesh. The present study also reveals that women with one to four and five to six family members are significantly 0.59 times ($p < 0.001$) and 0.71 times ($p < 0.001$) less likely to being high standard of living compared to those women with seven or more family members respectively.

On the other hands, it is observed that women's current age has an important effect on reproductive health of ever-married women in Bangladesh. The results of ordinal logistic regression model show that women current age below 20 years are insignificantly 0.98 times (p = 0.963) less likely to being high status of reproductive health compared to those women aged 40 years or above and women belonging to the age group 20-29 years are insignificantly 1.15 times (p = 0.757) more likely to deserve high status of reproductive health than those women aged 40 years or above. Moreover, ever-married women belonging to the age group 30-39 years are insignificantly 1.92 times ($p < 0.159$) more likely to being higher reproductive health compared to those women aged 40 years or above. This study also reveals that the married women are significantly 2.95 times ($p < 0.05$) more likely to expect higher reproductive health compared to those women who are divorced or separated. The early married women (age below or at age of 18 years) are significantly 0.77 times ($p < 0.05$) less likely to being high status of reproductive health compared to those women who married after age of 18 years. Mothers who have one to two children ever born are insignificantly 1.25 times ($p < 0.498$) more likely to being high status of reproductive health compared to the women with three or more children ever born. The women who have one and two living children are significantly ($p < 0.05$) 2.18 times and 1.83 times more likely respectively to deserve higher reproductive health compared to the women with three or more living children in Bangladesh. Another demographic factor such as place of residence has highly significant ($p < 0.001$) influence on reproductive health status of ever-married women. Women who are live in urban areas

significantly 1.92 times ($p < 0.001$) more likely to deserve higher reproductive health status compared to those women who are live in rural areas in Bangladesh. From this finding, it can be concluded that urban women are more expected to being high quality of reproductive health compared to rural counterparts in Bangladesh.

The results of multiple classification analysis (MCA) show that the effect of respondents' age at marriage ($\eta^2 = 0.05$ unadjusted and $\beta^2 = 0.14$ adjusted), children ever born ($\eta^2 = 0.11$ unadjusted and $\beta^2 = 0.13$ adjusted), living children ($\eta^2 = 0.09$ unadjusted and $\beta^2 = 0.05$ adjusted), place of residence ($\eta^2 = 0.44$ unadjusted and $\beta^2 = 0.43$ adjusted) and family size ($\eta^2 = 0.06$ unadjusted and $\beta^2 = 0.09$ adjusted) have the strongest influence for explaining the variability on standard of living status of ever-married women among the selected variables. This study also shows that women marital status ($\eta^2 = 0.06$ unadjusted and $\beta^2 = 0.07$ adjusted), age at marriage ($\eta^2 = 0.10$ unadjusted and $\beta^2 = 0.06$ adjusted), children ever born ($\eta^2 = 0.17$ unadjusted and $\beta^2 = 0.05$ adjusted), number of living children ($\eta^2 = 0.17$ unadjusted and $\beta^2 = 0.18$ adjusted), place of residence ($\eta^2 = 0.19$ unadjusted and $\beta^2 = 0.17$ adjusted) and family size ($\eta^2 = 0.06$ unadjusted and $\beta^2 = 0.01$ adjusted) have strong influence for explaining the variability on reproductive health status of ever-married women among the selected demographic variables. In the case of health of ever-married women, MCA shows that the effect of women's current age ($\eta^2 = 0.19$ unadjusted and $\beta^2 = 0.23$ adjusted), marital status ($\eta^2 = 0.06$ unadjusted and $\beta^2 = 0.09$ adjusted), children ever born ($\eta^2 = 0.01$ unadjusted and $\beta^2 = 0.11$ adjusted), number of living children ($\eta^2 = 0.11$ unadjusted and $\beta^2 = 0.18$ adjusted) and place of residence ($\eta^2 = 0.18$ unadjusted and $\beta^2 = 0.17$ adjusted) have strong influence for explaining the variation on health status of ever-married women among the included variables.

Factor analysis has been applied to investigate and determine responsible demographic, poverty and reproductive health factors to explain the respective set of variables in an effort to find a new sets of variables, fewer in number than the original variables. From the factor analysis it is observed that there are nine eigen values greater than unity and almost 69.017 percent of the total variance is attributable to the nine factors. Five variables; household electricity (0.649), household television (0.755), household

refrigerator (0.397), household cooking fuel (0.782) and household floor materials (0.773) are loaded on Factor 1 and an inspection of these items clearly shows that the majority of these items reflect the socio-economic characteristics. Factor 2 contains seven variables; number of visits antenatal care (0.527), place of delivery (0.804), health care after delivery (0.892), delivery by caesar (0.845), postnatal care provider (0.884), place of first postnatal care (0.496) and fertility planning status (0.754) with larger loading that clearly reflect the reproductive health. Factor 3 contains five variables; current age of respondents (0.775), total children ever born (0.919), number of living children (0.919), place of residence (0.663) and family size (0.538) with larger loading that clearly reflect the demography. Factors 5, 7, and 9 contain the variables; household drinking water (0.678), respondents mass media exposure (0.630), household radio (0.816), household toilet facility (0.496) and household bicycle (0.539) with larger loading that appear to reflect the related motives of socio-economic and an inspection of these items clearly shows that these items reflect socio-economic conditions. Factor 4 contains two variables such as current use of contraceptive (0.710) and contraceptive method types (0.784) with larger loading that clearly reflect the related motive of reproductive health. Factor 6 and 8 contain the variables current marital status (0.681), age at marriage (0.716) and religion (0.837) with higher loading that appear to reflect the changing pattern in composition of population and an inspection of these items clearly shows that these items reflect the demography.

The present factor structure appears to be represented by three dimensions (Socio-economic, Reproductive health, and Demography). So, it was decided to rerun factor analysis, stipulating the extraction of only three factors and rotated component matrix presents only three rotated factors. Factor 1 contains ten variables i.e., household electricity (0.697), household radio (0.819), household television (0.787), household refrigerator (0.658), household bicycle (0.536), household cooking fuel (0.624), household drinking water (0.675), household toilet facility (0.557), household floor materials (0.740) and respondents mass media exposure (0.554) with larger loadings that clearly reflect the socio-economic conditions and was thus Factor 1, labeled as Poverty Factor. Factor 2 contains nine variables i.e., number of visit antenatal care (0.503), place

of delivery (0.806), health checkup after delivery (0.872), current use of contraceptive (0.706), delivery by caesar (0.843), postnatal care providers (0.862), place of first postnatal care (0.561), contraceptive method types (0.781) and fertility planning status (0.686) with larger loadings that reflect the reproductive health conditions and was thus Factor 2, labeled as Reproductive health Factor. Factor 3 contains eight variables i.e., current age of respondents (0.788), marital status (0.619), age at marriage (0.711), children ever born (0.888), number of living children (0.901), place of residence (0.491), Religion (0.814) and family size (0.535) with larger loadings that reflect the demographic conditions and was thus Factor 3 labeled as demographic factor. Finally, this three-factor model represents the combination of the nine original factors and appears to reflect adequately the underlying factor structure of the 27 variables.

In this study structural equation modeling (path analysis) has been employed to examine and determine the direct and indirect effects of demographic factors on poverty, reproductive health and health of ever-married women in Bangladesh. For standard of living of ever-married women, it has been found that there are 20 paths out of 21 hypothesized paths statistically significant ($p < 0.001$). The SEM results reveal that that respondent's marital status, place of residence, religion, children ever born and number of living children have direct significant ($p < 0.001$) negative effects on standard of living and respondent's current age and family size have direct significant ($p < 0.01$) positive effects on standard of living of ever-married women in Bangladesh.

Total effects of the respondent's current age, marital status, age at marriage, place of residence, religion and family size on standard of living of ever-married women are transmitted through its implied effect about 67.9%, 77.0%, 45.8%, 83.0%, 75.7% and 77.5% respectively and indirect effects of those exogenous variables through endogenous variable children ever born on standard of living are 24.8%, 16.5%, 41.7%, 13.3%, 17.6% and 16.5% respectively. However indirect effects of the respondent's current age, marital status, age at marriage, place of residence, religion and family size on standard of living through endogenous variable number of living children are 7.4%, 6.5%, 12.5%, 3.7%, 6.8% and 6.0% respectively. Total effect of children ever born and number of living children on standard of living of ever-married women are about -0.275 and -0.084 of

which both are about 100.0% transmitted through its direct effect on standard of living of ever-married women.

SEM results for reproductive health show that there are 18 paths out of 21 hypothesized paths statistically significant on reproductive health of ever-married women and out of eight variables, five variables are found to have significant ($p < 0.05$) direct effect on reproductive health of ever-married women. Among those respondent's marital status, place of residence and children ever born have direct significant ($p < 0.05$) negative effects and respondent's current age and age at marriage have direct significant ($p < 0.01$) positive effects on reproductive health of ever-married women in Bangladesh.

Total effects of the respondent's current age, marital status, age at marriage, place of residence, religion and family size on reproductive health of ever-married women are transmitted through its implied effect about 67.0%, 80.1%, 77.0%, 81.3%, 43.3% and 62.6% respectively and indirect effects of those exogenous variables through endogenous variable children ever born on reproductive health are 28.7%, 16.7%, 19.7%, 16.5%, 46.7% and 31.6% respectively. However indirect effects of the respondent's current age, marital status, age at marriage, place of residence, religion and family size on reproductive health of ever-married women through endogenous variable number of living children are 4.3%, 3.2%, 3.3%, 2.3%, 10.0% and 5.8% respectively. Total effect of children ever born and number of living children on reproductive health are about -0.314 and -0.048 of which both are about 100.0% transmitted through its direct effect on reproductive health of ever-married women.

For health of ever-married women, it is found that there are 19 paths out of 21 hypothesized paths statistically significant on health of ever-married women and out of eight variables six variables are found to have significant ($p < 0.05$) direct effect on health of ever-married women. Among those respondent's marital status, place of residence and children ever born have direct significant ($p < 0.01$) negative effects and respondent's current age, age at marriage and number of living children have direct significant ($p < 0.01$) positive effects on health of ever-married women in Bangladesh.

Total effects of the respondent's current age, marital status, age at marriage, place of residence, religion and family size on health of ever-married women are transmitted

through its implied effect about 65.7%, 78.3%, 53.8%, 85.1%, 48.4% and 38.9% respectively and indirect effects of those exogenous variables through endogenous variable children ever born on health of ever-married women are 25.7%, 15.2%, 34.6%, 11.4%, 35.5% and 43.5% respectively. However indirect effects of the respondent's current age, marital status, age at marriage, place of residence, religion and family size on health of ever-married women through endogenous variable number of living children are 8.6%, 6.5%, 11.5%, 3.5%, 16.1% and 17.6% respectively. Total effect of children ever born and number of living children on health of ever-married women are about -0.247 and 0.086 of which both are about 100.0% transmitted through its direct effect on health of ever-married women.

Therefore the variables children ever born, number of living children and family size are needed to be controlled for better standards of living as well as reproductive health status of ever-married women, age at marriage and urbanization are needed to be enhanced in Bangladesh for the development of socio-economic and reproductive health status of ever-married women.

GLOSSARY OF TERMS

ANC	Antenatal Care
AIDS	Acquired Immune Deficiencies Syndrome
BBS	Bangladesh Bureau of Statistics
BCC	Behavior Change Communication
CEB	Children Ever Born
CI	Confidence Interval
MCWC	Maternal and Child welfare Centre
HIV	Human Immunodeficiency Virus
HSC	Higher Secondary Certificate
HPSS	Health and Population Sector Strategy
HPSP	Health and Population Sector Program
HNPSP	Health Nutrition and Population Sector Program
ICPD	International Conference on Population and Development
MCA	Multiple Classification Analysis
MDG	Millennium Development Goal
MOHFW	Ministry of Health and Family Welfare
NGO	Non-Government Organization
OR	Odds Ratio
RC	Reference Category
SSC	Secondary School Certificate
SPSS	Statistical Packages for Social Science
STD	Sexually Transmitted Disease
SEM	Structural Equation Modeling
TK	Taka
TV	Television
TT	Tetanus Injection
UNICEF	United Nations Children's Emergency Fund
WHO	World Health Organization

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

Introduction

1.1 Background

Policymakers often ask about how demographic factors affect health and poverty. The popular view in the 1960s and 1970s—that fertility decline would slow population growth in developing countries and thus reduce poverty—came in for a great deal of criticism in the 1980s, and by the 1990s, it was no longer in vogue. The alternative perspective emerged that demographic considerations are largely relevant to reproductive health and poverty reduction (Merrick 2002).

Today, new thinking and fresh evidence challenge these views. Much of this research shows that demographic trends are indeed important. However, the potential benefits of slower population growth depend on the timing and intensity of demographic change, the economic and social status of women, and the type and focus of economic policies in countries undergoing demographic change. The World Bank estimates that in 1998, more than one billion people lived on less than one dollar per day. When exclude China from the estimates, it was seen that there were almost 106 million more very poor people in the world in 1998 than there were a decade earlier. The world's total population is projected to increase by another three billion people by the middle of this century, with most all of this growth occurring in the poorest countries. As global economic growth has stalled, demographers and economists have been examining more closely the role played by rapid population growth in explaining the differences between countries that are reducing poverty and those that are not. Such efforts may help to identify the policies and program interventions that are most likely to reduce the numbers of people worldwide who are extremely impoverished (World Bank 2000).

There are two major contrasting views about the relationship between population growth and poverty: Some believe that high fertility causes poverty and that lower fertility is the key to reducing poverty. At the end of the 18th century, Thomas Malthus (1976) and his followers argued that high fertility and poverty went hand in hand. Malthus himself, focusing on the impoverishing effects of scarce land and rising food prices, urged couples not to marry and have children unless they could afford to support them. One and one-half centuries later, when population growth rates in developing countries were accelerating as a result of high fertility and declining mortality, Malthus's successors (dubbed "neo-Malthusians") took another tack. They

argued that because high birth rates create large numbers of children relative to the number of working adults, savings that might otherwise be invested in the country's infrastructure and development instead must be diverted to meeting the immediate food, healthcare, housing and education needs of growing numbers of children and adolescents. This prevents countries and families from making the longer-term investments needed to help lift them out of poverty (Malthus 1976).

Eradicating poverty and to develop health status are essential for human existence in developing countries. Eradicating poverty everywhere is more than a model imperative and commitment to human solidarity. It is a practical possibility and in the long run an economic imperative for global prosperity. And because poverty is no longer inevitable, it should no longer be tolerated. The time has come to eradicate the worst aspects of human poverty in a decade or two –to create a world that is more human, more stable and more just.

Reaching this goal early in the 21st century is more feasible than most people realize. True, there are the obstacles of vested interests and opposition. But skepticism and disbelief are least as disabling. Everyone has right to a standard of living adequate for the health and well- being of himself and his family, including food, clothing, housing and medical care and necessary social services.

First, a few definitions are in order. The WHO definition of reproductive health is “a state of physical, mental, and social well-being in all matters relating to the reproductive system at all stages of life” (WHO 2004). Corresponding to this broad definition of reproductive health, which was explicitly intended to incorporate sexual health, in this study and take abroad view as to what constitutes reproductive health services. This will obviously include traditional family planning, maternal and antenatal care.

International Conference on Population and Development (ICPD) definition of reproductive health “Reproductive health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, in all matters relating to the reproductive system and to its functions and processes. Reproductive health therefore implies that people have the capability to reproduce and the freedom to decide if, when and how often to do so. Implicit in this last condition is the rights of

men and women to be informed and to have access to safe, effective, affordable and acceptable methods of family planning of their choice, as well as other methods of their choice for regulation of fertility which are not against the law, and the right of access to appropriate health care services that will enable women to go safely through pregnancy and child birth and provide couples with the best chance of having a healthy infant. In line with the above definition of reproductive health, reproductive health care is defined as the constellation of methods, techniques, and services which contribute to reproductive health and well-being through preventing and solving reproductive health problems. It also includes sexual health, the purpose of which is the enhancement of life and personal relations, and not merely counseling and care related to reproduction and sexually transmitted diseases".

Since the International Conference on Population and Development (ICPD) in 1994, reproductive health has been a focus of health programs World-wide. Many countries have worked to revise reproductive health policy in accordance with the ICPD Program of Action. In 1997, POLICY conducted case studies in eight countries—Bangladesh, Ghana, India, Jamaica, Jordan, Nepal, Peru, and Senegal—to examine field experiences in developing and implementing reproductive health policies. With these basics out of the way, it's turn to provide an overview of the interactions among poverty, reproductive health (reproductive health services and related behaviors and knowledge). The links are many and complex, with numerous possible feedback effects.

The 1994 International Conference on Population and Development (ICPD) moved the rationale for "population" activities from macro-level concerns about the effects of population growth and structure on economic growth to individual reproductive rights and health needs. While family planning had been the main focus of the pre-ICPD population agenda, reproductive health includes not only family planning but also other sexual and reproductive health needs, including safe delivery, prevention and treatment of sexually transmitted infections, safe abortion, and violence against women. The reproductive health approach agreed upon in 1994 has come under increasing attack by social conservatives who oppose reproductive health, safe abortion and even family planning. They succeeded in eliminating the ICPD goal of universal access to reproductive health care from the list of Millennium Development

Goals (MDGs), which many donors and countries now are using to set priorities for allocation of scarce funding. The absence of reproductive health from the MDGs has made it easier for nations and donors to neglect the reproductive health and rights of the poor. While few donors have embraced the conservative agenda, there is an atmosphere of self-policing to avoid the controversy associated with reproductive health.

A key concern about "traditional" approaches to aid is that they have benefited the rich more than the poor. In response, poverty reduction has moved to center stage in setting of priorities for program funding. Countries seeking debt relief are preparing Poverty Reduction Strategy Papers (PRSPs) to guide the re-allocation of funds that were previously being used for debt service to social services that will help the poor to escape poverty. Poverty analyses are also guiding priority setting for program funding in countries that are not seeking debt relief. Though diseases specific projects are not completely gone, current health funding is more likely to be tied to broader sectorial or multi-sectorial grants and loans and aimed at priority goals like those embodied in the MDGs, the first of which is the elimination of extreme poverty.

While all this was occurring there has been renewed research interest in evidence that population change may act as a stimulus to economic growth. The strongest case for this so-called "demographic bonus" comes from the experience of east asia. The caveat is that the positive impact of favorable demographic change (principally a rapid decline in fertility and a temporary bulge in the working age population enabling a high rate of savings) depends on appropriate economic policies. Without appropriate policies, including openness to trade, investments in human capital, and flexible labor markets, countries may miss the one-off opportunity that the demographic bonus represents. Further research is needed on both the demographic and policy contexts in countries now experiencing rapid demographic transitions to determine whether the "bonus" argument is applicable, particularly in countries for which the particular set of economic policies that helped East Asian countries realize their demographic bonuses may not be appropriate. For example, the liberal trade and labor market policies that worked for East Asian "tigers" may not work for poor African countries.

While more research is needed, particularly in poor countries where adverse demographics may indeed be undermining economic prospects, it is unlikely that demographic arguments alone will ever restore population funding to the privileged position that it once held. One of the ironies of this is that investments in family planning have helped to accelerate fertility declines in many countries and have created the impression that the "population problem" doesn't exist anymore. This perspective particularly overlooks those poor countries that have not yet experienced fertility decline and may well be caught in a population/poverty trap. Also, the failure of markets to serve poor women in countries that have experienced fertility decline is not being addressed. Even when contraceptive devices are available for purchase, poor women may not have information about the effectiveness and safety of particular methods or they may be too poor to pay for them. Distance, travel costs and social exclusion may also impede access.

The case can and should be made for funding reproductive health care, including family planning for poor women and men both as a right and as a means of helping them escape poverty. A stronger evidence base is needed to demonstrate that poor reproductive health outcomes do, infect, undermine the chances of the poor to escape poverty. While common sense suggests that poor reproductive health outcomes—early pregnancy, unintended pregnancy, excess fertility (when actual births exceed desired fertility), poorly managed obstetric complications—adversely affect the chances of poor women, their children and families to escape poverty, the evidence base to support this argument is thin and the evidence that does exist could be more effectively marshaled. As already noted, HIV/AIDS and infectious-disease advocates have done a better job of demonstrating links between these health outcomes and poverty: as their funding increases, funding for reproductive health is stagnating, and services are being crowded out in the deployment of scarce organizational and health personnel at the service delivery level. A stronger evidence base will support the appropriate inclusion of reproductive health in country level poverty reduction strategies and in the allocation of poverty reduction funding.

In the field of poverty and health status measurements, very few scientific and organized studies have so far been done. In the recent past these branches of study received increasing attention of policy makers and researchers. At different times

government organizations and individual researchers have tried to measure the extent of poverty and health status and explain the various factors causing them.

The reproductive health of women contributes significantly to their overall well-being. Three of the eight Millennium Development Goals (MDGs) are directly related to reproductive and sexual health while mental disorders make up three of the ten leading causes of disease burden in low and middle-income countries. In the contest of slower progress in achieving MDGs in developing countries and the ever increasing man-made and natural disasters in these areas, it is important to understand the association between reproductive health and demographic factors among women with post-disaster experiences (Anwar *et al.*, 2011). "Reproductive health is a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity, in all matters relating to the reproductive system anti to its functions and processes. Reproductive health therefore implies that people are able to have a satisfying and safe sex life and that they have the capability to reproduce and the freedom to decide if when and how often to do so. Implicit in this last condition are the right of men and women to be informed and to have access to safe, effective, affordable and acceptable methods of family planning of their choice, as well as other methods of their choice for regulation of fertility which are not against the law, and the right to access to appropriate health-care services that will enable women to go safely through pregnancy and childbirth and provide couples with the best chance of having a healthy infant" (ICPD 1994).

"In providing quality reproductive health programs, United Nations Fund for Population Activities (UNFPA) assistance will make a contribution to the achievement of two important goals of the Cairo process. First, that all countries 'should take steps to meet the family planning needs of their populations as soon as possible and should, in all cases by the year 2020, seek to provide universal access to a full range of safe and reliable family planning method; and to related reproductive health services which are not against the law (ICPD Program of Action: 7.16). And second that countries 'should strive to effect significant reductions in maternal mortality by the year 2020: a reduction in maternal mortality by one half of the 1990 levels by the year 2000 and a further one half by 2020 (ICPD Program of Action: 8.21)" (UNFPA 1995).

Reproductive health status in Bangladesh is part of a series of assessments in 13 countries in Asia and Near East (Country Report 2012). The purpose of this study is to highlight the reproductive health status and standard of living in Bangladesh within the context of the lives of women. The context begins with social issues—the issues that need to be addressed to meet the reproductive health needs of women. It also outlines specific reproductive health issues, legal and policy issues related to reproductive health, current in-country programs on reproductive health, its operational barriers, and concludes with recommendations to improve the situation in Bangladesh.

The government of Bangladesh has thus identified poverty and reproductive health, this issue as a priority and a challenge and to face the challenge, has incorporated both in the current Health and Population Sector Program (HPSP 2003). There are expectations that with the introduction of the Essential Services Package (ESP) across Bangladesh through the HPSP, there will be an overall increase in the quantity and quality of information and services available for reproductive health through a network of clinics at various levels: community, upazilla, and district. However, studies conducted by the different agencies concluded that the potential for improvements directly associated with HPSP service delivery are unlikely to make significant contributions to achieving reproductive health results during the HPSP period (1990-2003) without additional efforts from other agencies (Annual Progress Review of HPSP 2000 and 2001).

Addressing the social context of reproductive health involves setting priorities among certain issues. In Bangladesh, these issues needing immediate attention, particularly for women. Gender discrimination in the form of discrimination against women has been identified as one of the prime reproductive health issues in Bangladesh. This form of discrimination starts at birth and continues until death. The discrimination exists in the spheres of education, employment, marriage, dowry and even violence.

Employment opportunity across all service sectors is one of the greatest concerns in Bangladesh, though conditions are improving. Gender and age discrimination in wage work is highly pronounced in Bangladesh. Although the garment sector had looked promising for women (1.5 million women work in garments), only 24 percent of all manufacturing workers across all industries are women. The major manufacturing industries in which women are concentrated are the food and beverage, textiles, garments, leather, tea, wood, and fabricated metal products. Nearly 46 percent of

employees for agricultural activities (agriculture, fisheries, and poultry) are women. Women's participation in construction activities is increasing (MOHFW 1998a).

Early marriage is customary for women in Bangladesh. Almost all of these marriages are arranged by their parents (MOHFW 1998a). Although the average age at first marriage is 18 years for females and 27 years for males, rural females tend to marry even earlier. Approximately 75 percent of the girls are married before the age of 18, and only 25 percent are married after 18 years, which is the legal age of marriage for females in Bangladesh (MOHFW 1998a). According to the 2001 census, about one-half of the females in the 15-19 year-old age group are married compared with only 5 percent of males in this age group. By age 24, approximately 87 percent of the females are married compared with 31 percent of the males (BBS 2002).

The present study is devoted to investigate the nature and magnitude of interrelationship among the factors of poverty, health and demographic events with an aim to determine the components that capture the inherent peculiarities of health and poverty and interrelationship in presence of demographic phenomena.

1.2 Objectives

Apart from the greater concern of demographers and other social scientists, this study on the impact of demographic factors on poverty and reproductive health in Bangladesh, unlike other demographic studies, deserves a special attention. The major purpose of the inclusion of this study is to assist the more focused and specialized analysis at the later stages.

This study is conducted keeping the following objectives in mind:

- To identify the responsible demographic factors of poverty and reproductive health of ever-married women.
- To examine the impact of demographic factors on poverty and reproductive health of ever-married women.
- To determine and describe the interrelationship between poverty and demographic factors.
- To determine and describe the interrelationship between reproductive health and demographic factors.
- To investigate more influential demographic factors and their direct and indirect effect on poverty, reproductive health and health of ever-married women in Bangladesh.

1.3 Data and Methodology

1.3.1 Sample Design and Sample Size

The sample for the 2014 BDHS is nationally representative and covers the entire population in the country. The survey used a sampling frame from the list of enumeration areas (EAs) of the 2011 Population and Housing Census of the People's Republic of Bangladesh, provided by the Bangladesh Bureau of Statistics (BBS). The primary sampling unit (PSU) for the survey is an EA created to have an average of about 120 households. The survey is based on a two-stage stratified sample of households. First stage, 600 EAs was selected with probability proportional to the EA size, with 207 EAs in urban areas and 393 in rural areas.

Second stage of sampling, a systematic sample of 30 households on average was selected per EA to provide statistically reliable estimates of key demographic, poverty and health related variables for the country as a whole, for urban and rural areas separately, and for each of the seven divisions. With this sampling design, the study selected 18,000 residential households, which were expected to result in completed interviews with about 18,000 ever-married women. Interviews were successfully completed in 17,300 households. A total of 18,245 ever-married women age 15-49 were identified in these households, and 17,863 were interviewed. Finally, a total of 2570 ever-married women were selected who gave last birth within three years preceding the survey for the purpose particularly reproductive health analysis.

1.3.2 Data Collection

Questionnaires

The 2014 BDHS used three types of questionnaires

Household questionnaire: Some basic information was collected on the characteristics of each person listed, including age, sex, education, current working status, birth registration, and individual possessions. The main purpose of household questionnaire was to identify women who were eligible for individual interview and information about dwelling unit, such as source of water, type of toilet facilities, floor, roof, wall materials and ownership of various consumer goods.

Questionnaire for women: Questionnaire for women was used to collect information from ever-married women age 15-49. Women were asked questions on the related

topics: age, education, religion, and media exposure, reproductive history, use and source of family planning methods, antenatal, delivery, and postnatal care, children immunization, marriage and fertility preferences and awareness of AIDS and STI's.

Community questionnaire: Community questionnaire was included questions about the existence of development organizations in the community and the availability and accessibility of health services and other facilities.

1.3.3 Data Analysis

The data analysis followed several statistical procedures in the present study. Univariate, bivariate and multivariate analyses such as logistic regression analysis: multinomial logistic regression analysis and ordinal logistic regression analysis, multiple classification analysis, factor analysis and structural equation modeling (path analysis) are performed. Statistical tests (chi-square test and Wald test) are employed to understand significance of the study. The statistical tests and analyses are used upon the nature of the data and according to the objectives of the study. The data analysis is carried out using the statistical package (SPSS version 22.0) and is converted to tabular forms for convenience of understanding. Study findings are graphically presented for better understanding using LibreOffice, a Microsoft Office graphical tool.

1.3.4 Methods of Analysis

The research has used some statistical techniques to analyze the data whenever warranted, the simplest of which is the univariate presentation that provides descriptive statistics of variables of interest. To explore relationships between variables bivariate analysis has employed. In some cases, the extent of relationship discerned from the analysis has evaluated by some usual measures of association viz. chi-square and contingency coefficient. Some advanced multivariate statistical methods (multinomial logistic regression analysis, ordinal logistic regression analysis, multiple classification analysis, factor analysis and structural equation modeling) have applied with the selected variables in order to assess the contribution of each independent variable on the dependent variable controlling for others. The choice of a particular multivariate analysis has made depending on the nature of the data and nature of outcome desired. Multivariate statistical methods such as multinomial

logistic regression analysis, ordinal logistic regression analysis, multiple classification analysis (MCA), factor analysis and structural equation modeling (path analysis) have been used in this thesis.

1.4 Hypothesis

The following hypotheses are formulated for the present study:

- Women with longer age at marriage are likely to have higher standard of living.
- Women with higher children ever born and more living children are likely to have increased lower standard of living.
- Women with low family size are more likely to deserve high status of reproductive health.
- Women with lower age at marriage and women with limited children more deserve high status of reproductive health facilities.

1.5 Variables Included in the Study

Demographic variables: Current age of respondents, Marital status, Age at marriage, Total children ever born, Number of living children, Place of residence, Religion and Family size.

Poverty related variables: Education level of respondents, working status of respondents, Occupation of respondents, Source of drinking water, Sanitation facilities, Floor materials, Cooking fuel, Electricity, Radio, Television, Refrigerator, Bicycle, Motorcycle/Scooter and Car/Truck.

Reproductive health related variables: Pregnancy complication, Place of delivery, Delivery by Caesar, Pattern of contraceptive uses, Current use by method type, Fertility planning status, Visit antenatal care, Place of antenatal care, Postnatal care after delivery, Place of postnatal care, Postnatal care provider and Place of first postnatal care.

Dependent variables: Standard of living status of ever-married women, Reproductive health status of ever-married women, and Health of ever-married women (BMI).

1.6 Review of Literature

The meaning of the term "Reproductive health" refers to a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, in all matters relating to the reproductive system and to its functions and processes. Many researchers have tried to study the secular trends in reproductive health, height, weight, and BMI of adult female for other population. Also for other populations many researchers have done the association with anthropometric measures, demographic variables, environmental influences and socio-economic status. In the past few years, the issues of reproductive health have been increasingly perceived as social problems, researcher have emerged as a matter of increasing concern throughout the developed and developing countries.

Rahman (1994) worked on the determination of poverty line of income by estimating the cost of package consisting of the minimum balanced food bundle and certain non –food necessities needed to fulfill predetermined calorie intake and non-food requirements for proper functioning in the society.

In a recent study in India, Audinarayana (1997) observed that the percentage of urban population and the per capita income were highly significant or moderately significant and were positively correlated with each of the indicators of maternal and child health.

Ghosh (1995) indicated that reproductive rights one usually asserts the individual rights of women over her reproductive power. Reproductive health and sexual health, on the other hand, is a state of complete physical, mental, sexual and social well-being in all matters relating to reproductive system and to its functioning and processes. Reproductive rights and sexual health are two important components of overall health, throughout the life cycle, include reproductive rights on decision making, including voluntary choice in marriage, family formation and determination of the number, timing and spacing of one's children; and the right to have access to the information and means needed to exercise voluntary choice, equality and equity for men and women to enable individuals to make free and informed choices in all spheres of life, free from discrimination based on gender, sexual and reproductive security including freedom from sexual violence and coercion, and the right to privacy, to protect the

right of all persons to the highest possible quality of health care and the right to be free from traditional practices which are harmful to health and to protect children, contraception, child marriage, early pregnancy, childbirth are the facets of a widespread and deepening, but largely neglected crisis in women's reproductive health. Moreover, illnesses and deaths from complications of pregnancy, childbirth and unsafe abortion, lack of access to prenatal and post-natal care, lack of access to health services.

Akhter *et al*., 1996 revealed that in Bangladesh the poor women are going to choose either pill or IUD, injectables, implants or tubectomy. It is not the option of poor women for use any particular method of contraceptive rather it is the government's policy, planning and development program to encourage enough the women to use contraceptives. Women have to take permission from their respective husbands to use the contraceptives. This means the patriarchal attitude has not been changed. Rather the patriarchal social control has more strengthened through the training of the religious leaders and community leaders for successful implementation of family planning methods. These leaders only talk to men about the measures of contraceptives. But the men who are motivated otherwise to control their children, pursued their wives for the acceptance of contraceptives. Therefore, women lose control over her reproductive rights and fertility behavior through the patriarchal institutions.

Akhter (1997) represented that the magnitude of reproductive health problems of Bangladeshi women is reflected in the high maternal mortality ratio of nearly 4.5 per 1000 live births. A study report indicates that among 6,493 women the mean number of morbidity per pregnancy has been found to be 1.8, which includes antenatal, intra-partum, postpartum and residual type. About 20 percent reported obstructed labor. The postpartum bleeding rate is about 17 percent. High fever and foul discharge are also responsible for postpartum morbidity. Uterine prolapsed and dyspareunia are highest reported morbidities in Bangladesh. The prevalence of recto-vaginal fistula is one per 1000 pregnancies.

Rochat and Akter (1999) examined that the nature of morbidity due to reproductive tract infections among users of various contraceptives and among the non-users of contraceptives in a rural community. A clinic based study on family planning and

sexually transmitted diseases found about 29 percent prevalence of genital ulcer among the selected women respondents in rural Bangladesh. A clinic based study found about 60 percent prevalence of RTI among poor urban women of which the bacterial agenesis was the most common type infection.

According to Kabir (2000) an overwhelming majority rural women are subject to vulnerable during pregnancy related delivery due to early marriage, complications, having pregnancy more than three times, anemia, lack of balanced diet and social and cultural prejudice. In Bangladesh, the risks of maternal mortality are 150 times greater than developed countries. The maternal mortality is around 5.7 per thousand live births. Most of these deaths result from the five major causes of pregnancy related deaths i.e. abortion, ecclesia, infection, hemorrhage and obstructed labor.

Khan (2001) studied that women in rural areas in Bangladesh are not aware sufficiently of STDs and their modes of transmission. Even after probing; only one quarter of they were of aware of STDs, syphilis and gonorrhea similarly, only one quarter of the women spontaneously reported knowledge about any STD. Furthermore, less than 12 percent could specify any transmission mechanisms. Very few were aware of AIDS and its mode of transmission.

WHO (2003) examined that gender-based violence is the most common form of daily violence. Given the regularity of gender-based violence and its relative acceptance in some cultures, it may be overlooked. Overall, it is estimated that one in three women is subjected to one or more acts of physical, sexual or emotional violence during her lifetime. In a multi-country study by the World Health Organization (WHO), it was reported that among developing countries, 41-72 percent of ever-partnered women reported physical abuse or sexual violence or both by an intimate partner in their lifetime. The highest levels were recorded in rural provinces of Ethiopia and Pern with 71 percent and 69 percent, respectively, and in urban Bangladesh where 62 percent of ever-partnered women reported physical abuse or sexual violence or both by an intimate partner.

MOHFW (2003) has reported that to bring maternal mortality down to an acceptable level, the government of Bangladesh has been striving to provide maternal health care to urban women through national health and family planning program. The

government health centers such as, urban health complex, and satellite clinics, to maternal and child health services to the rural population free of change. However the use of health center is very low. Among the women visiting the HFWCs, only 8 percent came from antenatal care (ANC).

Hossain and Hassan (2005) highlighted that the situation of reproductive rights, reproductive health and sexuality of women in Bangladesh is subject to physical, sexual and psychological violence that occur within the family environment because of existing socio-economic, cultural and religious factors. The violations include battering, sexual abuse of female children, dowry-related tenure, marital rape, female genital mutilation, violence related to sexual harassment and intimidation at work and at educational institutions, trafficking of women and children, coercion or arbitrary family planning and sexually transmitted diseases, deprivation of liberty etc.

According to BDHS (2004) about 28 per cent of teenagers of Bangladesh give birth and another five per cent becomes pregnant with their first child. The major cause includes early age at marriage, poverty, sack of educational attainment, religious norms and values, superstition, patriarchal attitudes of family members, social and cultural expectation etc. Though the contraceptive prevalence rate in Bangladesh is about 58 per cent in 2004, more than a sevenfold increase from 1975, more than 95 per cent contraceptives are used by the females in comparison to only 4.2 per cent condom and 0.6 percent male sterilization. In Bangladesh the legal age at marriage is 18 years for women, however about 68 percent of the women age 24-24 was married before the age 18 as found in BDHS, 2004. The under-five mortality rate for the most recent five years is 88 per 1000 live births, and infant mortality is 65 per 1000 live births. About half of all under five-deaths occurs during neonatal period, about a quarter occur during the postnatal period and another quarter occurs between the ages 1 and 4 years. This indicates the vulnerable condition of mothers especially the pregnant mothers during child bearing and delivery services including malnourished and ill health situation.

Glasier *et al*., 2006 identified that to ensure a healthy pregnancy and delivery, women need information about maternal health and nutrition, signs of illness or complications during pregnancy, and actions they can take. Five core facts of sexual and reproductive health care are: More than half a million women die of pregnancy-

related causes one year; about 10 million women suffer complications related to pregnancy or childbirth, many with lifelong consequences. In sub-Saharan Africa, high fertility in earlier decades will result in a dramatic (20 percent) increase in the number of women of reproductive age (15-44 years) by 2015. Total fertility rates in 32 countries remains at or above five births per woman, on average, only 12 percent of women in these countries use a modern method of contraception. Family planning services are, therefore, essential. In some low- and middle-income countries, up to half of hospital budgets allocated to obstetrics and gynecology are spent treating complications of unsafe abortion. A billion STIs (one per every three adults) occur each year. Symptomatic and asymptomatic STIs can be passed to infants or result in infertility. In most developing countries, women lack the basic information and social support needed to make informed decisions regarding their sexual health.

Sedgh *et al*., 2007 studied that family planning is one of the most basic and essential healthcare services. The ability to choose the number and spacing of their children promotes healthier mothers and children, as well as smaller families that are better able to meet their household's economic needs. Family planning is an effective means to reduce maternal mortality by preventing unwanted pregnancy and unsafe abortion and by promoting healthy pregnancies.

Anwar *et al*., 2011 investigated reproductive health and access to healthcare facilities: risk factors for depression and anxiety in women with an earthquake experience and found that post-earthquake reproductive health events together with economic deprivation, lower family support and poorer access to health care facilities explained a significant proportion of difference in the experiencing of clinical levels of depression and anxiety.

The positive association between possession of television and use of their health services were even strong than those between possession of a radio and use of the same services (Becker *et al.,* 1993). Who watching television daily is significantly more likely to use some from prenatal care as well as formal delivery care. Mere ownership of a television set without watching, however, is not significantly related to use of either type of care.

Utilization of antenatal care facilities is associated with educational status of women and their husbands. Benefits of antenatal care should be widely disseminated in the community (Rawal and Tiwari 2004).

Several number of studies of the utilization of health care services, treatment facilities show relationship between utilization and treatment behavior and demographic factors such as age, education, occupation, place of residence, religion etc (Genece and Rohde 1988). In Tamil Nadu, South India study, showed an interrelationship economic factors. This study found that distance from town, education and accessibility of medical facilities play a significant role in making various decisions for the family in utilization of the best available health care and in raising their health status (Rao and Richard 1984).

Bhuiya (1989) had conducted a study on Bangladesh. He indicated that immunization among children varying with mother's age. Children of younger mothers are more likely to be immunized than those of older mothers and the likelihood of immunization was 40 percent and 38 percent higher among children of mother age less than 20 and in the 20-29 years age group than those of 30 years and above.

Several studies conducted in sixties and seventies also reported very low age at marriage (Obaidullah *et al*., 1978). During 1975-76 the mean age at marriage among all ever married women in Bangladesh was reported to be 12.4 years (BFS 1975). As a consequence by the age 19, nearly 73 percent of ever married women have already had their first birth (Mahmud and Mahmud 2000).

Early marriage leads early beginning of childbearing, large complicated family size and short birth intervals. The subsequent children of young mothers suffer additionally from hazards of close spacing, as the mother health and nutrition status does not have time to recover from the previous pregnancy and consequently increase risk of morbidity and mortality for both mother and child. Besides, early motherhood can severely curtail educational and employment opportunities and are likely to have a long-term adverse impact on their children's quality of life (ICPD 1994).

Complications of childbirth and unsafe abortions are among the main causes of death for women under age 20 (Population Reports 1995). Even under optimal conditions,

young mother specially those under age 17, are more likely than women in their 20s suffer pregnancy related complications and to die in child birth (Fraser *et al.*, 1995). Studies conducted in developed countries have shown that many of the adverse health consequences of childbearing at very young ages can overcome with adequate education and prenatal care (Trussell 1998).

It is found in many studies that age is varies considerably by age of women. Women are less likely to use contraceptives in their early reproductive age. This depicts their desire for pregnancy (Monteith *et al.*, 1985). This also happen since the number if children is not achieved by the women or since they have less exposure/access to contraceptive methods. Rehan (1984) found highest prevalence of contraceptive among women aged 25-29 years because of highly pregnancy risk. A majority of women who took advice of contraception were aged between 20 and 29 years.

Puberty signals the onset of sexual maturation. During this developmental stage, the adolescent experiences physical, hormonal, psychological and sexual changes and becomes capable of reproduction. In some societies, a culture of silence and a series of taboos surround menarche, and girls confront it with little information (Greene 1998).

Entry into reproductive life is a key transition in a person's life and the choices and behavioral patterns acquired during this early stage will typically shape the subsequent life course (United Nations 1998). This transition is marked by critical life events, puberty, sexual initiation, marriage and the onset of the childbearing. The timing sequence and context in which these events take place have immediate and long term repercussions for individual’s sexual and reproductive health. A recent review of research has documented the health risks of premature sexual initiation and the adverse consequences of early marriage and childbearing (Guttmacher 1998). The onset of sexual activity typically takes place during adolescence, a period of growth, experimentation and identity search, during which individuals are particularly vulnerable and in many cases ill-informed with respect to making responsible choice that would not compromise their sexual and reproductive health (Zabin and Kiragu 1998). Harmful traditional practices such as female genital mutilation pose an additional health threat to young women (Yinger 2001).

A number of studies have documented that education plays an influential role in the timing and context of young people's sexual initiation (Blanc 2000). The association between women's higher educational level and later onset of sexual activity is well established in sub-Saharan Africa, although the association between education and premarital sexual behavior varies across countries (Gage and Meekers 1994).

There are fewer studies that focus on men, but there is some evidence suggesting that socio-economic factors may affect male and female sexual behavior differently. The influence of the family environment on the timing and context of young people's transition to sexual activity is also increasingly acknowledged (Miller 1998).

Parents and other family members usually play a central role in shaping young persons, knowledge, values and attitudes, including those related to gender roles and sexual and reproductive health. The important role of parents and other family members in guiding adolescents towards responsible sexual behavior and promoting gender equality has been acknowledged in the Program of Action of the International Conference on Population and Development (United Nations l995a).

In all societies, marriage marks an important transition in a person's life and is generally contemplated as the initial stage of the family building process. Although in many setting entry into marriage no longer coincides with the onset of sexual activity, marital unions remain the predominant context within which child bearing and child rearing take place. The timing of marriage has been receiving increasing attention from researchers and policy makers because of its long lasting implications for a person's life course, reproductive health and family well-being (United Nations 2000a).

International human rights conventions provide that marriage shall be entered into only with the free and full consent of each spouse, but many women enter marriage without exercising their right to choose or are simply too young to make an informed decision (UNICEF 2001). Early marriage usually deprives a girl of her adolescence, reduces her educational opportunities and limits her level of autonomy within the family, including her decision-making power in matters regarding sexual and reproductive health (Kishor and Neitzel 1996).

In addition, early marriage often entails premature child-bearing and increases the risk of divorce (Tilson and Larsen 2000), contributing to the feminization of poverty and its resulting impact on children. Although most countries have enacted laws that regulate marriage, in terms of both minimum age and consent, the laws are not always enforced and often apply only to unions lacking parental consent. According to recent Demographic and Health Surveys, the proportion of young women married before age 18 exceeds one fourth in Bangladesh (BDHS 2011).

Early marriage for female is customary in Bangladesh. There is strong social pressure for preservation of virginity until marriage, which is culture in Bangladesh. Sex outside marriage is seldom and premarital sex is looked down upon in the society. In Bangladesh, the average rate of first marriage is 14.8 years for females though the minimum age level set by the government is 18 years (Islam and Mahmud 1993).

1.7 Importance of the Study

Poverty and reproductive health are emerging issues in developing country like Bangladesh especially for women. It is very important to know the health behavior of a country, because the development of a country depends on the healthy population. By the study of reproductive health one can identified the problem and to solve this problem the world need good research on this subject. This research has the great importance as far as the further research on the ever-married women reproductive health and poverty in the grater filed is concerned. The results that are put on the study can meet just enough to fulfill adequate researches regarding the reproductive health behavior in the study areas. This study also would help to find out the rate of reproductive health status among the ever-married women and could give a better prediction about what should be the initiative and strategy to provide information about the reproductive health and poverty for the general civilian of our country to create more awareness among the people. So from the above discussion it can be said that the impact of demographic factors on poverty and reproductive health among ever married women in Bangladesh have a great importance.

1.8 Organizations of the Study

Here brief discuss is made on how the study has been organized. This study has been divided into eight chapters. In order to accomplish a meaningful representation the present study is organized in the following chapters:

Chapter One is introductory chapter which contains background, objectives, hypothesis, data and methodology, review of literature, importance of the study and organization of the study.

Chapter Two contains a brief discussion about sample population characteristics i.e., Univariate Analysis for demographic, poverty, reproductive health and health related variables for ever-married women.

In Chapter Three, Bivariate Analysis measures the association among different demographic variables with poverty, reproductive health and health of ever-married women.

In Chapter Four, Logistic Regression Analysis is employed to discuss demographic factors affecting on poverty, reproductive health and health of ever-married women.

In Chapter Five, Multiple Classification Analysis (MCA) is used to isolate the intensity of the influence of various demographic factors on poverty, reproductive health and health of ever-married women.

In Chapter Six, Factor Analysis (FA) for identifying the responsible factors from demographic, poverty and reproductive health related variables.

In Chapter Seven, Structural Equation Modeling (Path Analysis) is discussed to determine the direct and indirect effects of demographic factors on poverty, reproductive health and health of ever-married women.

Finally, conclusions, policy implications and recommendations are included in Chapter Eight.

Chapter 2

Univariate Analysis for Demographic, Poverty and Reproductive Health Related Variables

2.1 Introduction

In this chapter univariate analysis has been used to show the simultaneous effects of analytical variables. Besides this, the statistical analysis such as the frequency distribution and different graphical representations of data are used to observe the background characteristics of the study population. In any research, it is important to know the background characteristics of the study or target population or nature of the data. In order to study the background characteristics of different variables, it is important to focus on the frequency distribution of the considered variables. Frequency distribution shows the pattern of distribution and observations in different groups. Thus, important preliminary step of this study is to examine the frequency distribution of some considered variables.

Univariate analysis is the simplest form of analyzing data. “Uni” means one, so in other words data has only one variable. It doesn’t deal with causes or relationships and its major purpose is to describe; univariate analysis takes data, summarizes that data and finds pattern in the data. The major purpose of univariate analysis is to describe central tendency, dispersion, frequency distribution etc. It is important to investigate the nature of characteristics of the data before performing any analysis. A basic way of presenting univariate data is to create a frequency distribution of the individual cases which involves presenting the number of cases in sample that fall into each category of values of the variable. Information on the background characteristics of the study population is essential for interpretation of the study results.

2.2 Characteristics of the Sample Population

2.2.1 Age-sex distribution

Population characteristics of the sample households have been collected to understand the representativeness of the sample. Age-sex structures, marital status, level of education, occupational status are the important indicators to be analyzed. The population in the sample household is collected on *de facto* (the place of each person stayed the night before the survey interview) system, which is further classified by the level of residence, sex and age group (five years).

Table-2.1: Age distribution of sample population according to sex, BDHS 2014.

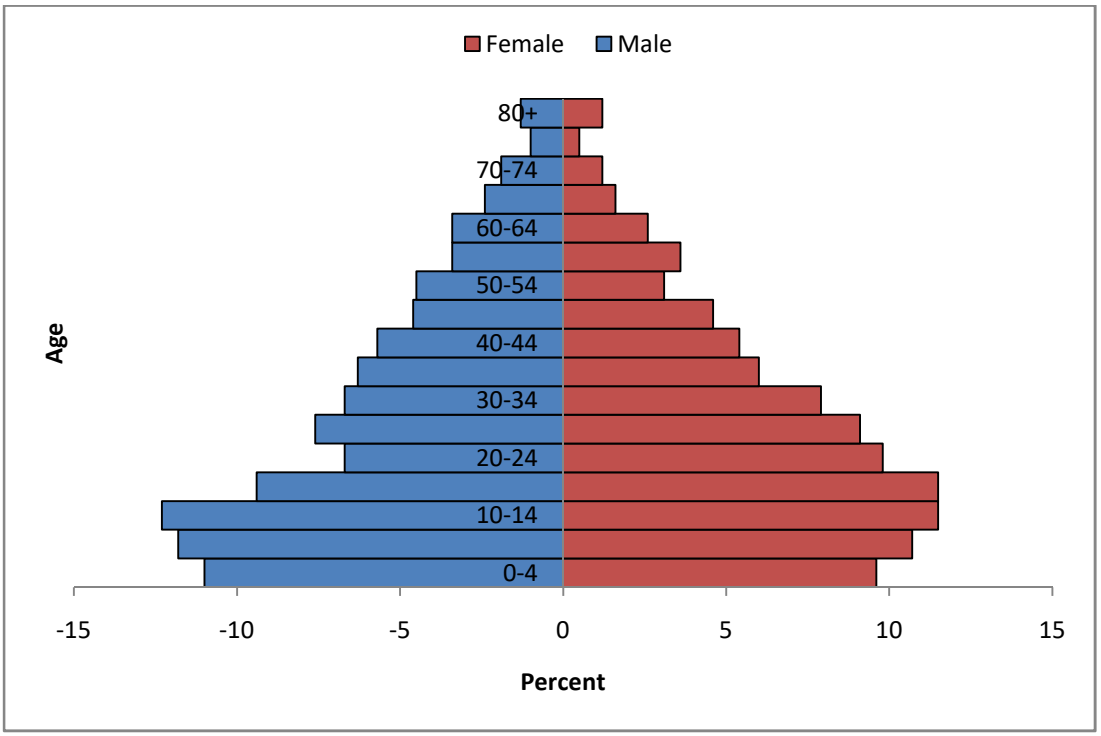
Age	Male	Female	Total
0-4	11.0	9.6	10.3
5-9	11.8	10.7	11.2
10-14	12.3	11.5	11.9
15-19	9.4	11.5	10.5
20-24	6.7	9.8	8.3
25-29	7.6	9.1	8.3
30-34	6.7	7.9	7.3
35-39	6.3	6.0	6.2
40-44	5.7	5.4	5.6
45-49	4.6	4.6	4.6
50-54	4.5	3.1	3.8
55-59	3.4	3.6	3.5
60-64	3.4	2.6	3.0
65-69	2.4	1.6	2.0
70-74	1.9	1.2	1.5
75-79	1.0	0.5	0.8
80+	1.3	1.2	1.3
Total	100.0	100.0	100.0
Number	37,672	39,641	77,313

Third stage of the demographic transition exists in Bangladesh, in which fertility (TFR has fallen from 6.4 in 1974 to 2.3 in 2014) is declining steadily over the long period of time. The population distribution of the sample area is shown in the Table-2.1 and also in the Figure-2.1. The age-sex distribution shows that the population is relatively young where 33.5% are less than 15 years and 5.6% population is over 65 years. The mean age of the sample population is 22.5 years, which is very close to the national figure (22.2 years). The under-five population is 10.3% and the estimated TFR is 2.3. The female population in 15-39 age group is higher than the male counterpart. Urban-Rural migration for employment and education reduces the male population in the rural areas. On the contrary, the male population in the age group 35-49 is higher in comparison to the female population. Like other developing

nations, aging is a series issue in Bangladesh, where as 5.6% population is over 65 years.

The age-sex structure of the population is shown by the population pyramid in Figure-2.1. The pyramid is wider at the base than the top and narrows slightly at the youngest age group. This pattern is typical of a historically high-fertility regime that has recently started to stabilize or decline.

Figure-2.1: Population pyramid for age-sex of sample population



2.3 Demographic Characteristics of Respondents

Demographic characteristics of the respondents have a vital role to play in the analysis of poverty and reproductive health behavior among ever-married women in Bangladesh. The variables, which depicting the demographic status of the respondents are termed as demographic variables. The frequency and percentage distributions of the selected demographic variables are given below:

2.3.1 Current age of respondents

The current age of respondents is an important demographic variable for both poverty and reproductive health. Child bearing age that means 15-49 are called reproductive age of women. Early marriage for female is a serious concern for Bangladesh. Almost half of female get married before the age of twenty. The sample population shows (Table-2.2) that more than eleven percent of women are getting married by 19 years of age. This is one of the major issue in women's health and poor pregnancy-related outcome in Bangladesh. It is repeatedly told that early marriage leads to early motherhood that causes high maternal mortality. The situation is worse in the rural areas, where two out of three teenage mothers are getting married before 20 years age. From the Table 2.2, it is observed that the age of 36.4% of respondents are in the age group 20-29 years, 30.0% are in 30-39 years, and 22.3% of the respondents are in 40 years or above.

The respondents are not evenly distributed across geographic divisions. Almost one-third of respondents live in Dhaka. The distribution of sampled women by division is similar to that in the 2011 BDHS, except in Rajshahi division, which was divided into two administrative divisions, Rajshahi and Rangpur, between the two BDHS surveys; 14.1 percent of women resided in Rajshahi and 14.2 percent in Rangpur in the current survey.

2.3.2 Marital status

Among the demographic indicators, marital status is another important one that influences the poverty and women reproductive health in Bangladesh. Only married couple can produce children and got socially establishment. In the present study area, more than 94% of the respondents are currently married and 5.8% women are divorced or separated.

2.3.3 Age at marriage

The age at marriage of a woman is the most important demographic indicators. Female age at marriage has strong association with social, economic and demographic changes in the population. In the developing countries, timing of the first marriage and level of fertility are directly related especially where the contraceptive use rate is low. Moreover, early marriage typically coincides with early childbearing. Early child

bearing increases the social, economic as well as health consequences of mothers and infants. These risks are exacerbated by poverty and inadequate utilization of maternal health care which in turn increases the maternal morbidity and mortality.

Despite gradual upward trend, Bangladeshi women are still getting married at an early age. The age at marriage is the lowest in Bangladesh even among the South Asian region. Science marriage is the socially accepted norms in which human reproduction occurs; marital age has great social and demographic impact in the country. The study represents that the distribution of the respondents according to their age at marriage 71.3% respondents are married within 18 years of age and only 29% women are married after age of 18 years (Table-2.2).

2.3.4 Number of children ever born

It has been found that a substantial proportion of ever-married women included in the study have started childbearing at early age, thus it might happen that they have a high number of children born. However, for these ever-married women the number of children ever born and living may not reveal this picture because the information is truncated, as they have not attained their desired fertility yet. However, it would provide some indication for what will be their total fertility in future. The distribution of all currently married women included in the study by current age and number of children ever born is presented in Table-2.2. The table also shows the percent number of children ever born to the ever-married women aged 15-49 years. More than 48% ever-married women have one or two children ever born, 41.4% ever-married women have three or more children, and only 10% ever-married women have no children ever born.

2.3.5 Number of living children

Table 2.2 shows the information for ever-married women according to the percent of the number of living children. Out of 17,863 ever-married women, more than 26% ever-married women have only one living children, 32.5% have two living children, and 40.9% ever married women have three or more living children in Bangladesh.

2.3.6 Place of Residence

Place of residence is an important determinant of demographic scenarios of the women which represents the outlook in terms of education, employment, healthy life

styles and also access to information. And then it affects the reproductive behavior of women. A study of the effect of socio-economic characteristics on health in 20 countries revealed that health status is significantly higher among urban women in 22 of the 27 population surveyed. From the Table-2.2 seen that only 34.5% ever-married women live in urban area and 65.5% ever-married women live in rural area in Bangladesh.

Table-2.2: Percentage distribution of the ever-married women according to demographic characteristics

Demographic characteristics	Number of respondents	Percentage
Current age		
Less than 20 years	2023	11.3
20 – 29 years	6504	36.4
30 – 39 years	5352	30.0
40 years or more	3984	22.3
Marital status		
Married	16830	94.2
Divorced/Separated	1033	5.8
Age at marriage		
≤ 18 years	5984	71.3
> 18 years	2409	28.7
Children ever born		
No children	1784	10.0
1-2	8687	48.6
3 or more	7392	41.4
Living children		
1 child	4247	26.6
2	5193	32.5
3 or more	6532	40.9
Place of residence		
Urban	6167	34.5
Rural	11696	65.5
Division		
Barisal	2142	12.0
Chittagong	2865	16.0
Dhaka	3093	17.3
Khulna	2581	14.3
Rajshahi	2512	14.1
Rangpur	2531	14.2
Sylhet	2139	12.0
Religion		
Muslim	16135	90.3
Non-Muslim	1724	9.7
Family size		
1-4	7602	42.6
5-6	5969	33.4
7 or more	4292	24.0

2.3.7 Religion

The religious composition of population in a society is considered to be an immense importance because religion tends to be institutional embodiments of values and which often influence demographic processes. Nonetheless, religious value system which influences individual values in different perspectives. In this study area, Muslims are higher than Non-Muslims in respect of population density as well as religion. Classification of the respondents by their religious affiliation is presented in Table-2.2. From the Table 2.2 about 90.3% of the ever-married women are Muslim and only 9.7% ever-married women are Non-Muslim.

2.3.8 Family size

In poverty and reproductive health studies number of family members is also an important demographic variable. Higher the family member, lower the quality of life. Distribution of the respondents by their family size is shown in Table-2.2. About 42.6% of the respondents have family size with 1-4 members, 33.4% have family size with 5-6 and 24.0% ever-married women live with family members 7 or above.

2.4 Socio-economic Characteristics of the Respondents

Socio-economic characteristics of the respondents play an important role to analyze the social research. The variables reflecting the picture of social and economic status of a community are termed as socio-economic variables. The distribution of economic condition and social benefits is closely related to the knowledge of reproductive health. Socio-economic factors have influence on reproductive health of both married and unmarried women.

Housing characteristics and household assets can be used to measure the socio-economic status of the respondents. Access to basic utilities, sources of drinking water, access to sanitation facilities, housing structure, cooking fuels, and access to mass media of a household that are used to assess the general wellbeing and socio-economic status of respondents.

2.4.1 Highest level of education

Education provides opportunities for personal advancement, awareness of social mobility and higher non-familial aspiration. It also provides a new outlook, freedom from tradition, willingness to analyze measure of social status and has strong relationship with reproductive behavior. In the present study, education was measured as the complete level of formal schooling. Ever-married women are categorized

according to level of education as no education, primary, secondary and higher. Literacy rate, especially among the women in Bangladesh is very low. The majority of Bangladeshi women have never received any formal education. In this study, it is observed that a countable part of total respondents 23.5% are illiterate and second largest number of respondents 29.3% completed their primary level. The percentages of the respondents those who complete the secondary education level are 37.6% and only 9.6% of the women have higher education (Table-2.3).

Table-2.3: Percentage distribution of the respondents according to socio-economic characteristics

Socio-economic characteristics	Number of respondents	Percentage
Education level		
No education	4206	23.5
Primary	5226	29.3
Secondary	6722	37.6
Higher	1709	9.6
Working status		
Worked	5624	31.5
Not worked	12234	68.5
Employment status		
All time	5139	85.3
Seasonal	332	5.5
Occasional	556	9.2
Source of drinking water		
Improved source	16338	97.9
Non-improved source	356	2.1
Toilet facility		
Improved facility	11825	70.7
Non-improved facility	4891	29.3
Toilet facilities shared with other households		
No	11184	68.9
Yes	5052	31.1
Floor material		
Kutcha floor	11055	66.2
Pucca floor	5647	33.8
Wall material		
Kutcha wall	10005	60.3
Pucca wall	6576	39.7
Roof material		
Kutcha roof	14239	85.4
Pucca roof	2440	14.6
Cooking fuel		
Liquid fuel	2589	15.5
Solid fuel	14094	84.5

2.4.2 Women working status

Working status of a woman reflects her position in the family as well as in the society. Although there has been large gain in female education, still women lag behind men in many respects. This influences women's sense of personal security and consequently affects their reproductive decisions. Work status, among other factors, enhances women's status and counters traditional incentives for larger families and leads to improved reproductive health. In the present study, data relating to work status of the respondents were obtained about participation on economic activity other than household work. Based on their responses, more than 31% of the respondents were gainfully employed in addition to their usual domestic work. The remaining 68.5% were not gainfully employed.

2.4.3 Sources of drinking water

Access to safe water is a basic determinant of better health status. Table-2.3 presents the information on household drinking water and more than 97 percent respondents use drinking water from improve sources and only 2.1 percent respondents' use drinking water from non-improve sources.

2.4.4 Sanitation facilities

Sanitation is an important factor of women reproductive health. Within 17863 ever-married women only 70.7 women are use improved sanitation facilities and more than 29% ever-married women are use non-improved sanitation facilities (Table-2.3).

2.4.5 Quality of house

Type of main living house is considered as indicator of economic position of the households. Bangladesh is predominately rural countries. But in this time data are taken from over all the country. So, most of the respondents build their living house with palm, bamboo, wood plank and mud which are called kutcha house. To assess the nature of dwelling house Table-2.3, which easily identify the socio-economic condition of the respondents. From the Table-2.3, it is seen that 66.2% of the respondent's living house are kutcha floor and only 33.8% living house are pucca floor in Bangladesh. So it can be conclude that, maximum living houses floor materials are kutcha.

2.4.6 Modern facilities

Modern facilities are also useful indicators of household socio-economic status. In this study area 64.8% respondents have modern facility electricity and 35.2% respondents have no electricity, only 47.4% respondents have television, 22.0% respondents have modern facility refrigerator and only 0.8% respondents who have modern facilities car or truck. Also it is observed that only 8.4% respondents' have modern facilities motor cycle or scooter and 28.6% respondents have bicycle (Table-2.4).

Table-2.4: Percentage distribution of the respondents according to socio-economic characteristics

Characteristics	Number	Percentage
Household has: Electricity		
No	5878	35.2
Yes	10841	64.8
Household has: Radio		
No	16129	96.5
Yes	590	3.5
Household has: Television		
No	8795	52.6
Yes	7924	47.4
Household has: Refrigerator		
No	13047	78.0
Yes	3672	22.0
Household has: Bicycle		
No	11930	71.4
Yes	4789	28.6
Household has: Motorcycle/Scooter		
No	15315	91.6
Yes	1404	8.4
Household has: Car/Truck		
No	16578	99.2
Yes	141	0.8

2.4.7 Mass media exposure

Access to information through the media is essential to increase population's knowledge and awareness of what takes place around them. The mass media exposure assessed by asking respondents if they listened to radio, watched television, or read newspapers or magazines at least once a week. To plan effective programs to disseminate information about health and family planning, it is important to know which subgroups of population are most likely to be reached by specific media.

The Table-2.5 shows that the percentage and frequency distribution of source of recreation among the married women which publish the reproductive health awareness related program. From the Table-2.5, it is also seen that 60.4% ever-married women age 15-49 watch television at least once a week, 4.2% listen to the radio at least once a week, and only 15.0% read a newspaper or magazine.

Table-2.5: Percentage distribution of the respondents according to mass media exposure

Mass media exposure	Number	Percentage
Reading newspaper/ Magazine		
No	15154	85.0
Yes	2681	15.0
Listening to radio		
No	17110	95.8
Yes	752	4.2
Watching television		
No	7067	39.6
Yes	10795	60.4

2.4.8 Standard of living status of ever-married women

The index of standard of living of the ever-married women is calculated by principal component method and used as background characteristic with information on durables of the households and other selected variables (Appendix-A). It is well documented that standard of living index is an indicator of wealth, which is consistent with expenditure and income measure through there is debate on using this index. Now a day, it is widely used in relation to inequalities in household income, use of

health services and health outcomes (Hewe *et al.*, 2008). Table-2.6 shows that more than 36 percent ever-married women are the lowest standard of living in study areas. But only 38.6 percent and 25.2 percent ever-married women are middle and highest standard of living respectively.

Table-2.6: Percentage distribution of the ever-married women according to standard of living status

	Number of respondents	Percentage
Standard of living status		
Low (1 to 33rd percentile)	6023	36.2
Medium (34th to 66th percentile)	6427	38.6
High (67th percentile and above)	4188	25.2

2.5 Reproductive Health Characteristics of Ever-married Women

There are some health related variables which are closely related with reproductive health. The present study has selected some variables in this regard. The frequency and percentage distribution of the selected variable are given on the following Table-2.7.

2.5.1 Age of respondents at first birth

The age at which childbearing begins has important demographic consequences for society as a whole as well as for the health and welfare of mother and their children. The demographic consequence of age at first birth is the increase in population growth since the women having first birth at early age are more likely to have more children with short spacing. In many countries, postponement of first birth reflects as an increase in the age at marriage which has contributed greatly to overall fertility decline. Early initiation into childbearing is generally a major detriment of large family size and rapid population growth, particularly in countries where family planning is not widely practiced. Moreover, bearing children at a young age involves substantial risks to the health of both the mother and their children. Early childbearing tends to restrict educational and economic opportunities for women. Analysis of the study revealed that childbearing begins early in Bangladesh. Out of 17863 ever-married women age 15-49 years, more than 75% ever-married women became mother at the age before 20 years, 23.9% became mother between the age 20-29 years, and only 0.9% ever-married women became mother after age 30 years (Table-2.7).

2.5.2 Current use of contraception

Family planning means a planning to keep the rate of growth of population by educating the people about the use of contraceptives and the opening birth control clinics. It refers to the deliberate efforts of couples or individuals to regulate fertility by delaying or spacing births or limiting their numbers, which implies deliberate action to avoid conception or a live birth. Family planning does not mean, always birth control or abortion, which destroy human life. But it means a planning through which the individual couple can determine the number of children they wish to have in view of small family size. Family planning depends upon the culture of people, their needs economic condition, political ideology and the social structure.Table-2.7 revealed that more than 81% of the ever-married women were currently using contraception method and only 18.93% ever-married women were not using any contraception method due to social culture.

2.5.3 Current use by method types

The term current use refers to the method which is being currently used by the respondent. Thus, any respondent using a contraceptive method at the time of the survey has been regarded as current user. The study represent that more than 51% of the ever-married women were using modern contraceptive method, only 7.5% of the respondents were using traditional method and still now 41.4% ever-married women were not using any contraception method due to fear of side effects.

2.5.4 Antenatal care

Maternal health services have potential roles to play in the improvement of reproductive health. There is little doubt that access to skilled assistance and well equipped health facility during delivery can reduce maternal mortality and morbidity and improve pregnancy outcomes.

The government of Bangladesh is committed to provide maternal health care to the women through the national health and family planning programme. The government health centers, such as Thana Health Complexes (THCs), Health and Family Welfare Centers (HFWCs) and Satellite Clinics (SCs) and also different non-government organizations (NGOs) came forward to provide maternal and child health to the women. Data from Bangladesh Demographic and Health Survey (BDHS 2014)

revealed that about 68% ever-married pregnant women received less than four times any antenatal care and only 32.0% pregnant women received four or more times antenatal care (Table-2.7). Although the trend is decreasing but progress is very slow.

2.5.5 Pregnancy complication

Table-2.7shows that 52.7% ever-married women are not face different complications during pregnancy and more than 47% ever-married women are facing various complications during pregnancy.

2.5.6 Place of postnatal care

From the Table-2.7, it is found that in this study area more than 39.2% ever-married women take the postnatal care at home after the last delivery, only 20.4% ever-married women take postnatal care at public hospital and more than 40.4% women received care after delivery at private hospital or clinic in Bangladesh.

2.5.7 Fertility planning

From the Table-2.7, it is found that89.7%ever-married women desire their last child and only 10.3% women desire their last child later on

2.5.8 Place of delivery

From the Table 2.7, it is observed that about 60.8% ever-married women have given their last birth at home. Table also reveals that in case of last child more than 13% delivery occur in public hospital and remaining 25.7% delivery occur in private hospital or clinic.

Table-2.7: Percentage distribution of the ever-married women according to reproductive health characteristics

Characteristics	Number of respondents	Percentage
Age at first birth		
Less than 20 years	12097	75.2
20-29 years	3845	23.9
30 years or more	137	0.9
Pattern of contraceptive uses		
Currently using	14493	81.1
Never used	3370	18.9
Current use by method type		
No method	7391	41.4
Traditional method	1338	7.5
Modern method	9134	51.1
Fertility planning		
Wanted	4032	89.7
Not wanted	461	10.3
Antenatal care visits		
≤ 3 times	3053	68.0
≥ 4 times	1435	32.0
Place of delivery		
Home	2869	60.8
Public hospital	639	13.5
Private hospital/Clinic	1211	25.7
Pregnancy complication		
No complicacy	1856	52.7
Had complicacy	1665	47.3
Postnatal care		
No care	1541	34.3
Seek care	2953	65.7
Place of postnatal care		
Home	1152	39.2
Public hospital	600	20.4
Private hospital/Clinic	1189	40.4
Postnatal care received from		
Qualified doctor	1281	43.4
Nurse/Health assistant	831	28.2
Unqualified doctors	838	28.4

2.5.9 Reproductive health status of ever-married women

Reproductive health status is prepared based on the access of health facilities and services using principal component method (Appendix-B). Reproductive health status of ever-married women has consistently been reported as varying widely and has never been uniform across the country. Three domains of reproductive health - antenatal care, safe delivery place and postnatal care were considered in the present study. Reproductive health status is largely depending on the use of health facilities and services, it will be relevant to understand the importance communities attach with the various health facilities (Cornelius *et al*., 2005). Table-2.8 shows that about 33 percent ever-married women live with low status of reproductive health and more than 35 percent are live with medium status of reproductive health. From Table-2.8, it is also observed that only 32 percent ever-married women are live with high status of reproductive health in Bangladesh.

Table-2.8: Percentage distribution of the ever-married women according to reproductive health status

	Number of respondents	Percentage
Reproductive health status of women		
Low (1 to 33rd percentile)	847	33.0
Medium (34th to 66th percentile)	901	35.1
High (67th percentile and above)	822	32.0

2.6 Health Status of Ever-married Women

Body Mass Index is a common measure of physical health status of women. BMI is calculated as weight in kilogram divided by height in meter squared. The World Health Organization (WHO) consultants suggest three categories of BMI cutoff points for Asian countries (WHO 2003). A cutoff point less than 18.5 kg/m^2 is used to define underweight or Low health status and BMI 18.5 kg/m^2 to 24.9 kg/m^2 is define as normal health status. A BMI of 25.0 kg/m^2 or more indicates overweight or obese. BMI status of a woman has a linkage to the health status of ever-married women of reproductive age group. Women having low health status carry multiple risks during pregnancy. They are susceptible to suffer from complications, more likely to deliver low birth weight babies and carry higher chance of mortality.

Table-2.9 shows that more than 17 percent ever-married women have low health status in their reproductive age group.

Table-2.9: Percentage distribution of the ever-married women according to their health status

	Number of respondents	Percentage
Health status of women		
Under weight (BMI<18.5)	3101	17.8
Normal (18.5≤BMI≤24.9)	10060	57.7
Overweight/Obese (BMI≥25.0)	4273	24.5

About 57.7 percent ever-married women have normal health status (18.5 ≤ BMI ≤ 24.9) and remaining 24.5 percent ever-married women have overweight or obese (BMI ≥ 25.0).

2.7 Summary

Demographic characteristics of the respondents have vital role to play in the analysis of poverty and reproductive health behavior among ever-married women in Bangladesh. The current age of respondents is an important demographic characteristic for both poverty and reproductive health. Child bearing age that means 15-49 are called reproductive age of women. Early marriage for female is a serious concern for Bangladesh. Almost half of female get married before the age of twenty. This is one of the major issues in women's health and poor pregnancy-related outcome in Bangladesh. It is repeatedly told that early marriage leads to early motherhood that causes high maternal mortality. The situation is worse in the rural areas, where two out of three teenage mothers are getting married before 20 years age. Despite gradual upward trend, Bangladeshi women are still getting married at an early age. The age at marriage is the lowest in Bangladesh even among the South Asian region. Since marriage is the socially accepted norms in which human reproduction occurs; marital age has great social and demographic impact in the country. The study represents that the distribution of the respondents according to their age at marriage 71.3% respondents are married within 18 years of age and only 29% women are married after age of 18 years.

A substantial proportion of ever-married women included in the study, have started childbearing at early age, thus it might happen that they have a high number of children born. The percent number of children ever born to the ever-married women

aged 15-49 years shows that more than 48% ever-married women have one or two children ever born, 41.4% ever-married women have three or more children, and only 10% ever-married women have no children ever born. Place of residence is important determinant of reproductive health status of the women which increases outlook in terms of education, employment, healthy life styles and also access to information. And then it affects the reproductive behavior of women. A study of the effect of socio-economic characteristics on health in 20 countries revealed that health status is significantly higher among urban women in 22 of the 27 population surveyed. From the present study it has been seen that only 34.5% ever-married women live in urban area and 65.5% ever-married women live in rural area in Bangladesh.

In poverty and reproductive health studies number of family members is also an important demographic variable. Higher the family member, lower the quality of life. Distribution of the respondents by their family size is shown that about 42.6% of the respondents have family size with 1-4 members, 33.4% have family size with 5-6 and 24.0% ever-married women live with family members 7 or above.

The standard of living status of the ever-married women is used as poverty measure with information on durables of the respondent's households. It is well documented that standard of living index is an indicator of poverty and this study results show that more than 36 percent ever-married women are the lowest standard of living in study areas. However about 38.6 percent and 25.2 percent ever-married women are middle and high standard of living status respectively in Bangladesh.

There are some health related variables selected that are closely related with reproductive health of ever-married women. The percentage distribution of the reproductive health shows that about 33 percent ever-married women live with low status, 35.1 percent with medium and remaining 32 percent ever-married women live with high status of reproductive health in Bangladesh.

Chapter 3

Bivariate Analysis for Demographic, Poverty and Reproductive Health Related Variables

3.1 Introduction

The present study has been used bivariate analysis to determine the association or relationship between poverty and demographic variables and also between reproductive health and demographic variables of ever-married women in Bangladesh. Bivariate analysis is a statistical method designed to detect and describe the relationship between two variables. This examines individually the independent variables that give a preliminary idea of how important each variable is by itself. Bivariate analysis allows not only association or relationship between two variables but also measures the strength of relationship.

Cross-tabulation is used to evaluate the relationship between two categorical (nominal or ordinal) variables. Cross-table display the joint distribution of values of the dependent and independent variables by listing the categories for one variable along one side and the categories for the other variable across the top. Each case is then placed in the cell of the table that represents the combination of values that corresponds to its scores on the variables. Basically, a cross-table is a bivariate (or two variables) percentage distribution and count either column or row percentage. After the observed cases are cross tabulated, according to all variables in the table, the table is then percentage, on the independent variable. All percentages in a column or row should be the total of 100%. A quick method for assessing strongest of the relationship is to examine the percentage difference across the different categories.

3.2 Chi-square Test

The chi-square tests are among the most useful and most widely used tests in statistics. The assumptions on which these test are based on minimal, although a certain minimum sample size is usually required. The variables which are being examined can be measured at any level, nominal, ordinal, interval, or ratio. The tests can thus be used in most circumstances. For the variables measured in interval or ratio scale t-test or z-test may be used. Chi-square is simply an extension of cross tabulation that gives us more information about relationship between nominal or ordinal level variables. Although it allows testing for significant differences between groups it provides no information about the direction of the relationship between two variables. It is hypothesized that there exists no relationship between variables.

Significance value p must be the same size or smaller than the considered significance level.

The chi-square statistics is defined as-

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i},$$

where χ^2 = Chi-square statistics

O_i = Observed frequency in the ith cell

E_i = Expected frequency in the ith cell

The expected frequency is calculated as-

$$E_i = \frac{R_i C_i}{n}.$$

From each contingency table coefficient of contingency is calculated by using the following formula.

The formula is $$CC = \sqrt{\frac{\chi^2}{\chi^2 + N}}.$$

3.3 Determinants Association of Standard of living status of Ever-married Women with Selected Demographic Variables

The present study used standard of living status of ever-married women as dependent variable to identify the association or relationship with the demographic variables. Association of standard of living status of ever-married women with some selected demographic variables has been shown in (Table-3.1).

The current age of ever-married women has significant ($p < 0.001$) association with standard of living status. It has been observed that women aged less than 20 years are 39.2 percent low status, 41.3 percent medium standard of living and only few of them (19.6%) live with high status. The women belonging to the age group 20-29 years are 36.4 percent low standard of living status, 38.1 percent are medium status and 25.5 percent ever-married women are live with high standard. The ever-married women belonging to age group 30-39 years are 36 percent live with low status, 37.6 percent medium status and remaining 26.4 percent women are high status of living. In this way, it is found that low status of women decreases with increase of women's age. On the other hand, women high status of living increases with increasing trend of their age. Lastly, the women after age 40 years or above 34.8 percent women are low status, 39.7 percent women are medium status and remaining 25.5 percent women are

belonging to high standard of living status. The findings also indicate that among the younger aged women (15-19), the risk of being life style is low standard and among elder aged women the risk of being life style is high standard. The large percentage of younger ever-married women in Bangladesh has risk of being low status during their early age.

The findings of the study indicate that women's marital status has a significant ($p < 0.01$) relationship with their standard of living status.Table-3.1 shows that among the women who are married, 36.0 percent lower class, 38.6 percent women are medium class, and 25.5 percent women are live in upper class while it is only 39.8 percent lower class, 39.8 percent middle class, and 20.3 percent upper class respectively for those women who are divorced or separated. Marital status is significantly negatively associated with being low standard of living status, but positively associated with being high standard of living status. Moreover, the percentage of divorced or separated has found higher (39.8%) in low standard of living status than the high standard of living status (20.3%).

The findings of the study indicate that standard of living status has significant ($p < 0.001$) association with age at marriage of women. It is found that majority (39.6%) of the women are economically lower class and they are getting marriage before or at the age of 18 years, 40.2 percent are middle class, and 20.2 percent are upper class in the same age of marriage. On the other hand, low status of living is 31.8 percent, medium status is 39.0 percent, and high status is 29.2 percent women respectively among those women who are getting marriage after age at marriage 18 years. The findings indicate that the percentage (39.6%) of ever-married women of low standard of living status is higher than those women who are getting marriage after age 18 years.

Table-3.1 shows that total number of children ever born has significant ($p < 0.001$) association with standard of living status of ever-married women. The study also reveals that among the women with one to two children, 31.2 percent are low status of living, 38.5 percent are medium status, and 30.4 percent women are high status of live lead. The women with three or more children, 42.9 percent women are live lead with lower status, 38.4 percent women are medium status, and 18.6 percent ever-married women are lead their life with high standard. From this finding it can be concluded that women percentage of low status increases while the number of children ever born

increasing and on the other hand women percentage of high status decreases while the number of children ever born increasing. It is also mentioned that women with three or more children have high risk of low standard of living than the women who have one to two children ever born.

A significant ($p < 0.001$) association has been found between the standard of living status and number of living children. Among the women living in households with the one living child majority of them (31.7%) are contemptible, 37.5 percent are middle class, and 30.8 percent women are live lead in high society. The women with two living children, 32.6 percent are lower class, 39.2 percent are live in middle class, and remaining 28.2 percent women lead their life in upper class. The study also reveals that women with three or more living children, 42.9 percent are low status, 38.3 percent are medium status, and 18.8 percent women are live in high standard. The findings of this study reflect that the percentage of women of low status rapidly increases while women with number of living children increase. Besides, the percentage of ever-married women of high standard of living decreases while the women with number of living children increase.

The place of residence has significant ($p < 0.001$) association with standard of living status of ever-married women. Moreover, 13.7 percent ever-married women are live with low status, 36.1 percent women are live in medium standard, and more than 50 percent ever-married women are live with high standard of living status in urban areas. It is also found that 48.2 percent ever-married women are live with low standard of living status, 40.0 percent women are medium status, and remaining 11.9 percent ever-married women are live with high status in rural areas in Bangladesh.

Table-3.1 shows that the religious affiliation has significant ($p < 0.001$) association with standard of living status of ever-married women. Among the Muslim women, 35.6 percent are live lead with lower class, 38.9 percent women are middle class, and remaining 25.5 percent women are live lead in higher class. On the other hand, 41.8 percent Non-Muslim women are live lead in lower class, 36.0 percent in middle class, and 22.2 percent women are lead their life in higher class. The findings of this study reflect that the percentage of low standard of living is least for Muslim women (35.6 percent), than for Non-Muslim women and the percentage is 41.8.

Table-3.1: Association between standard of living status of ever-married women and some selected demographic characteristics

Characteristics	Standard of living status (Percentage)			χ^2 value	Contingency coefficient	*P* - value
	Low	Medium	High			
Current age						
Less than 20 years	39.2	41.3	19.6			
20 – 29 years	36.4	38.1	25.5	36.91	0.05	0.000
30 – 39 years	36.0	37.6	26.4			
40 years or more	34.8	39.7	25.5			
Marital status						
Married	36.0	38.6	25.5	13.89	0.03	0.001
Divorced/Separated	39.8	39.8	20.3			
Age at marriage						
≤18 years	39.6	40.2	20.2	83.42	0.10	0.000
>18 years	31.8	39.0	29.2			
Children ever born						
1-2 children	31.2	38.5	30.4	351.10	0.15	0.000
3 or more	42.9	38.4	18.6			
Living children						
1 child	31.7	37.5	30.8			
2	32.6	39.2	28.2	282.34	0.14	0.000
3 or more	42.9	38.3	18.8			
Place of residence						
Urban	13.7	36.1	50.2	449.02	0.42	0.000
Rural	48.2	40.0	11.9			
Religion						
Muslim	35.6	38.9	25.5	25.62	0.05	0.000
Non-Muslim	41.8	36.0	22.2			
Family size						
1-4	36.7	38.0	25.2			
5-6	38.7	38.0	23.3	58.07	0.06	0.000
7 or more	31.3	40.9	27.9			

From Table-3.1, it is observed that standard of living status is significantly ($p < 0.001$) associated with family size of the respondents and the value of contingency coefficient gives the evident that the association is strong for standard of living and family size of the respondents. It is found that women with one to four family members, 36.7 percent are lower class, 38.0 percent women are middle class, and 25.2 percent women are live in higher class. The women with five to six family members, 38.7 percent are low status, 38.0 percent are medium status, and 23.3 percent women live in high standard of living status. The present study also reveals that percentage of women's for low status increases with the increasing of their family size.

3.4 Determinants Association of Reproductive Health Status of Ever-married Women with Selected Some Demographic Variables

In this study reproductive health status of ever-married women used as another dependent variable to identify the association or relationship with the demographic variables. Association of reproductive health status of ever-married women with some selected demographic variables has been shown in (Table-3.2).

The current age of ever-married women has significant ($p < 0.05$) association with reproductive health of women. It is observed that the women aged less than 20 years,33.8 percent ever-married women reproductive health status are low, 38.1 percent are medium status and only few of them (28.1%) are live with high status of reproductive health. The women belonging to the age group 20-29 years are 33.0 percent low reproductive health status, 33.7 percent are medium status and 33.3 percent ever-married women are live with high status. The ever-married women belonging to age group 30-39 years are 30.9 percent live with low status, 35.3 percent are medium status and remaining 33.8 percent women are high status of reproductive health. In this way, it is found that low status of women reproductive health increases with increase of women's reproductive age. On the other hand, women reproductive health status increases with the increasing trend of their reproductive age. Lastly, the women after age 40 years or above 45.7 percent women are low status of reproductive health,45.7 percent women are medium status and remaining 8.6 percent women are belong to high status of reproductive health. The findings also indicate that among the younger aged women (15-19), the risk of being reproduced is low and among elder

aged women the risk of being reproduced is high. The large percentage of younger ever-married women in Bangladesh has risk of being low status during their early age.

The findings of the study indicate that women's marital status has insignificant (p = 0.108) relationship with their reproductive health status. Table-3.2 shows that among the women who are married, 32.8 percent low status reproductive health, 35.0 percent women are medium status, and 32.2 percent women are high status of reproductive health while it is only 48.1 percent low status, 37.0 percent medium, and remaining 14.8 percent women possess high status of reproductive health respectively for those women who are divorced or separated. Marital status is significantly negatively associated with being low status but positively associated with being high status of reproductive health. Moreover, the percentage of divorced or separated has found higher (48.1%) in low status of reproductive health than the high status (14.8%).

The findings of the study indicate that reproductive health status of ever-married women has significant ($p < 0.01$) association with age at marriage of women. It is found that majority (36.1%) of the women are belong to lower status of reproductive health and they are getting marriage before or at the age of 18 years, about 38 percent are medium status, and remaining 25.8 percent are higher reproductive health status in the same age of marriage. On the other hand, low status is 29.8 percent, medium status is 33.9 percent, and high status is 36.3 percent women respectively among those women who are getting marriage after age at marriage 18 years. The findings indicate that the percentage (36.1%) of ever-married women of low reproductive health status is higher than those women who are getting marriage after age 18 years.

Table-3.2 shows that total number of children ever born has significant ($p < 0.001$) association with reproductive health status of ever-married women. The study also reveals that among the women with one to two children, 29.5 percent are low status of reproductive health, 34.4 percent are medium status, and 36.1 percent women are high status of reproductive health. The women with three or more children, 43.1 percent women are live with lower status of reproductive health, 36.9 percent women are medium status, and 20.1 percent ever-married women are lead their life with high status of reproductive health. From this finding it can be concluded that women percentage of low status of reproductive health increases while their number of children ever born increasing and on the other hand women percentage of high status

of reproductive health decreases while the number of children ever born increases. It is also mentioned that women with three or more children have high risk of reproductive health than the women who have one to two children ever born.

A significant ($p < 0.001$) association has been found between the reproductive health of ever-married women and women's number of living children. Among the women living in households with the one living child, 28.4 percent women are low status of reproductive health, 34.7 percent are middle, and only 36.9 percent women are live lead with high status of reproductive health. The women with two living children, 32.3 percent are lower status, 32.8 percent are live in medium status, and remaining 35.0 percent women lead their life with high status of reproductive health. The present study also reveals that women with three or more living children, 43.5 percent are low status of reproductive health, 37.3 percent are medium status, and remaining 19.2 percent women are live with high status of reproductive health. The findings of this study reflect that the percentage of women of low status of reproductive health rapidly increases while women with number of living children increase. Besides, the percentage of ever-married women of high status of reproductive health decreases while the women with number of living children increase.

The place of residence has significant ($p < 0.001$) association with reproductive health status of ever-married women. Moreover, 21.1 percent ever-married women are live with low status of reproductive health, 37.3 percent women are live in medium status, and more than 41percent ever-married women are live with high status of reproductive health urban areas. It is also found that more than 40 percent ever-married women are live with low status of reproductive health, 33.6 percent women are medium status, and remaining 25.6 percent ever-married women are live with high status of reproductive health in rural areas in Bangladesh.

Table-3.2 shows that the religious affiliation has insignificant ($p = 0.06$) association with reproductive health of ever-married women. Among the Muslim women, 33.5 percent women are live with lower status of reproductive health, 35.1 percent women are medium status, and remaining 31.4 percent women are live lead with higher reproductive health. On the other hand, about 26.5 percent Non-Muslim women are live lead in low status of reproductive health, 35.0 percent in medium status, and 38.5 percent women are lead their life with high status of reproductive health. The findings

of this study reflect that the percentage of low status of reproductive health is least for Non-Muslim women (26.5 percent), than Muslim women and the percentage is 33.5.

Table-3.2: Association between reproductive health status of ever-married women and some selected demographic characteristics

Characteristics	Women reproductive health status (Percentage)			χ^2 value	Contingency coefficient	P - value
	Low	Medium	High			
Current age						
Less than 20 years	33.8	38.1	28.1			
20 – 29 years	33.0	33.7	33.3	15.52	0.08	0.017
30 – 39 years	30.9	35.3	33.8			
40 years or more	45.7	45.7	8.6			
Marital status						
Married	32.8	35.0	32.2	4.46	0.04	0.108
Divorced/Separated	48.1	37.0	14.8			
Age at marriage						
≤18 years	36.1	38.1	25.8	12.93	0.11	0.002
>18 years	29.8	33.9	36.3			
Children ever born						
1-2 children	29.5	34.4	36.1	67.83	0.16	0.000
3 or more	43.1	36.9	20.1			
Living children						
1 child	28.4	34.7	36.9			
2	32.3	32.8	35.0	69.33	0.16	0.000
3 or more	43.5	37.3	19.2			
Place of residence						
Urban	21.1	37.3	41.6	124.26	0.22	0.000
Rural	40.8	33.6	25.6			
Religion						
Muslim	33.5	35.1	31.4	5.62	0.05	0.060
Non-Muslim	26.5	35.0	38.5			
Family size						
1-4	32.7	32.5	34.8			
5-6	34.7	35.5	29.8	7.41	0.06	0.116
7 or more	31.4	37.1	31.4			

From Table-3.2, it is observed that reproductive health status of ever-married women is insignificantly (p = 0.116) associated with family size of the respondents and the value of contingency coefficient gives the evident that the association is strong for reproductive health status and family size of the women. It is also found that women with one to four family members, 32.7 percent are low status of reproductive health, 32.5 percent women are medium status, and 34.8 percent women are live with high status of reproductive health. The women with five to six family members, 34.7 percent are low status, 35.5 percent are medium status, and 23.3 percent women live with high status of reproductive health. Among the women with seven or above family members, 31.4 percent women belong to low status of reproductive health, 37.1 percent women are medium status, and remaining 31.4 percent women live with high status of reproductive health. The present study also reveals that percentage of women's for low status of reproductive health increases with the increasing of their family size.

3.5 Determinants Association of Health Status of Ever-married Women with Selected Demographic Variables

The study used health status (BMI) of ever-married women as dependent variables to identify the association or relationship with the demographic variables. Association of health status of reproductive women with some selected demographic variables has been shown in (Table-3.3).

The current age of reproductive women has significant (p < 0.001) association with health status of ever-married women. It is observed that the women aged before 20 years are 29.0 percent underweight or malnourished, 63.2 percent normal weight and only few of them (7.7%) are obese. The women belonging to the age group 20-29, about 18.3 percent of them are underweight, 60.4 percent normal weight, and remaining 21.3 percent are overweight or obese. Among the women of aged 30-39, nearly 14 percent of them have problem of underweight and 55.1 percent of normal weight, and about 31.3 percent of them are obese. In this way, it is found that underweight problem decreases with increase of women's reproductive age. On the other hand, overweight or obese problem increases with increasing trend of their reproductive age. Lastly, the women of their age after 40 years or above are 16.9 percent underweight, 54.0 percent normal weight, and only 29.1 percent of them are

overweight or obese. The findings also indicate that among the younger aged reproductive women, the risk of being underweight or malnutrition is severe and among elder aged reproductive women the risk of being overweight or obesity is increasing. The large percentage of younger reproductive women in Bangladesh has risk of being underweight during their early age.

The ever-married women health status has significant ($p < 0.001$) association with women marital status. From Table-3.3, it is reveal that married women are 17.3 percent under weight, 57.8 percent normal weight, and remaining 24.8 percent women are obese. The study also found that among the divorced or separated women25.4 percent women are under weight, 55.4 percent are normal weight, and remaining 19.1 percent are overweight or obese. Finally, it can be conclude that the percentage of women of underweight is higher in divorced or separated women and the percentage of women of obese is higher in married women.

The findings of the study indicate that health status of ever-married women has insignificant ($p = 0.127$) association with age at marriage of women. It is found that about 19.1 percent women are under weight and they are getting marriage before or at the age of 18 years, 58.6 percent are normal weight, and remaining 22.4 percent are obese in the same age at marriage. On the other hand, 18.3 percent women are under weight, 57.3 percent normal weight, and 24.4 percent women are obese among those women who are getting marriage after age at marriage 18 years. The findings indicate that the percentage (19.1%) of underweight is higher among those women who are getting marriage before or at age 18 years.

The findings of the study indicate that total number of children ever born has a significant ($p < 0.01$) relationship with their health status. Children ever born is significantly negatively associated with being underweight of women, but positively associated with being overweight and obese of women. The number of women's with underweight increases with the increase of women with children ever born. That means, lower the children ever born of women are more physically sound than those of women with higher children ever born. For instance, among the women who have one to two children, 16.6 percent are underweight and only few of them (26.5%) are overweight while it is only 18.5 percent and 24.4 percent respectively for the reproductive women with three or more children ever born. So, the risk of being

underweight increases with the increase of women with children ever born. It is also observed that majority of women with one to two children ever born are obese or overweight.

The level of health status of ever-married women has significant ($p < 0.001$) association with women's number of living children. It is found that about 20.7 percent women with one living children are underweight, only few (22.1%) of them are obese and remaining portion (57.2%) has normal weight. The women with two living children, 13.6 percent are under weight, 57.0 percent women are normal weight, and remaining 29.4 percent are obese. Among the women with three or more living children, 18.5 percent women are under weight, 56.9 percent are normal weight, and 24.6 percent women are obese. The findings indicate that the risk of being underweight is comparatively high among women with one living child and the women with two living children the risk of being obese is high.

The place of residence has significant ($p < 0.001$) association with health status of ever-married women. From Table-3.3, it is observed that women in urban area are 12.2 percent under weight, 51.8 percent normal weight, and remaining 36.0 percent ever-married women are obese. The women in rural area are 20.7 percent under weight, 60.8 percent normal weight, and 18.5 percent women are overweight or obese. It is found that the percentage of women of underweight is severe among rural women and risk of being obesity or overweight is high among urban women.

Table-3.3 shows that the religious affiliation has insignificant ($p = 0.500$) association with health status of ever-married women. Among the Muslim women, 17.8 percent are under weight, 57.6 percent women are normal weight, and remaining 24.6 percent are obese. On the other hand, 17.3 percent Non-Muslim women are under weight, 59.0 percent are normal weight, and 23.7 percent women are obese. The findings of this study reflect that the percentage of underweight is least for Non-Muslim women (17.3 percent), than Muslim women and it is 17.8 percent.

A significant ($p < 0.001$) association has been found between the health status of ever-married women and family size of the respondents and the value of contingency coefficient gives the evident that the association is strong for health status of ever-married women and family size of the respondents.

Table-3.3: Association between health status of ever-married women and some selected demographic characteristics

Characteristics	Health status of ever-married women (Percentage)			χ^2 value	Contingency coefficient	P - value
	Under weight	Normal	Obese			
Current age						
Less than 20 years	29.0	63.2	7.7			
20 – 29 years	18.3	60.4	21.3	610.34	0.18	0.000
30 – 39 years	13.7	55.1	31.3			
40 years or more	16.9	54.0	29.1			
Marital status						
Married	17.3	57.8	24.8	48.35	0.06	0.000
Divorced/Separated	25.4	55.4	19.1			
Age at marriage						
≤18 years	19.1	58.6	22.4	4.13	0.02	0.127
>18 years	18.3	57.3	24.4			
Children ever born						
1-2 children	16.6	56.9	26.5	14.53	0.03	0.001
3 or more	18.5	57.1	24.4			
Living children						
1child	20.7	57.2	22.1			
2	13.6	57.0	29.4	122.40	0.09	0.000
3 or more	18.5	56.9	24.6			
Place of residence						
Urban	12.2	51.8	36.0	705.97	0.20	0.000
Rural	20.7	60.8	18.5			
Religion						
Muslim	17.8	57.6	24.6	1.39	0.01	0.500
Non-Muslim	17.3	59.0	23.7			
Family size						
1-4	16.5	57.2	26.4			
5-6	17.8	58.1	24.1	44.95	0.05	0.000
7 or more	20.2	58.1	21.7			

Among the women living in household with the one to four family members, 16.5 percent are under weight, 57.2 percent are normal weight, and remaining 26.4 percent women are obese. The women living in household with five to six family members, 17.8 percent are under weight, 58.1 percent are normal weight, and 24.1 percent women are obese. Among women with seven or above family members, 20.2 percent are under weight, 58.1 percent are normal weight, and remaining 21.7 percent women are overweight or obese. The findings of this study reflect that underweight is serious in women with five to six and seven or above family members. Besides, overweight or obesity arises high among the women with one to four family members in a household of the respondents.

3.6 Summary

The current age of ever-married women has significant ($p < 0.001$) association with their standard of living status. Findings indicate that among the younger aged women (15-19 years), the life style is low standard and among elder aged women the life style is high standard. The large percentage of younger ever-married women in Bangladesh has risk of being low status during their early age. This study also indicates that standard of living status has significant ($p < 0.001$) association with age at marriage of women. Ever-married women percentage of low standard of living status is higher than those women who are getting marriage after age 18 years. Women's children ever born has highly significant ($p < 0.001$) association with standard of living status of ever-married women. The percentage of low status of ever-married women increases while the number of children ever born increase and on the other hand the percentage of high status decreases while the number of children ever born increase.

The present study also reflects that the percentage of low status of ever-married women increases while the number of living children increases. Besides, the percentage of ever-married women of high standard of living decreases while the women with number of living children increase. Standard of living status is significantly ($p < 0.001$) associated with family size of the respondents and the value of contingency coefficient gives the evident that the association is strong for standard of living and family size of the respondents. The study also reveals that the percentage of women with low status increases with the increase of their family size.

In this study reproductive health status of ever-married women used as another dependent variable to identify the association or relationship with the demographic variables. The current age of ever-married women has significant ($p < 0.05$) association with reproductive health of women. Among the younger women (15-19), the risk of being reproduced is low and elder aged women the risk of being reproduced is high. The large percentage of younger ever-married women in Bangladesh has risk of being low status during their early age. Reproductive health status of ever-married women has significant ($p < 0.01$) association with respondent's age at marriage. It is found that majority (36.1%) of the women are belong to lower status of reproductive health and the percentage (36.1%) of ever-married women of low reproductive health status is higher than those women who are getting marriage after age 18 years. Also a significant ($p < 0.001$) association has been found between the reproductive health of ever-married women and women's number of living children. Among the women living in households with the one living child, 28.4 percent women are low status of reproductive health, 34.7 percent are middle and 36.9 percent women are leading with high status of reproductive health. This study reflects that the percentage of women of low status of reproductive health rapidly increases while women with number of living children increase. Besides, the percentage of ever-married women of high status of reproductive health decreases while the women with number of living children increase.

The present study also investigates the association and strength of relationship between selected demographic characteristics and health status of ever-married women in Bangladesh. The results of the bivariate analysis show that women's current age, marital status, children ever born, number of living children, place of residence and family size are significantly ($p < 0.01$) associated with health status of ever-married women of reproductive age group in Bangladesh. Findings of this study also indicate that the lower health status of women increase with the increase of their children ever born. Our study also shows that the risk of health problems among rural women is higher than urban women in Bangladesh.

Chapter 4

Logistic Regression Analysis

4.1 Introduction

The main purpose of logistic regression analysis is to identify potential demographic factors that have influence on poverty, reproductive health and health of ever-married women in Bangladesh based on BDHS 2014 data. In this chapter, logistic regression analysis has been applied to assess the effects of demographic factors on poverty, reproductive health and health of ever-married women in Bangladesh. Logistic regression model is now widely used in statistical analysis to assess the influence of various socio-demographic characteristics controlling for the effect of other variables on the likelihood of the occurrence of the event of interest. The logistic regression analysis is a multivariate technique for estimating the probability that an event occurs. In the most applications, the dependent variable may be dichotomous or polytomous and in such cases the assumption of normality is violated for which the estimation of parameters become difficult through the least squares method. To overcome this problem, a very interesting and appropriate technique is logistic regression analysis, which was developed by Cox (1958). Subsequently, this model was illustrated by Cox himself (1970), Lee (1980) and Fox (1984). Since the logistic regression model does not require any distributional assumption (Cox's 1970), unlike many other multivariate techniques (i.e., the variables are normally distributed with equal variance), it can appropriately handle situations in which the independent variables are qualitative or measured in nominal or ordinal scale. In this chapter, we first employed multinomial logistic regression analysis for response variable with more than two categories to examine the relative importance of all the independent variables simultaneously. To assess the relative influence of all the independent variables on response variable with more than two ordered categories, we employed ordinal logistic regression analysis.

4.2 Multinomial Logistic Regression Analysis

Logistic regression methods have become an integral component to describe the relationship between a response variable and one or more explanatory variables. Multinomial logistic regression analysis is the most widely used technique when the dependent variables are categorized into three categories.

Assume that the categories of the outcome variable Y, are coded as 0, 1 and 2. Recall that the logistic regression model used for a binary outcomes variable is

parameterized in terms of the logit of $Y = 1$ versus $Y = 0$. In the three outcomes category model, here need two logit function and have to be decide which outcome categories to compare. The obvious extension is to use $Y = 0$ as the referent or baseline outcome and to form logits comparing $Y = 1$ and $Y = 2$ to it (Hosmer and Lemeshow 2000).

To develop the model, assume that p covariates and a constant term, denoted by the vector, x, of length $p + 1$ where $x_0 = 1$. Then two logit function as

$$g_1(x) = \ln\left[\frac{p(Y = 1/x)}{p(Y = 0/x)}\right]$$

$$= \beta_{10} + \beta_{11}x_1 + \beta_{12}x_2 + \ldots\ldots\ldots + \beta_{1p}x_p$$

$$= x'\ _1$$

and

$$g_2(x) = \ln\left[\frac{p(Y = 2/x)}{p(Y = 0/x)}\right]$$

$$= \beta_{20} + \beta_{21}x_1 + \beta_{22}x_2 + \ldots\ldots\ldots + \beta_{2p}x_p$$

$$= x'\ _2$$

It follows that the conditional probabilities of each outcome category given the covariate vector are

$$P(Y = 0/x) = \frac{1}{1 + e^{g_1(x)} + e^{g_2(x)}}\ .$$

$$P(Y = 1/x) = \frac{1^{g_1(x)}}{1 + e^{g_1(x)} + e^{g_2(x)}}\ .$$

and

$$P(Y = 2/x) = \frac{e^{g_2(x)}}{1 + e^{g_1(x)} + e^{g_2(x)}}\ .$$

Following the convention for the binary model, we let $\pi_{j(x)} = P(Y = j/x)$ for $j = 0,\ 1,\ 2$. Each probability is a function of the vector of $2(p + 1)$ parameters $' = \ _1/\ _2$.

A general expression for the conditional probability in the three category model is,

$$P(Y = j/x) = \frac{e^{g_j(x)}}{\sum_{k=0}^{2} e^{g_j(x)}}\ .$$

where, the vector $\beta_0 = 0$ and $g_0(x) = 0$.

To construct likelihood function we create three binary variables coded 0 or 1 to indicate the group membership of an observation. We note that these variables are introduced only to clarify the likelihood function and are not used in the actual multinomial logistic regression analysis. The variables are coded as follows:

If $Y = 0$ then $Y_0 = 1,\ Y_1 = 0,\ Y_2 = 0$;

If $Y = 1$ then $Y_0 = 0,\ Y_1 = 1,\ Y_2 = 0$; and

If $Y = 2$ then $Y_0 = 0,\ Y_1 = 0,\ Y_2 = 1$.

We note that no matter what value Y takes on, the sum of these variables is $\sum_{j=0}^{2} Y_j = 1$. Using this notation it follows that the conditional likelihood function for a sample of n independent observations is $l(\beta) = \prod_{i=1}^{n} [®_0(x_i)^{y_{0i}} ®_1(x_1)^{y_{1i}} ®_2(x_i)^{y_{2i}}]$.

Taking the log and using the fact that $\sum y_{ji} = 1$ for each i, the log likelihood function is

$$L(\ ) = \sum_{i=1}^{n} y_{1_i} g_1(x_i) + y_{2i} g_2) - (1 + e^{g_1(x_i)} + e^{g_2(x_i)}).$$

The likelihood equations are found by taking partial derivatives of $L(\beta)$ with respect to each of the $2(p+1)$ unknown parameters. To simplify the notation somewhat, we let $\pi_{ji} = \pi_j(x_i)$. The general form of these equations is

$$\frac{\partial L(\ )}{\partial L(k)} = \sum_{i=1}^{n} x_{k_i}(y_{ji} - ®_{ji}); \text{for } j = 1,\ 2 \text{ and } k = 0,\ 1,\ 2, \ldots\ldots, p \text{ for each subject.}$$

The maximum likelihood estimator $\hat{\ }$, is obtained by setting these equal to zero and solving for β. The solution requires the same type of iterative computation that is used to obtain the estimate in binary outcome cases.

The matrix of the second partial derivative is required to obtain the information matrix and the estimator of the covariance matrix of the maximum likelihood estimator. The general form of the elements in the matrix of the second partial derivative is as follows:

$$\frac{\partial^2 L(\ )}{\partial\ _{jk} \partial\ _{jk}} = \sum_{i=1}^{n} x_{k'_i} x_{ki} ®_{ji}(1 - ®_{ji}) \text{ and}$$

$$\frac{\partial^2 L(\ )}{\partial\ _{jk} \partial\ _{j'k'}} = \sum_{i=1}^{n} x_{k'_i} x_{ki} ®_{ji} ®_{j'i} \text{ for } j \text{ and } j' = 1, 2 \text{ and } k \text{ and } k' = 0, 1, 2, \ldots\ldots, p$$

The observed information matrix, $I(\hat{\ })$, is the $2(p+1)$ by $2(p+1)$ matrix whose elements are the negatives of the values in above second derivatives evaluated at $\hat{\ }$. The estimator of the covariance matrix of the maximum likelihood estimator is the inverse of observed information matrix.

4.2.1 Results of multinomial logistic regression analysis for the effects of demographic factors on ever-married women health status

The multinomial logistic regression model can be easily modified to handle the case where the outcome variable is nominal with more than two categories. The goal is to model the odds of plan choice as a function of covariate and to express the result in terms of odds ratio for choice of different plan. McFadden (1974) made a modification of the logistic regression model and called it a discrete choice model. As a result the model is frequently referred to as the discrete choice model in business and econometric literature while it is called the multinomial, polychotomous or polytomous logistic regression model in the health and life sciences.

In this study dependent variable health status (BMI) of ever-married women which can be categorized into three groups as (i) Underweight (BMI < 18.5), (ii) Normal (18.5 ≤ BMI ≤ 24.9) and (iii) Overweight (BMI ≥ 25.0). To identify the predictors of women health by considering these three categories of the dependent variable, multinomial logistic regression model is the ideal technique to find out the predictors of women's health status since dependent variable is categorized into more than two categories. The advantage of considering the multinomial logistic regression model is that women with underweight and overweight health status can be compared with those of normal health status.

The present study of ever-married women health status has been developed by multinomial logistic regression model to identify the causes of ever-married women health status considering the corresponding demographic variables as explanatory variables. Since ever-married women health status is categorized into three mutually-exclusive groups which carry different implications in demographic health of women in Bangladesh. The study performed a multinomial logistic regression to estimate the odds ratio (OR) and 95 percent confidence interval (CI) taking normal health status as the reference category. The estimated coefficients and their exponential

transformations that yielded the ORs are always relative to the reference category. Thus, the odd of a respondent with underweight vs. normal weight is the probability of being an underweight divided by the probability of a respondent with a normal weight (Khan and Kraemer 2009). The odds ratio, OR, is usually the parameter of interest in a logistic regression due to its easy interpretation. It is also mentioned that confidence interval provide an additional information about the odds ratio (Hosmer and Lemeshow 2000).

The results of multinomial logistic regression analysis for underweight health status indicate that most of the independent variables are found as significant predictors of ever-married women health status (Table-4.1).

Among the women aged after 40 years or above, majority of them (54%) have normal health status. For this reason, the present study considers them as reference category to interpret the risk of being underweight and overweight or obese among the women of other age groups. The reproductive women aged before 20 years are 2.70 times more likely to be underweight than those of aged 40 years or above with normal health status. Again, confidence interval (2.04, 3.57) suggests that the risk of being underweight among women aged before 20 years will be as little as 2.04 times or as much as 3.57 times more likely than those women aged 40 years or more with normal health status at 95 percent confidence level. The women belonging to the age group 20-29 years are about 32.7 percent more likely to be underweight with confidence interval (1.09, 1.61) than those women aged 40 years or above with normal health status. The ever-married women belonging to the age group 30-39 years are about 17 percent less likely to be underweight with confidence interval (0.69, 0.99) than those women aged 40 years or above with normal weight. From this finding, it can be concluded that adolescent ever-married mothers of Bangladesh are suffering a severe underweight health problem than the old age mothers.

Table-4.1 shows that the married women are 0.54 times less likely to be underweight than those women who are divorced or separated having normal health status and this risk of being underweight among married women will be as little as 0.43 times or as much as 0.69 times more likely than those women who are divorced or separated with normal health status at 95 percent confidence level. From this finding, it can be concluded that health problem more affected in divorced or separated women than

married women. So, marital status is an important demographic factor that affects the women health status in Bangladesh.

Women's children ever born have a significant ($p < 0.01$) influence on ever-married women health status. Among the women having one to two children ever born are 0.67 times less likely to be under weight than those women who have three or more children ever born with normal health status. This risk of being underweight may be changed as little as 0.50 times or as much as 0.89 times more likely than those women who have three or more children ever born with normal health status at 95 percent confidence level. From this finding, it is observed that the relative chance to be underweight for the ever-married women increases with the increase of women with children ever born.

The urban ever-married women are slightly less likely (27 percent) to be underweight than those of rural having normal health status and this risk of being underweight among urban women will be as little as 0.64 times or as much as 0.85 times more likely than those women of rural with normal health status at 95 percent confidence level. From this finding, it may be conclude that in the urban areas, underweight is the minor problem.

From Table-4.1 it is also reveals that family size has an insignificant ($p = 0.315$) influence on ever-married women health status. The women belonging to the family size one to four members are 4.7 percent less likely to risk of being underweight than those women with seven or more family members having normal health status. This risk of being underweight may be changed as little as 0.81 times or as much as 1.12 times more likely than those women who have family size seven or more members with normal health status at 95 percent confidence level. Among the women having five to six family members are 8.1 percent less likely to risk of being underweight than those women who have seven or more family members with normal health status .So, underweight problem is severe among the women with larger family size. From these findings, it is found that the demographic condition is associated with health status of ever-married women in Bangladesh.

The results of multinomial logistic regression analysis for overweight or obese indicate that most of the independent variables are found as highly significant predictors of ever-married women health status (Table-4.1).

The ever-married women aged before 20 years are 0.23 times less likely to be overweight or obese than those women who are aged after 40 years or above with normal health status. Again, confidence interval (0.16, 0.33) suggests that the risk of being overweight among ever-married women aged before 20 years will be as little as 0.16 times or as much as 0.33 times less likely than those women of aged 40 years or above with normal health at 95 percent confidence level. The women belonging to the age group 20-29 years are 0.55 times less likely to be overweight or obese with confidence interval (0.46, 0.65) than those women of aged 40 years or above with normal weight. The women of 30-39 years age group are 1.02 times more likely to risk of being overweight or obese than those women of aged 40 years or above with normal health status. From this finding, it may be concluded that ever-married women of Bangladesh are suffering a severe problem of overweight at their final stage of reproduction.

Women's marital status have significant ($p < 0.001$) influence on health status of ever-married women in Bangladesh. Table-4.1 shows that the married women are 1.74 times more likely to be overweight or obese than those women who are divorced or separated having normal health status and this risk of being overweight or obese among married women will be as little as 1.33 times or as much as 2.27 times more likely than those women who are divorced or separated with normal health status at 95 percent confidence level. From this finding, it can be concluded that health problem more affected in married women than divorced or separated women. So, marital status is an important demographic factor that affects the women health status in Bangladesh.

From Table-4.1, it is also observed that the women age at marriage has insignificant ($p = 0.835$) influence on the risk of being overweight or obese among ever-married women. The women who are getting marriage before or at the age of 18 years, 0.98 times less likely to be overweight or obese than those women who are getting marriage after 18 years having normal health status at 95 percent confidence interval (0.87, 1.12) in Bangladesh.

Women's children ever born have significant ($p < 0.01$) influence on health status of ever-married women in Bangladesh. Among the women having one to two children ever born are 1.42 times more likely to be overweight or obese than those women having three or more children ever born with normal health status. This risk of being overweight or obese may be changed as little as 1.09 times or as much as 1.85 times more likely than those of women having three or more children ever bore with normal weight at 95 percent confidence level. From these findings, it is observed that the relative chance of being overweight decreases sequentially among the women of higher children ever born.

The urban ever-married women are 2.22 times more likely to be overweight or obese than those of rural women having normal health status and this risk of being overweight or obese among urban women will be as little as 1.98 times or as much as 2.49 times more likely to be over weight than those of rural women with normal health status at 95 percent confidence level. From this finding, it may be concluded that, the risk of being overweight is higher among urban ever-married women than those of rural in Bangladesh.

From Table-4.1, it is also reveals that family size has an insignificant ($p = 0.705$) influence on ever-married women health status. The women belonging to the family size one to four members are 1.00 times more likely to risk of being overweight or obese than those women with seven or more family members having normal health status. This risk of being overweight may be changed as little as 0.86 times or as much as 1.18 times more likely than those women who have family size seven or more members with normal health status at 95 percent confidence level. Among the women having five to six family members are 0.97 times less likely to risk of being overweight than those women who have seven or more family members with normal health status. So, overweight or obese problem is severe among the women with larger family size. From these findings, it is found that the demographic condition is associated with health status of ever-married women in Bangladesh.

Table-4.1: Results of multinomial logistic regression analysis for the effects of demographic factors on ever-married women health status

Logits	Demographic characteristics	Co-efficient	S.E of Estimates	p-value	Odd Ratio	95% C.I. for OR	
						Lower	Upper
Under weight	**Current age**						
	Less than 20 years	0.993	0.143	0.000	2.700	2.040	3.574
	20 – 29 years	0.283	0.099	0.004	1.327	1.093	1.610
	30 – 39 years	-0.186	0.091	0.041	0.830	0.694	0.992
	40 years or more (RC)	-	-	-	1.000		
	Marital status						
	Married	-0.610	0.119	0.000	0.543	0.430	0.686
	Divorced/Separated(RC)	-	-	-	1.000		
	Age at marriage						
	≤ 18 years	-0.025	0.070	0.724	0.975	0.850	1.120
	> 18 years (RC)	-	-	-	1.000		
	Children ever born						
	1-2 children	-0.406	0.147	0.006	0.666	0.500	0.888
	3 or more (RC)	-	-	-	1.000		
	Living children						
	1 child	0.021	0.171	0.901	1.021	0.731	1.428
	2	-0.167	0.142	0.240	0.847	0.641	1.118
	3 or more (RC)	-	-	-	1.000		
	Place of residence						
	Urban	-0.311	0.073	0.000	0.733	0.636	0.845
	Rural (RC)	-	-	-	1.000		
	Religion						
	Muslim	0.044	0.117	0.707	1.045	0.831	1.315
	Non-Muslim (RC)	-	-	-	1.000		
	Family size						
	1-4	-0.048	0.083	0.559	0.953	0.811	1.120
	5-6	-0.084	0.084	0.315	0.919	0.780	1.084
	7 or more (RC)	-	-	-	1.000		
Obese	**Current age**						
	Less than 20 years	-1.480	0.183	0.000	0.228	0.159	0.326
	20 – 29 years	-0.602	0.089	0.000	0.548	0.460	0.652
	30 – 39 years	0.022	0.075	0.030	1.022	0.882	1.184
	40 years or more (RC)	-	-	-	1.000		
	Marital status						
	Married	0.553	0.136	0.000	1.739	1.333	2.268
	Divorced/Separated(RC)	-	-	-	1.000		
	Age at marriage						
	≤ 18 years	-0.013	0.064	0.835	0.987	0.871	1.118
	>18 years (RC)	-	-	-	1.000		

	Children ever born						
	1-2 children	0.351	0.134	0.009	1.421	1.092	1.848
	3 or more (RC)	-	-	-	1.000		
	Living children						
	1 child	-0.175	0.159	0.271	0.840	0.615	1.146
	2	-0.018	0.134	0.895	0.982	0.756	1.277
	3 or more (RC)	-	-	-	1.000		
	Place of residence						
	Urban	0.798	0.059	0.000	2.220	1.977	2.493
	Rural (RC)	-	-	-	1.000		
	Religion						
	Muslim	0.104	0.105	0.324	1.109	0.903	1.363
	Non-Muslim (RC)	-	-	-	1.000		
	Family size						
	1-4	0.008	0.079	0.925	1.008	0.862	1.177
	5-6	-0.031	0.081	0.705	0.970	0.828	1.136
	7 or more (RC)	-	-	-	1.000		

Note: The reference category is: Normal weight of ever-married women for dependent variable and (RC) indicates reference category of independent variables.

4.3 Ordinal Logistic Regression Analysis

Several logistic regression analyses such as multinomial logistic, ordinal logistic regression analysis have used for analyzing polytomous data. For the ordinal response, it is necessary to use ordinal logistic regression model to get precise and efficient estimates of the regression coefficients. In most of the previous studies, the ordinal logistic regression models for ordinal data have been broadly used (Kleinbaum and Ananth 1997). The proportional odds model (POM), partial proportional odds model (PPOM), and continuous ratio models (CRM) are all the ordinal logistic regression models. In practice the proportional odds model is often used for ordinal data.

In the present study the response variables standard of living status and reproductive health status for ever-married women has been classified into three categories (low, medium and high) according to an order of magnitude. The proportional odds model has been used in this study for obtained the odds ratios.

Let the response variable Y with k categories and the $\tilde{x} = (x_1, x_2, ..., x_p)'$ vector of p explanatory variables.

Then the proportional odds model can be written as

$$\alpha_j(\tilde{x}) = \ln\left\{\frac{\sum_{j=1}^{j} P(Y = j|\tilde{x})}{\sum_{j+1}^{k} P(Y = j|\tilde{x})}\right\} = \sim_j + \sum_{i=1}^{p} {}_i\chi_i \; ; \quad i = 1, 2, ..., p \; ; \quad j = 1, 2, ..., k-1,$$

where α_j is the j^{th} intercept and β_i is the i^{th} regression coefficient and x_i is the i^{th} explanatory variable.

4.3.1 Results of ordinal logistic regression analysis for the effects of demographic factors on standard of living status among ever-married women

In this study odd ratios for ever-married women standard of living status obtained from the proportional odds model. All the covariates used in multivariate analysis are found to be significant on standard of living status of ever-married women.

From Table-4.2, it is observed that current age of ever-married women has significant (p < 0.01) influence on their standard of living status. Current age of ever-married

women below 20 years is significantly 0.382 times ($p < 0.001$) less likely to being high standard of living compared to those women aged 40 years or above. The ever-married women belonging to the age group 20-29 years are significantly 0.56 times ($p < 0.001$) less likely to deserve high standard of living than those women aged 40 years or above. The ever-married women belonging to the age group 30-39 years are significantly 0.92 times ($p < 0.01$) less likely to being high standard of living than those women aged 40 years or above. From these findings, it can be concluded that women deserve for high status of living standard increase with the increasing of their age.

Table-4.2: Results of ordinal logistic regression analysis for the effects of demographic factors on standard of living status among ever-married women

Characteristics	Co-efficient	S.E of Estimates	p-value	Odd Ratio	95% C.I. for OR	
					Lower	Upper
Current age						
Less than 20 years	-0.962	0.115	0.000	0.382	0.187	0.736
20 – 29 years	-0.573	0.071	0.000	0.564	0.711	1.434
30 – 39 years	-0.087	0.062	0.003	0.916	0.208	2.034
40 years or more(RC)	-	-	-	1.000		
Marital status						
Married	0.383	0.098	0.000	1.466	0.192	1.574
Divorced/Separated(RC)	-	-	-	1.000		
Age at marriage						
≤ 18 years	-0.320	0.051	0.000	0.726	0.419	0.921
>18 years (RC)	-	-	-	1.000		
Children ever born						
1-2 children	0.583	0.105	0.000	1.791	0.377	2.789
3 or more (RC)	-	-	-	1.000		
Living children						
1 child	0.239	0.125	0.055	1.269	0.005	1.483
2	0.125	0.104	0.229	1.133	0.079	1.330
3 or more (RC)	-	-	-	1.000		
Place of residence						
Urban	1.868	.052	0.000	1.476	0.765	1.971
Rural (RC)	-	-	-	1.000		
Religion						
Muslim	0.442	0.084	0.000	1.556	0.278	2.607
Non-Muslim (RC)	-	-	-	1.000		
Family size						
1-4	-0.529	0.063	0.000	0.589	0.653	1.406
5-6	-0.342	0.064	0.000	0.710	0.467	1.218
7 or more (RC)	-	-	-	1.000		

Note: (RC) indicates reference category of independent variables.

Women's marital status seems to have highly significant ($p < 0.001$) effect on standard of living status of ever-married women in Bangladesh. Table-4.2 also revealed that the married women are significantly 1.47 times ($p < 0.001$) more likely to expect high standard of living compared to those women who are divorced or separated in Bangladesh. Women's age at marriage has highly significant ($p < 0.001$) influence on standard of living status of ever-married women in Bangladesh. The early married women (age below or at age of 18 years) are significantly 0.73 times ($p < 0.001$) less likely to being high status of living than those women who married after age of 18 years. The results also show that women's number of children ever born has highly significant ($p < 0.001$) effect on their standard of living status. Mothers who have one to two children ever born are significantly 1.79 times ($p < 0.001$) more likely to desire high standard of living compared to women with three or more children ever born. Table-4.2 also shows that women's number of living children has an important effect on standard of living status of ever-married women in Bangladesh. The women who have one and two living children are insignificantly 1.27 times ($p = 0.055$) and 1.13 times ($p = 0.229$) more likely to deserve high standard of living compared to the women with three or more living children respectively.

While considering the place of residence, it seems to have much significant ($p < 0.001$) influence on standard of living status and the high standard of living is higher in urban areas compared with rural areas. Women who are live in urban areas are significantly 1.48 times ($p < 0.001$) more likely to deserve high standard of living than those women who are live in rural areas in Bangladesh. From this finding, it can be concluded that urban women are more expected to being high standard of living compared to rural counterparts in Bangladesh. From Table-4.2, it is also observed that Muslim women have 1.56 times higher deserved for high standard of living compared to Non-Muslim women in Bangladesh. The effects of family size on standard of living status of ever-married women in Bangladesh have an important significant ($p < 0.001$) determinant. Women with one to four and five to six family members are significantly ($p < 0.001$) 0.59 times and 0.71 times less likely to being high standard of living compared to those women with seven or more family members respectively.

4.3.2 Results of ordinal logistic regression analysis for the effects of demographic factors on reproductive health status among ever-married women

In present study odds ratios for ever-married women reproductive health status has been obtained by using the proportional odds model. All the covariates used in ordinal logistic regression analysis are found to be important factors effect on reproductive health status of ever-married women. The results of ordinal logistic regression model which depict the effects of demographic factors on reproductive health status of ever-married women are presented in Table-4.3.

Current age of ever-married women has an important effect on their reproductive health status in Bangladesh. From Table-4.3, it is observed that current age of ever-married women below 20 years are 0.98 times less likely to being high status of reproductive health compared to those women aged 40 years or above. The ever-married women belonging to the age group 20-29 years are 1.15 times more likely to deserve high status of reproductive health than those women aged 40 years or above. The ever-married women belonging to the age group 30-39 years are 1.92 times more likely to desire high status of reproductive health compared to those women aged 40 years or above. From these findings, it can be concluded that women expectation for high status of reproductive health increases with the increasing of their age.

Women's marital status has a significant ($p < 0.05$) influence on reproductive health status of ever-married women in Bangladesh. Table-4.3 also shows that the married women are significantly ($p < 0.05$) 2.95 times more likely to expect high status of reproductive health compared to those women who are divorced or separated. Women's age at marriage has a significant ($p < 0.05$) influence on reproductive health status of ever-married women in Bangladesh. The early married women (age below or at age of 18 years) are significantly ($p < 0.05$) 0.77 times less likely to being higher reproductive health status compared to those women who married after age of 18 years. The results also show that women's number of children ever born has an important effect on reproductive health status of ever-married women. Women who have one to two children ever born 1.25 times more likely to being high status of reproductive health compared to the women with three or more children ever born.

Table-4.3: Results of ordinal logistic regression analysis for the effects of demographic factors on reproductive health status among ever-married women

Characteristics	Co-efficient	S.E of Estimates	p-value	Odd Ratio	95% C.I. for OR	
					Lower	Upper
Current age						
Less than 20 years	-0.022	0.478	0.963	0.978	0.959	1.915
20 – 29 years	0.141	0.457	0.757	1.152	0.754	2.037
30 – 39 years	0.652	0.463	0.159	1.919	0.255	3.559
40 years or more (RC)	-	-	-	1.000		
Marital status						
Married	1.082	0.527	0.040	2.950	0.049	3.115
Divorced/Separated(RC)	-	-	-	1.000		
Age at marriage						
≤ 18 years	-0.260	0.124	0.036	0.771	0.503	2.017
>18 years (RC)	-	-	-	1.000		
Children ever born						
1-2 children	0.222	0.328	0.498	1.249	0.420	2.865
3 or more (RC)	-	-	-	1.000		
Living children						
1 child	0.781	0.381	0.041	2.183	0.033	3.528
2	0.603	0.346	0.043	1.827	0.075	3.280
3 or more (RC)	-	-	-	1.000		
Place of residence						
Urban	0.654	0.118	0.000	1.923	0.422	2.885
Rural (RC)	-	-	-	1.000		
Religion						
Muslim	-0.381	0.231	0.099	0.683	0.835	1.072
Non-Muslim (RC)	-	-	-	1.000		
Family size						
1-4	-0.027	0.144	0.850	0.973	0.310	1.256
5-6	-0.031	0.141	0.825	0.969	0.307	1.245
7 or more (RC)	-	-	-	1.000		

Note: (RC) indicates reference category of independent variables.

Women's number of living children has a significant ($p < 0.05$) impact on reproductive health status of ever-married women in Bangladesh. Women who have one and two living children significantly ($p < 0.05$) 2.18 times and 1.83 times more likely to deserve higher reproductive health status respectively compared to the women with three or more living children. From these findings, it can be concluded that women expectation of higher reproductive health status decreases with the increasing of their number of living children.

While considering the place of residence, it seems to have highly significant ($p < 0.001$) influence on reproductive health status of ever-married women. Women who are live in urban areas significantly 1.92 times ($p < 0.001$) more likely to deserve higher reproductive health status compared to those women who are live in rural areas in Bangladesh. From this finding, it can be concluded that urban women are more expected to being high quality of reproductive health compared to rural counterparts. From Table-4.3, it is also observed that Muslim women are 0.68 times less likely to have high deserved for reproductive health status compared to Non-Muslim women. The results reveal that family size also emerged as an important factor for determining the effects on reproductive health status of ever-married women in Bangladesh. Women with one to four and five to six family members are 0.97 times and 0.97 times less likely to being high status of reproductive health respectively compared to those women with seven or more family members in Bangladesh.

4.4 Summary

The results of multinomial logistic regression analysis for health status of ever-married women and ordinal logistic regression analysis for standard of living status and reproductive health status among ever-married women which depict the effects of demographic variables are presented briefly.

Multinomial logistic regression model shows that current age of ever-married women has significant ($p < 0.05$) influence on their health status in Bangladesh. The reproductive women aged before 20 years, women belonging to the reproductive age group 20-29 years and age group 30-39 years are 2.70 times and 1.33 times more likely and 0.83 times less likely to be underweight whereas the likelihoods of being overweight or obese are 0.23 times and 0.55 times less likely and 1.02 times more

likely among ever-married women aged before 20 years, women belonging to the reproductive age group 20-29 years, and 30-39 years than those women aged 40 years or above with normal health status respectively. Marital status of women appears to have highly significant ($p < 0.001$) influence on health status of ever-married women in Bangladesh. Married women are 0.54 times less likely to be underweight while 1.74 times more likely to be overweight or obese than those women who are divorced or separated having normal health status.

Women's children ever born have a significant ($p < 0.01$) influence on ever-married women health status. Among the women having one to two children ever born are 0.67 times less likely to be under weight and 1.42 times more likely to be overweight or obese than those women who have three or more children ever born with normal health status. From these findings, it is observed that the relative chance to the health problem of ever-married women increases with the increasing of their children ever born in Bangladesh. Women's place of residence has highly significant ($p < 0.001$) influence on their health status. With regards to the place of residence, urban ever-married women are 0.73 times less likely to be underweight while 2.22 times more likely to be overweight or obese relative to rural women having normal health status in Bangladesh.

Another demographic factor such as family size has an important effect on ever-married women health status. Women with family size one to four members and five to six members are 0.95 times and 0.92 times less likely respectively to risk of being underweight than those women with seven or more family members having normal health status. So, underweight health problem is severe among the ever-married women with larger family size. The odds of overweight or obese among ever-married women with family size one to four members and five to six members are 1.01 times higher and 0.97 times lower risk of being overweight or obese than those women with seven or more family members having normal health status respectively. From these findings, it is found that the demographic factor such as family size is associated with health status of ever-married women in Bangladesh.

Ordinal logistic regression model shows that current age of ever-married women has a significant ($p < 0.01$) influence on their standard of living status in Bangladesh. Current age of ever-married women below 20 years, ever-married women belonging

to the age group 20-29 years and age group 30-39 years are 0.382 times, 0.56 times and 0.92 times less likely to being high status of living standard respectively compared to those women aged 40 years or above. From these findings, it can be concluded that women deserve for high status of living standard increase with the increasing of their age. Women's marital status has highly significant ($p < 0.001$) effect on standard of living status of ever-married women in Bangladesh. Married women are 1.47 times more likely to expect high status of living standard compared to those women who are divorced or separated.

The results affirmed that women's age at marriage has highly significant ($p < 0.001$) impact on standard of living status of ever-married women in Bangladesh. The early married women (age below or at age of 18 years) are 0.73 times less likely to being high status of living than those women who married after age of 18 years. The results also show that women's number of children ever born has highly significant ($p < 0.001$) effect on their standard of living status. Women who have one to two children ever born are 1.79 times more likely to desire high standard of living status compared to women with three or more children ever born. Women's number of living children has an important effect on standard of living status of ever-married women in Bangladesh. The women who have one and two living children are 1.27 times and 1.13 times more likely to deserve high standard of living status respectively compared to the women with three or more living children in Bangladesh.

Place of residence has highly significant ($p < 0.001$) influence on standard of living status of ever-married women. Women who are live in urban areas are 1.48 times more likely to deserve high standard of living status than those women who are live in rural areas in Bangladesh. From this finding, it can be concluded that urban women are more expected to being high status of living standard compared to rural counterparts in Bangladesh. The results also show that Muslim women have 1.56 times higher deserved for high standard of living status compared to Non-Muslim women in Bangladesh. The effects of family size on standard of living status of ever-married women in Bangladesh have an important significant ($p < 0.001$) determinant. Women with one to four and five to six family members are 0.59 times and 0.71 times less likely to being high standard of living status respectively compared to those women with seven or more family members in Bangladesh.

For reproductive health status of ever-married women, ordinal logistic regression model shows that current age of ever-married women has an important effect on their reproductive health status in Bangladesh. Current age of ever-married women below 20 years, ever-married women belonging to the age group 20-29 years and age group 30-39 years are 0.98 times less likely, 1.15 times and 1.92 times more likely to being high status of reproductive health respectively compared to those women aged 40 years or above. From these findings, it can be concluded that women expectation for high status of reproductive health increases with the increasing of their age. Women's marital status has a significant ($p < 0.05$) influence on reproductive health status of ever-married women in Bangladesh. The results show that the married women are 2.95 times more likely to expect high status of reproductive health compared to those women who are divorced or separated.

Women's age at marriage has a significant ($p < 0.05$) impact on reproductive health status of ever-married women in Bangladesh. The early married women (age below or at age of 18 years) are 0.77 times less likely to being higher reproductive health status compared to those women who married after age of 18 years. The results also show that women's number of children ever born has an important effect on reproductive health status of ever-married women. Women who have one to two children ever born 1.25 times more likely to being high status of reproductive health compared to the women with three or more children ever born. Women's number of living children has a significant ($p < 0.05$) impact on reproductive health status of ever-married women in Bangladesh. Women who have one and two living children 2.18 times and 1.83 times more likely to deserve higher reproductive health status respectively compared to the women with three or more living children. From these findings, it can be concluded that women expectation of higher reproductive health status decreases with the increasing of their number of living children.

Place of residence has highly significant ($p < 0.001$) influence on reproductive health status of ever-married women. Women who are live in urban areas 1.92 times more likely to deserve higher reproductive health status compared to those women who are live in rural areas in Bangladesh. From this finding, it can be concluded that urban women are more expected to being high quality of reproductive health compared to rural counterparts. The results of ordinal logistic regression model show that Muslim

women are 0.68 times less likely to have high status of reproductive health compared to Non-Muslim women. The results reveal that family size also emerged as an important factor for determining the effects on reproductive health status of ever-married women in Bangladesh. Women with one to four and five to six family members are 0.97 times and 0.97 times less likely to being high status of reproductive health respectively compared to those women with seven or more family members in Bangladesh.

We included general health status of ever-married women along with reproductive health status because of the following reasons:

- General health of women, encompassing both underweight and overweight, is a major problem with important consequences for survival and healthy development.
- Reproductive health is one of the crucial components of general health and well-being and one among the central features of human development.
- Low pre-pregnancy BMI of women is a known risk factor for poor maternal and birth outcomes. Overweight or obese women are also predisposed to a wide range of reproductive health problems.
- Health status (BMI status) among ever-married women is associated with increased risk factors of maternal complications during pregnancy, delivery, postpartum, preterm birth, low birth weight, early mortality and adverse obstetrics.

Key findings of this chapter:

- The results of logistic regression analysis show that current age of ever-married women has significant ($p < 0.01$) impact on standard of living status and women deserve for higher status of living standard increase with the increase of their age.
- Women's age at marriage has highly significant ($p < 0.001$) influence on standard of living status of ever-married women in Bangladesh and women desire for higher standard of living status increase with the increase of their age at marriage.

- Children ever born among ever-married women has highly significant ($p < 0.001$) influence on their standard of living status and higher the children ever born of ever-married women lower the standard of living in Bangladesh.

- Women's number of living children has an important effect on their standard of living status in Bangladesh. Women expectation for high standard of living status decrease with the increase of their number of living children.

- In the case of reproductive health, women's age at marriage has highly significant ($p < 0.05$) impact on reproductive health status of ever-married women in Bangladesh. Women deserve for high reproductive health status increase while their ages at marriage increase.

- Women's number of living children has significant ($p < 0.05$) impact on reproductive health status of ever-married women in Bangladesh. Women expectation for higher reproductive health status decreases with the increase of their number of living children.

- Place of residence has highly significant ($p < 0.001$) influence on reproductive health status of ever-married women in Bangladesh and among the ever-married women desire for high status of reproductive health are higher in urban areas than rural areas in Bangladesh.

- In the case of health status, current age of ever-married women has a significant ($p < 0.05$) effect on their health status and adolescent mothers of Bangladesh are more suffer a serious health problem than the old age mother.

- Women's children ever born have a significant ($p < 0.01$) influence on ever-married women health status. The relative chance to the risk of health problem of ever-married women increases with the increase of their children ever born in Bangladesh.

Chapter 5

Multiple Classification Analysis

5.1 Introduction

The purpose of Multiple Classification Analysis (MCA) is to measure and isolate the intensity of the effect of independent variables on dependent one through an additive model. In this study MCA has been employed to measure and isolate the intensity of the effect of demographic factors affecting poverty, reproductive health and health of ever-married women in Bangladesh. The poverty, reproductive health and general health of ever-married women are influenced by a variety of demographic factors both at the societal and familial level (Dixon, 1971). It has been found almost universally that persons belonging to different demographic characteristics have different standard of living status, different reproductive health status and different health status (Bogue, 1969). This statement has been examined for Bangladesh in this study. In this chapter investigation is carried out for the contribution of various demographic factors such as current age, marital status, age at marriage, number of children ever born, number of living children, place of residence, religious affiliation and size of the family of ever-married women in order to understand the mechanisms which determine the standard of living status, reproductive health status and health status of ever-married women in Bangladesh.

The aforesaid factors affect poverty, reproductive health and health directly and indirectly. Therefore, there is need to evaluate these effects in order to know the intensity of the influences of the various demographic factors. For this purpose a well-known multivariate technique, Multiple Classification Analysis (MCA) is adopted.

5.2 Multiple Classification Analysis (MCA)

In 1934 Yates developed the multiple classification analysis and it was later expanded and detailed by Anderson and Bancraft in 1952. In 1963, the computerized MCA programme was prepared by a group of researchers at the Survey Research Center of the University of Michigan. Since then, the MCA programme has been widely used in demographic research. Multiple classification analysis requires one dependent variable and two or more independent variables. The dependent variable can be either a continuous or a categorical variable, but all the independent variables must be categorical variables. Multiple classification analysis can equally handle the nominal and ordinal variables and can also deal with linear and non-linear relationships of predictor variables with dependent variable.

Mathematically, the model can be expressed by the following equation:

$$Y_{ijk} = \bar{Y} + a_i + b_j + c_k + ...e_{ijk},$$

where, Y_{ijk} = value or score of an individual who falls in the i^{th} category of the factor A, j^{th} category of the factor B and k^{th} category of the factor C.

$\bar{Y}$ = grand mean of Y.

a_i = the effect due to the i^{th} category of the factor A, which is equal to the difference between $\bar{Y}$ and the mean of its category of factor A.

b_j = the effect due to the j^{th} category of the factor B, which is equal to the difference between $\bar{Y}$ and the mean of its category of factor B.

c_k = the effect due to the k^{th} category of the factor C which is equal to the difference between $\bar{Y}$ and the mean of its category of factor C.

e_{ijk} = the error term related with Y_{ijk} score of the individuals.

The coefficients which are estimated by solving the normal equation systems are called the adjusted or net effect of the predictors. These effects measure those of the predictor alone after taking into account the effects of all other predictors. If there is no inter-correlation among the predictors, the adjusted and unadjusted effects of the predictors will be the same. The unadjusted, eta-square (η^2) coefficient is a correlation ratio which explains how well the predictor variable explains the variation in dependent variable and is usually estimated by solving the normal equations with only one predictor. This unadjusted coefficient indicates the .proportion of variance explained by a single predictor alone. Similarly, the beta-square (β^2) coefficient indicates the proportion of variation explained by a predictor variable taking into account the proportion explained by the other predictor variables. The beta coefficient is compared to the partial correlation coefficient in multiple regression.

Statistically, analysis of variance, multiple classification analysis and dummy regression are the same, but multip1e classification analysis has some advantages. It provides estimates of each category of the predictor variables and at the same time provides the coefficients for explaining the strength of the relationship.

5.3 Variables Considered in the Analysis

The multiple classification analysis is undertaken first to evaluate the contribution of such demographic factors as current age, marital status, age at marriage, children ever born, number of living children, place of residence, religion and family size of the respondents on poverty. In this case standard of living status of ever-married women is taken to be the dependent variable and the aforesaid demographic factors as explanatory variables. Again, to evaluate the contribution of demographic factors like current age, marital status, age at marriage, children ever born, number of living children, place of residence, religion and family size of the respondent on reproductive health, the reproductive health status of ever-married women is taken to be the dependent variable and the aforesaid demographic factors as explanatory variables. In similar fashion, to evaluate the contribution of demographic factors like current age, marital status, age at marriage, children ever born, number of living children, place of residence, religion and family size of the respondents on health status, the health status of ever-married women is taken to be the dependent variable and the aforesaid demographic factors as explanatory variables.

All the demographic variables are the categorical variables. They are included in MCA in the following fashion:

Current age of women: 15 to 49 in single years
Marital status: 1= Married, 2= Divorced or Separated
Age at marriage: 1= Below or equal 18 years, 2= Above 18 years
Children ever born: 0 to 15 children
Number of living children: 1 to 12 children
Place of residence: 1= Urban, 2= Rural
Religion: 1= Muslim, 2= Non-Muslim
Family size: 1 to 25 members

The variables included in the model given above in the aforesaid fashion and the MCA is performed on data provided by BDHS 2014. The analysis of data is made using statistical software SPSS 22.0/PC+.

5.4 Factors Affecting Standard of Living Status of Ever-married Women

Of all the variables mentioned in section 5.3 the variables that are considered to look at the extent of effect on standard of living status of ever-married women are current age, marital status, age at marriage, children ever born, number of living children, place of residence, religion and family size. In this case, standard of living status of ever-married women is taken to be the dependent variable and the stated demographic variables as explanatory variables. Table-5.1 shows the mean standard of living status for both unadjusted and adjusted by different demographic characteristics with the values of η^2 and β^2 produced from MCA with data of 2014 BDHS. The salient features of the Table-5.1 are as follows:

i. Current age of ever-married women has highly significant ($p < 0.001$) effect on their standard of living status. From the results, it is observed that women with current age 40 years or above have higher living status than with current age below 20 years. The mean standard of living status, which is 0.32 times higher for the women aged 40 years or above compared to those women with age below 20 years. The women belong to age group 30-39 years, mean standard of living status which is 0.30 times higher than those women with age below 20 years. So, it can be conclude that ever-married women living standard increases while their current age is increasing.

ii. Marital status has an important effect on standard of living status of ever-married women. Standard of living status among the married women is higher than the divorced or separated women. The mean difference for married women's is 0.24 times higher than divorced or separated women in Bangladesh.

iii. Results also revealed that age at marriage has highly significant ($p < 0.001$) effect on standard of living status of ever-married women in Bangladesh. It is also observed that women who are marry earlier or at the age of 18 years adjusted mean value for standard of living status 0.11 times lower than those women who are marry after age of 18 years.

iv. Women's children ever born has highly significant ($p < 0.001$) effect on their standard of living status in Bangladesh. Women having one to two children

ever born have a 0.20 times higher mean standard of living status than those women who have three or more children ever born. Thus, children ever born of ever-married women decrease their standard of living status.

v. Women's number of living children has a significant ($p < 0.01$) impact on their standard of living status. Women having one living children have 0.09 times higher mean standard of living status than those women who have three or more living children. The women with two living children have 0.05 times higher mean standard of living status than those women who have three or more living children. From these findings, it can be concluded that the mean of ever-married women standard of living status decreases with the increasing their number of living children.

vi. Place of residence has a highly significant ($p < 0.001$) effect on standard of living status of ever-married women in Bangladesh. Standard of living status with urban residence women is higher than the women with rural residence. The mean standard of living for women's in urban residence is 0.68 times higher than women with rural residence.

vii. Religious affiliation has a significant ($p < 0.01$) influence on standard of living status of ever-married women. It is found that the Muslim ever-married women have higher living status than the Non-Muslims women. The gross as well as net difference in mean standard of living is 0.16 times higher among Muslim women than Non-Muslim. Thus religious difference in favor of Non-Muslim is apparent.

viii. Results show that women's family size has highly significant ($p < 0.001$) effect on their standard of living status. The mean value of living standard of ever-married women is 1.79 for those women who have family size 1-4 members, and is 0.06 times lower than the mean of living status of women who have 5-6 family members. But, the mean standard of living of women having 1-4 family members is 0.18 times lower than those women with seven or more family members in Bangladesh.

Table-5.1: Results of MCA of standard of living status for ever-married women with indicated demographic characteristics as explanatory variables

Explanatory variables	Standard of living status			
	Predicted mean		Correlation ratio	
	Unadjusted mean	Adjusted mean	(Unadjusted)	(Adjusted)
Current age* **				
Less than 20 years	1.76	1.62		
20-29 years	1.82	1.76	0.05	0.14
30-39 years	1.88	1.92		
40 years or more	1.88	1.94		
Marital status				
Married	1.85	1.86	0.02	0.04
Divorced/Separated	1.76	1.62		
Age at marriage* **				
≤ 18 years	1.80	1.82	0.10	0.07
>18 years	1.97	1.93		
Children ever born* **				
1-2 children	1.93	1.95	0.11	0.13
3 or more	1.77	1.75		
Living children **				
1 child	1.91	1.90	0.09	0.05
2	1.91	1.86		
3 or more	1.77	1.81		
Place of residence* **				
Urban	2.32	2.30	0.44	0.43
Rural	1.61	1.62		
Religion **				
Muslim	1.86	1.86	0.04	0.06
Non-Muslim	1.74	1.70		
Family size* **				
1-4	1.83	1.79	0.06	0.09
5-6	1.82	1.85		
7 or more	1.93	1.97		
Grand Mean = 1.85, Multiple = 0.896, Significance of model = 0.001				

Note: Level of significance * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

5.5 Intensity of the Effects of Demographic Factors on Standard of Living Status of Ever-married Women

Table- 5.1 also shows the contribution of the demographic variables of ever-married women current age, marital status, age at marriage, children ever born, number of living children, place of residence, religion and family size on standard of living status of ever-married women given by η^2 and β^2 resulted from MCA. From the selected variables place of residence is the first strongest influential factor for

explaining the variation on standard of living status of ever-married women among all other selected variables. The proportion of variation for standard of living status explained by women's place of residence is the highest (unadjusted value η^2 = 0.44 and adjusted value β^2 = 0.43) among all other variables in the model.

From the Table-5.1, it is observed that the effect of current age has been found to be the second strongest influential factor for explaining the variation on standard of living status as well as the proportion of variation explained by women's current age is (unadjusted) η^2 = 0.05 and (adjusted) β^2 = 0.14 respectively. The results also show that women's children ever born have found to be the third strongest influential factor for explaining variability of ever-married women standard of living status among the included variables. The proportion of variance explained by women's children ever born are (unadjusted) η^2 = 0.11 and (adjusted) β^2 = 0.13 respectively. It is also found from the results, the effect of family size is the fourth strongest influential factors on standard of living status as well as the proportion of variation explained by family size is (unadjusted) η^2 = 0.06 and (adjusted) β^2 =0.09 respectively. Table-5.1 also shows that the effect of women's age at marriage is the fifth strongest influential factor for explaining the proportion of variability of ever-married women standard of living status among the selected variables. The proportion of variation explained by age at marriage is (unadjusted) η^2 = 0.10 and (adjusted) β^2 = 0.07 respectively.

Religious affiliation of women is the sixth strongest influential factor for explaining the proportion of variability on standard of living status of ever-married women. The strength of explaining the variability by this variable is (unadjusted) η^2 = 0.04 and (adjusted) β^2 = 0.06. The results show that the effect of women's number of living children and marital status are seventh and eighth strongest influential factors for explaining the proportion of variability on standard of living status of ever-married women among the selected variables respectively. The proportion of variance explained by women's number of living children is (unadjusted) η^2 = 0.09 and (adjusted) β^2 = 0.05 where as the proportion of variance explained by marital status of women is the lowest (unadjusted value η^2 = 0.02 and adjusted value β^2 = 0.04).

5.6 Factors Affecting Reproductive Health Status of Ever-married Women

Of all the variables mentioned in section 5.3 the following are considered to look into the extent of the effect on reproductive health status of ever-married women: current age of women, marital status, age at marriage, children ever born, number of living children, place of residence, religion, and family size of the women. In this case reproductive health status of ever-married women is taken to be the dependent variable and the aforesaid demographic variables as explanatory variables.

Table-5.2 shows the mean of the reproductive health status of ever-married women both adjusted and unadjusted resulted from MCA by some demographic differentials and their contribution on reproductive health status. The salient features of the table-5.2 are as follows:

i. Current age of ever-married women has an important effect on their reproductive health status. The mean reproductive health status of ever-married women belong to the age group less than 20 years, 20-29 years, 30-39 years and 40 years or above are respectively 1.87, 1.93, 2.16 and 1.85. Among the women with age group 30-39 years have higher reproductive health status than the women of all other age groups. The reproductive health status, which is 0.29 times higher the women belong to age group 30-39 compared to those women with age below 20 years and 0.23 times higher than those women with belong to age group 20-29 years. So, it can be conclude that ever-married women reproductive health status increase with the increasing their current age.

ii. Marital status has a significant ($p < 0.05$) effect on reproductive health status of ever-married women in Bangladesh. Women who have married show the highest reproductive health status and it is lowest for the women with divorced or separated. It is observed that the mean (adjusted) status of reproductive health for ever-married women are1.96 and 1.49 respectively for married and divorced or separated women.

iii. Another demographic factor such as age at marriage has significant ($p < 0.01$) impact on reproductive health status of ever-married women. The higher age at marriage requires the higher reproductive health status of women. The reproductive health status for women with age at marriage after 18 years is 0.11

times higher than the women with age at marriage below 18 years or at the age of 18 years.

iv. Women's children ever born has highly significant ($p < 0.001$) effect on their reproductive health status in Bangladesh. The mean value of reproductive health status of ever-married women decreases with the increasing their children ever born. Women having one to two children have 0.09 times higher mean reproductive health status than those women who have three or more children ever born.

v. Women's number of living children has a significant ($p < 0.01$) influence on their reproductive health status. Women having one living children have 0.34 times higher mean status of reproductive health than those women who have three or more living children. The women with two living children have 0.07 times higher mean status of reproductive health than those women who have three or more living children. From the findings, it can be conclude that the mean of women's reproductive health status decreases with the increasing their number of living children.

vi. Place of residence has highly significant ($p < 0.001$) effect on reproductive health status of ever-married women in Bangladesh. Women in rural areas have lower reproductive health status (in terms of mean value of reproductive health status) than in urban areas. The mean reproductive health status of ever-married women (adjusted) in rural and urban areas are respectively 1.85 and 2.12. This observed differential may be attributed to lower age at marriage, higher level of children ever born, and higher level of living children and large family size and other social amenities in the rural areas which have the effect of lower reproductive health status of ever-married women.

vii. Religious affiliation has a significant ($p < 0.05$) effect on reproductive health status of ever-married women. The Non-Muslims have higher reproductive health status than Muslims. It may be due to the religious systems which influence individuals.

viii. The mean status of reproductive health of ever-married women is 1.95 for those women who have family size 1-4 members, and it is 0.01 times lower than the mean of reproductive health of women who have family members seven or more. But the on average reproductive health status of ever-married women having family members 5-6 is 0.02 times lower than those women who have family members seven or more.

Table-5.2: Results of MCA of reproductive health status of ever-married women with indicated demographic characteristics as explanatory variables

Explanatory variables	Reproductive health status			
	Predicted mean		Correlation ratio	
	Unadjusted mean	Adjusted mean	(Unadjusted)	(Adjusted)
Current age				
Less than 20 years	1.98	1.87		
20-29 years	1.95	1.93	0.05	0.12
30-39 years	1.92	2.16		
40 years or more	1.68	1.85		
Marital status*				
Married	1.96	1.96	0.06	0.07
Divorced/Separated	1.57	1.49		
Age at marriage**				
≤18 years	1.90	1.92	0.10	0.06
>18 years	2.07	2.03		
Children ever born***				
1-2 children	2.04	1.98	0.17	0.05
3 or more	1.75	1.89		
Living children**				
1 children	2.04	2.06		
2	2.02	1.99	0.17	0.18
3 or more	1.73	1.72		
Place of residence***				
Urban	2.14	2.12	0.19	0.17
Rural	1.84	1.85		
Religion*				
Muslim	1.94	1.94	0.07	0.04
Non-Muslim	2.15	2.09		
Family size				
1-4	2.01	1.95		
5-6	1.90	1.94	0.06	0.01
7 or more	1.95	1.96		
Grand Mean = 1.95, Multiple R^2 = 0.820, Significance of model = 0.001				

Note: Level of significance ***** $p < 0.05$ ****** $p < 0.01$ ******* $p < 0.001$

5.7 Intensity of the Effects of the Demographic Factors on Reproductive Health Status of Ever-married Women

From an earlier section it appears that demographic variables that are considered in the analysis have differential effects on reproductive health of ever-married women, producing different levels by various socio-demographic subgroups. However, the intensity of the influence of the variables considered is yet to be analyzed. Here an attempt is made to look at the extent of influences of the variables on reproductive health on the basis of the results produced by Multiple Classification Analysis (MCA). As regards the index of reproductive health, the reproductive health status of ever-married women is taken as the dependent variable. The results of MCA are given in Table-5.2. It presents both together with the values of η^2 and β^2 produced from MCA with data of 2014 BDHS. Table-5.3 produces the results of zero order correlation coefficients of reproductive health status of ever-married women with various demographic variables. The demographic variables will have to affect reproductive health status through some mechanism. The mechanism of relationships is, therefore, investigated using the technique of Multiple Classification Analysis (MCA), using the values of η^2 and β^2 in Table-5.2 and the values of Table-5.3. The salient features of the data in Table-5.2 and Table-5.3 are:

i. Current age of ever-married women has a positive association with reproductive health status of ever-married women and the correlation coefficient is found to be r = 0.012. The results revealed that the effect of the current age is the third strongest influential factor for explaining the proportion of variation on reproductive health status of ever-married women among all other included variables. The strength of explaining variability by current age of ever-married women is (unadjusted) η^2 = 0.05 and (adjusted) β^2 = 0.12 respectively.

ii. Women's marital status has also a significant ($p < 0.05$) contribution on their reproductive health status producing a negative association (r = - 0.041) with reproductive health status of ever-married women. From Table-5.2, it is seen that the effect of marital status is the fourth strongest influential factor for explaining the proportion of variation on reproductive health status of ever-married women among the remaining variables. The proportion of variance explained by marital status is (unadjusted) η^2 = 0.06 and (adjusted) β^2 = 0.07.

This is the fourth strongest determinants of reproductive health status of ever-married women among selected demographic variables.

iii. Age at marriage has a significant ($p < 0.01$) contribution on reproductive health status of ever-married women and it is positively associated (r = 0.098) with women reproductive health status. Among the included variables, age at marriage is the fifth strongest influential factor for explaining the proportion of variation on reproductive health status of ever-married women. The proportion of variance explained by age at marriage is (unadjusted) $\eta^2 = 0.10$ and (adjusted) $\beta^2 = 0.06$ respectively.

iv. Women's children ever born has highly significant ($p < 0.001$) influence on reproductive health status of ever-married women producing a negative association (r = - 0.161) with reproductive health status of ever-married women. Table-5.2 also shows that women's children ever born is the sixth strongest influential factor for explaining the variation on reproductive health status of ever-married women as well as the proportion of variance explained by women's children ever born is (unadjusted) $\eta^2 = 0.17$ and (adjusted) $\beta^2 = 0.05$ respectively.

v. Women's number of living children has a significant ($p < 0.01$) influence on reproductive health status of ever-married women and it is negatively associated with reproductive health status of ever-married women. The correlation coefficient is found to be r = - 0.150. Among the included variables women's number of living children is the first strongest influential factor for explaining the variation on reproductive health status of ever-married women. The proportion of variance explained by women's number of living children is (unadjusted) $\eta^2 = 0.17$ and (adjusted) $\beta^2 = 0.18$ respectively.

vi. Place of residence has highly significant ($p < 0.001$) contribution on reproductive health status of ever-married women. Place of residence has also the negative association (r = - 0.217) with reproductive health status of ever-married women. Findings indicated that the effect of place of residence has found to be the second strongest influential factors for explaining the proportion of variation on reproductive health status of ever-married women among all other selected variables. The proportion of variance explained by place of residence is (unadjusted) $\eta^2 = 0.19$ and (adjusted) $\beta^2 = 0.17$.

vii. Religion has also a significant ($p < 0.05$) contribution on reproductive health status of ever-married women and found to be positive association (r = 0.047). Table-5.2 shows that the effect of religion is found to be the seventh strongest influential factors for explaining the variation on reproductive health status of ever-married women for all other variables. The strength of explaining variability is (unadjusted) $\eta^2 = 0.07$ and (adjusted) $\beta^2 = 0.05$.

Table-5.3: Zero-order correlation coefficients of reproductive health status with selected demographic variables

	CAR	CMS	AM	CEB	LC	PR	R	FS	RHS
CAR	1.000	0.158**	0.044**	0.518**	0.562**	-0.023**	0.039**	-0.069**	0.012
CMS		1.000	-0.007	0.029**	0.003	-0.036**	-0.001	-0.055**	-0.041*
AM			1.000	-0.021	-0.021	-0.055**	0.053**	-0.009	0.098**
CEB				1.000	0.841**	0.099**	-0.044**	0.175**	-0.161**
LC					1.000	0.088**	-0.039**	0.151**	-0.150**
PR						1.000	-0.012	0.043**	-0.217**
R							1.000	-0.020**	0.047*
FS								1.000	-0.010
RHS									1.000

****** Correlation is significant at the 0.01 level and ***** Correlation is significant at the 0.05 level.

viii. Women's family size has a negative association with reproductive health status of ever-married women and it is found to be r = - 0.010. The results also revealed that the effect of family size is found to be the lowest influential factor for explaining the variation on reproductive health status of ever-married women (unadjusted $\eta^2 = 0.06$ and adjusted $\beta^2 = 0.01$).

5.8 Factors Affecting Health Status of Ever-married Women

Of all the variables mentioned in section 5.3 the following are considered to look into the extent of the effect on health status of ever-married women: current age, marital status, age at marriage, children ever born, number of living children, place of residence, religion, and family size of the ever-married women. In this case ever-married women health status (BMI) is taken to be the dependent variable and the aforesaid demographic variables as explanatory variables.

Table-5.4 shows the mean of the ever-married women health status both adjusted and unadjusted resulted from MCA by some demographic differentials and their contribution on ever-married women health status. The salient features of the table-5.4 are as follows:

i. Current age of ever-married women has highly significant ($p < 0.001$) effect on their health status. The mean value (adjusted) of health status of ever-married women belong to the age group less than 20 years, 20-29 years, 30-39 years and 40 years or above are 1.69, 1.97, 2.18 and 2.14 respectively. Among the ever-married women with age group 30-39 years have higher health status than the women of all other age groups. The health status, which is 0.49 times higher the women belong to age group 30-39 compared to those women with age below 20 years and 0.21 times higher than those women with belong to age group 20-29 years. So, it can be conclude that ever-married women health status increase with the increasing their current age.

ii. Marital status has a significant ($p < 0.001$) impact on health status of ever-married women. Women who have married show the highest health status and it is lowest for the women with divorced or separated. From Table-5.4, it is also observed that the mean (adjusted) health status of ever-married women is 2.07 and 1.84 respectively for married and divorced or separated women.

iii. Age at marriage has an important effect on health status of ever-married women. The higher the age at marriage the lower health status of ever-married women. The health status for women with age at marriage after 18 years is only 0.01 times lower than the women with age at marriage below or at the age of 18 years.

iv. Women's children ever born has a significant ($p < 0.01$) effect on health status of ever-married women. The mean health status of ever-married women decreases with the increasing level of children ever born of ever-married women. Women having one to two children have 0.15 times higher mean health status than those women who have three or more children ever born.

v. Women's number of living children has highly significant ($p < 0.001$) impact on health status of ever-married women in Bangladesh. Women having one living children have 0.04 times lower mean health status than those women who have

three or more living children. The women with two living children have 0.02 times higher mean health status than those women who have three or more living children. From these findings, it can be conclude that women health status decrease with the increasing their number of living children.

Table-5.4: Results of MCA for ever-married women health status with indicated demographic characteristics as explanatory variables

Explanatory variables	Women health status			
	Predicted mean		Correlation ratio	
	Unadjusted mean	Adjusted mean	(Unadjusted)	(Adjusted)
Current age* **				
Less than 20 years	1.73	1.69		
20-29 years	2.01	1.97	0.19	0.23
30-39 years	2.17	2.18		
40 years or more	2.09	2.14		
Marital status* **				
Married	2.07	2.07	0.06	0.09
Divorced/Separated	1.90	1.84		
Age at marriage				
≤ 18 years	2.05	2.06	0.02	0.01
>18 years	2.07	2.05		
Children ever born**				
1-2 children	2.06	2.13	0.01	0.11
3 or more	2.05	1.98		
Living children* **				
1 children	1.95	2.02	0.11	0.18
2	2.14	2.08		
3 or more	2.05	2.06		
Place of residence* **				
Urban	2.22	2.21	0.18	0.17
Rural	1.97	1.98		
Religion				
Muslim	2.05	2.06	0.01	0.01
Non-Muslim	2.07	2.04		
Family size				
1-4	2.08	2.06	0.05	0.01
5-6	2.06	2.06		
7 or more	2.01	2.05		
Grand Mean = 2.06, Multiple R^2 = 0.840, Significance of model = 0.000				

Note: Level of significance * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

vi. Place of residence has highly significant ($p < 0.001$) effect on health status of ever-married women in Bangladesh. Women in rural areas have lower health status (in terms of mean health status) than in urban areas. The mean (adjusted) values of health status of ever-married women in rural and urban areas are respectively 1.98 and 2.21. This observed differential may be attributed to lower age at marriage, higher level of children ever born, higher level of living children, large family size and other social amenities in the rural areas which have effect on health status of ever-married women in Bangladesh.

vii. The Non-Muslims ever-married women have lower health status than Muslims. It may be due to the religious systems which influence individuals.

viii. The mean health status of ever-married women is 2.06 for those women who have family size 1-4 members, and it is 0.01 times higher than the mean health status of ever-married women who have family members seven or more. But, on an average health status of ever-married women having 5-6 family members is only 0.01 times higher than those women who have family members seven or more.

5.9 Intensity of the Effects of Demographic Factors on Ever-married Women Health Status

From an earlier section it appears that demographic variables which are considered in the analysis have differential effects on ever-married women health status, producing different levels by various socio-demographic subgroups. However, the intensity of the influence of variables considered is yet to be analyzed. Here an attempt is made to look at the extent of influences of the variables on health status of ever-married women on the basis of the results produced by Multiple Classification Analysis (MCA). As regards the index of health status, ever-married women health status is taken as the dependent variable. The results of MCA are given in Table-5.4. It presents both together with the values of η^2 and β^2 produced from MCA with data of 2014 BDHS. Table-5.5 produced the results of zero order correlation coefficients of health status of ever-married women with various demographic variables. The demographic variables will have to affect ever-married women health status through some mechanism. The mechanism of relationships is, therefore, investigated using the technique of Multiple Classification Analysis (MCA), using the values of η^2 and β^2

in Table-5.4 and the values of Table-5.5. The salient features of the data in Table-5.4 and Table-5.5 are:

i. Current age of ever-married women has highly significant ($p < 0.001$) influence on their health status in Bangladesh. The results also revealed that current age has a positive contribution on ever-married women health status and the correlation coefficient is found to be r = 0.144. From the selected variables current age is the first strongest influential factor for explaining the variation on health status of ever-married women among all other selected variables. The proportion of variability explained by women's current age is (unadjusted) $\eta^2 = 0.19$ and (adjusted) $\beta^2 = 0.23$ respectively.

ii. Marital status has a significant ($p < 0.001$) contribution on health status of ever-married women producing a negative association (r = - 0.050) with ever-married women health status. The proportion of variation explained by marital status is (unadjusted) $\eta^2 = 0.06$ and (adjusted) $\beta^2 = 0.09$. This is the fifth strongest predictor of health status of ever-married women among all other selected demographic variables.

iii. Age at marriage has an important contribution on health status of ever-married women and it is positively associated (r = 0.020) with ever-married women health status. Among the included variables, age at marriage has the lowest influence on health status of ever-married women. The proportion of variation explained by age at marriage is (unadjusted) $\eta^2 = 0.02$ and the proportion of variation explained by this variable it is (adjusted) $\beta^2 = 0.01$.

iv. Women's children ever born has highly significant ($p < 0.01$) influence on health status of ever-married women producing a negative association (r = - 0.030) with health status of ever-married women. The results also show that the effect of women's children ever born is the fourth strongest influential factors on health status of ever-married women as well as the proportion of variation explained by children ever born is (unadjusted) $\eta^2 = 0.01$ and (adjusted) $\beta^2 = 0.11$.

v. Women's number of living children has highly significant ($p < 0.001$) influence on their health status and it is positively associated with ever-married women health status. The correlation coefficient is found to be r = 0.018. Among the included variables women's number of living children is the

second most important factor for explaining the variation on health status of ever-married women. The proportion of variation explained by women's number of living children is (unadjusted) η^2 = 0.11 and (adjusted) β^2 = 0.18 respectively.

vi. Place of residence has highly significant (p < 0.001) contribution on health status of ever-married women in Bangladesh. Place of residence has also the negative association (r = -0.191) with health status of ever-married women. Among the included variables place of residence is the third strongest influential factor for explaining the variation on health status of ever-married women as well as the proportion of variation explained by place of residence is (unadjusted) η^2 = 0.18 and the proportion of variation explained by this variable it is (adjusted) β^2 = 0.17.

Table-5.5: Zero order correlation coefficients of ever-married women health status with selected demographic variables

	CAR	CMS	AM	CEB	LC	PR	R	FS	WHS
CAR	1.000	0.158**	0.044**	0.518**	0.562**	-0.023**	0.039**	-0.069**	0.144**
CMS		1.000	-0.007	0.029**	0.003	-0.036**	-0.001	-0.055**	-0.050**
AM			1.000	-0.021	-0.021	-0.055**	0.053**	-0.009	0.020
CEB				1.000	0.841**	0.099**	-0.044**	0.175**	-0.030**
LC					1.000	0.088**	-0.039**	0.151**	0.018**
PR						1.000	-0.012	0.043**	-0.191**
R							1.000	-0.020**	-0.002
FS								1.000	-0.050**
WHS									1.000

**. Correlation is significant at the 0.01 level and *. Correlation is significant at the 0.05 level.

vii. Religion has also an important contribution on health status of ever-married women and found to be negative association (r = -0.002). Religion becomes less effect on health status of ever-married women. The strength of explaining variability is (unadjusted) η^2 = 0.01 and (adjusted) β^2 = 0.01.

viii. Women's family size has a negative association with health status of ever-married women and it is found to be r = -0.050. Women's family size has another less important effect (unadjusted η^2 = 0.05 and adjusted β^2 = 0.01) on health status of ever-married women.

5.10 Summary

In multiple classification analysis (MCA), current age of ever-married women has highly significant ($p < 0.001$) effect on their standard of living status and ever-married women living standard increase with the increase of their current age. Moreover, the effect of current age is found to be the second strongest influential determinant for explaining the variation on standard of living status as well as the proportion of variation explained by women's current age is (unadjusted) $\eta^2 = 0.05$ and (adjusted) $\beta^2 = 0.14$ respectively. Marital status is also an important factor that affecting the standard of living status of ever-married women. The mean difference for married women is 0.24 times higher than divorced or separated women in Bangladesh and the proportion of variation explained by marital status is (unadjusted) $\eta^2 = 0.02$ and (adjusted) $\beta^2 = 0.04$. Another demographic factor such as age at marriage has highly significant ($p < 0.001$) effect on standard of living status of ever-married women in Bangladesh. Although the average level of age at marriage is very low, age at marriage still has a strong relationship with standard of living status. Moreover, women who marry earlier or at the age of 18 years adjusted mean value for standard of living status 0.11 times lower than those women who marry after age of 18 years and the effect of women's age at marriage is the fifth strongest influential factor for explaining the proportion of variability of ever-married women standard of living status among the selected variables with proportion of variation (unadjusted) $\eta^2 = 0.10$ and (adjusted) $\beta^2 = 0.07$ respectively.

Women's children ever born has highly significant ($p < 0.001$) effect on their standard of living status in Bangladesh. The mean value of ever-married women standard of living status decreases with the increase of their children ever born. Women's children ever born have found to be the third strongest influential factor for explaining variability of ever-married women standard of living status among the included variables and the proportion of variance explained by women's children ever born are (unadjusted) $\eta^2 = 0.11$ and (adjusted) $\beta^2 = 0.13$ respectively. Another demographic factor women's number of living children has significant ($p < 0.01$) impact on their standard of living status. The mean value of ever-married women standard of living status decreases with the increase of their number of living children. The proportion of variation explained by women's number of living children is (unadjusted) $\eta^2 =$

0.09 and (adjusted) β^2 = 0.05. Place of residence has a highly significant ($p < 0.001$) effect on standard of living status of ever-married women in Bangladesh. The mean value of standard of living status for women's in urban residence is 0.68 times higher than women with rural residence and the proportion of variation for standard of living status explained by women's place of residence is the highest (unadjusted value η^2 = 0.44 and adjusted value β^2 = 0.43) among all other variables in the model. Demographic variable such as women's family size has highly significant ($p < 0.001$) contribution on their standard of living status and the effect of family size is the fourth strongest influential predictor on standard of living status as well as the proportion of variation explained by family size is (unadjusted) η^2 = 0.06 and (adjusted) β^2 =0.09 respectively.

For reproductive health status of ever-married women, MCA shows that women's current age is one of the most important factors for their reproductive health status and the effect of the current age is the third strongest influential factor for explaining the proportion of variation on reproductive health status of ever-married women among all other included variables. The strength of explaining variability by current age of ever-married women is (unadjusted) η^2 = 0.05 and (adjusted) β^2 = 0.12 respectively. Marital status has a significant ($p < 0.05$) contribution on their reproductive health status producing a negative association (r = - 0.041) with reproductive health status of ever-married women. The proportion of variation explained by marital status is (unadjusted) η^2 = 0.06 and (adjusted) β^2 = 0.07. This is the fourth strongest determinants of reproductive health status of ever-married women among selected demographic variables. Another influential significant ($p < 0.01$) factor is age at marriage for reproductive health status of ever-married women in Bangladesh. The higher age at marriage requires the higher reproductive health status of women. Among the included variables, age at marriage is the fifth strongest influential predictor for explaining the proportion of variation on reproductive health status of ever-married women and the proportion of variation explained by age at marriage is (unadjusted) η^2 = 0.10 and (adjusted) β^2 = 0.06 respectively.

Women's children ever born has highly significant ($p < 0.001$) effect on their reproductive health status in Bangladesh. The mean value of reproductive health status of ever-married women decreases with the increase their children ever born.

Moreover, women's children ever born is the sixth strongest influential determinant for explaining the variation on reproductive health status of ever-married women as well as the proportion of variability explained by women's children ever born is (unadjusted) η^2 = 0.17 and (adjusted) β^2 = 0.05 respectively. Although the average level of living children is high, women's number of living children still has significant (p < 0.01) impact on reproductive health status of ever-married women and it is negatively associated with reproductive health status of ever-married women. Among the included variables women's number of living children is the first strongest influential determinant for explaining the variability on reproductive health status of ever-married women and the proportion of variation explained by this determinant is (unadjusted) η^2 = 0.17 and (adjusted) β^2 = 0.18 respectively. Place of residence has highly significant (p < 0.001) contribution on reproductive health status of ever-married women and women in rural areas have lower reproductive health status (in terms of mean value of reproductive health status) than women in urban areas in Bangladesh. Findings also indicate that the effect of place of residence is found to be the second strongest influential factors for explaining the proportion of variation on reproductive health status of ever-married women among all other selected variables and the proportion of variation explained by place of residence is (unadjusted) η^2 = 0.19 and (adjusted) β^2 = 0.17.

For health status of ever-married women, MCA shows that current age of ever-married women has highly significant (p < 0.001) effect on their health status and ever-married women health status increase with the increase of their current age in Bangladesh. From the selected variables current age is the first strongest influential factor for explaining the variation on health status of ever-married women among all other selected variables and the proportion of variability explained by this factor is (unadjusted) η^2 = 0.19 and (adjusted) β^2 = 0.23 respectively. Marital status has significant (p < 0.001) contribution on health status of ever-married women. Women who are married show the highest health status and it is lowest for the divorced or separated women. The proportion of variation explained by marital status is (unadjusted) η^2 = 0.06 and (adjusted) β^2 = 0.09. Marital status is the fifth strongest predictor of health status of ever-married women among all other selected demographic variables.

Women's children ever born has significant ($p < 0.01$) effect on their health status and the mean health status of ever-married women decreases with the increase of their children ever born in Bangladesh. The effect of women's children ever born is the fourth strongest influential determinant on health status of ever-married women as well as the proportion of variation explained by children ever born is (unadjusted) η^2 = 0.01 and (adjusted) β^2 = 0.11. Although the average level of living children is high, women's number of living children still has highly significant ($p < 0.001$) impact on their health status and ever-married women health status decrease with the increase of their number of living children in Bangladesh. Among the included variables women's number of living children is the second most important determinant for explaining the variation on health status of ever-married women and the proportion of variability explained by women's number of living children is (unadjusted) η^2 = 0.11 and (adjusted) β^2 = 0.18. Place of residence has highly significant ($p < 0.001$) contribution on health status of ever-married women and women in rural areas are lower health status (in terms of mean value of health status) than women in urban areas in Bangladesh. Among the included variables place of residence is the third strongest influential factor for explaining the variation on health status of ever-married women as well as the proportion of variability explained by place of residence is (unadjusted) η^2 = 0.18 and (adjusted) β^2 = 0.17 respectively.

Key findings of this chapter:

- MCA results show that current age of ever-married women is an important factor that affects their standard of living status and ever-married women standard of living status increase with the increase of their current age.
- Women's age at marriage is an another most impotent factor that affect their standard of living status and ever-married women standard of living status increase with the increase of their age at marriage in Bangladesh.
- Women's children ever born is the third strongest influential factor for explaining variability of ever-married women standard of living status and women's children ever born decreases with the increase of their standard of living status.
- Women's number of living children is an another most impotent factor that affect their standard of living status The mean value of ever-married women

standard of living status decreases with the increase of their number of living children in Bangladesh.

- Place of residence is the first strongest influential factor for explaining the variability on standard of living status of ever-married women. Standard of living status with urban residence women is higher than the women with rural residence.
- In the case of reproductive health, current age of ever-married women is the first strongest influential factor for explaining the variation on their health status and ever-married women reproductive health status increase with the increase of their current age.
- Another influential factor is age at marriage for reproductive health and the higher age at marriage requires the higher reproductive health status of ever-married women in Bangladesh.
- Women children ever born are the strongest influential determinant for explaining the variability on their reproductive health status. Reproductive health status of ever-married women decreases with the increase of their level of children ever born.
- Women's number of living children is the first strongest influential determinant for explaining the variability on reproductive health status and women's reproductive health status decreases with the increase of their number of living children in Bangladesh.
- For health status of ever-married women, current age is the first strongest influential factor for explaining the variation on their health status among all other selected variables. Ever-married women health status increase with the increase of their current age in Bangladesh.
- The effect of women number of living children is the second most important determinant for explaining the variation on their health status and ever-married women health status decrease with the increase of their number of living children in Bangladesh.

Chapter 6

Factor Analysis

6.1 Introduction

The main purpose of Factor Analysis is to investigate and identify the responsible factors for demographic, poverty and reproductive health related variables of ever-married women in Bangladesh based on BDHS 2014 data. In this study factor analysis has been employed to investigate and determine responsible demographic, poverty and reproductive health factors to explain the respective set of variables in an effort to find a new set of variables, fewer in number than the original variables. To extract the significant factors for demographic, poverty and reproductive health related variables of ever-married women in Bangladesh, factor analysis has been used in this chapter based on principal components. Factor analysis is a data reduction technique for investigating interdependence. By factor analysis means the study of interrelations among the variables in an effort to find a new set of variables, fewer in number than the original variables (Takane and Leeuw 1987).

The essential purpose of factor analysis is to describe, if possible, the covariance relationships in terms of a few underlying, but unobservable random quantities called factor. If the variables can be grouped by their correlations i.e., all variables within a particular group are highly correlated among themselves, but have relatively small correlation with variables in a different groups.

A huge number of variables can be used to describe a community- degree of industrialization, commercial, activity, population mobility, average family income, extent of home ownership, birth rate and so forth, however, description of that is meant by the term "community" might be greatly simplified if it has possible to identify underlying dimension, or factors or communities.

The basic assumption of factor analysis is that underlying dimensions, or factors, can be used to explain complex phenomena. Observed correlations between variables result from their sharing these factors. For example, correlations between test scores might be attributable to such shared factors as general intelligence, abstract reasoning skill, and reading comprehension. The goal of factor analysis is to identify the not directly observable factors based on a set of observable variables.

The mathematical model for the factor analysis appears somewhat similar to a multiple regression equation. Each variable is expressed as a linear combination of factors, which are not actually observed.

In general, the model for the i^{th} standardized variable is written as –

$$X_i = A_{il}F_1 + A_{i2}F_2 + \ldots\ldots\ldots\ldots\ldots + A_{ik}F_k + U_i,$$

where, F's are the common factors

U_i is unique factor, and

A's are the constants used to combine the K factors.

The unique factors are assumed uncorrelated with each other and with the common factors.

The general expression for the estimate of the j^{th} factor

$$F_j = \sum_{i=1}^{P} W_{ji}X_i = W_{jl}X_1 + W_{j2}X_2 + \ldots\ldots\ldots\ldots\ldots + W_{jP}X_P,$$

where W_i 's are factor score coefficients,

X_i is the i^{th} variable

F_j is the j^{th} factor score and

P is the number of variables.

Factor analysis is carried out in four steps:

- First the correlation matrix for all variables is computed. Variables that do not appear to be related to other variables can be identified from the matrix and associated statistics. The appropriateness of the factor model is also be evaluated. At this step we also decided what to do with cases that have missing values for some of the variables.
- In the second step, factor extraction-the number of factors necessary to represent the data and the method of calculating them - is determined. At this step, we also "ascertain how well the chosen model fits the data.
- The third step, rotation, focuses on transforming the factors to make them more interpretable.
- At the fourth step, scores for each factor is computed for each case. These scores can be used in a variety of other analysis.

6.2 Examination of correlation matrix

The first step of factor analysis is examination of correlation matrix (Appendix-C). At initial stage it is observed that there are 27 variables are included in to the correlation matrix i.e., current age of respondents (C_age), marital status (M_status), age at marriage (A_marriage), children ever born (CEB), number of living children (L_child), place of residence (P_resi), Religion, family size (F_size), household electricity (H_elec), household radio (H_radio), household television (H_tele), household refrigerator (H_refri), household bicycle (H_bicy), household cooking fuel (H_cook), household drinking water (H_drink), household toilet facility (H_toilet), household floor materials (H_floor), respondents mass media exposure (M_media), number of visit antenatal care (VAC), place of delivery (PD), health checkup after delivery (HCAD), current use of contraceptive (CUCM), delivery by caesar (DC), postnatal care providers (PCRF), place of first postnatal care (PFPC), contraceptive method types (CMT), and fertility planning status (FPS). The variables are grouped by their correlations and variables within a particular group are highly correlated among themselves but have relatively small correlations with variables in different group and correlation's within the groups are positive but each and every correlation's between the groups are negative.

So, the present study like to point out that first group belongs to Demographic indicators, second group belongs to Poverty indicators and third group belongs to Reproductive health indicators. All the correlations are highly significant. Most of them are significant at one percent level and some others are significant at 5 percent level. This indicates factor analysis technique may be appropriate to the data.

6.3 Sampling adequacy

The Kaiser-Meyer-Olkin (1974) index is used to compare the magnitudes of the observed correlation coefficients with the magnitude of the partial correlation coefficient to identify whether correlation variables are preferable or not for factor analysis. It is computed as

$$KMO = \frac{\sum\sum_{i \neq j} r_{ij}^2}{\sum\sum_{i \neq j} r_{ij}^2 + \sum\sum_{i \neq j} a_{ij}^2},$$

where, r_{ij} is the simple correlation coefficient between variables i and j, and

a_{ij} is the partial correlation coefficient between variables i and j.

Small values for KMO indicates that a factor analysis of the variables may not be good idea, Kaiser characterizes the measures as 0.90 to be marvelous, 0.80 as

meritorious, 0.70 as middling, 0.60 as mediocre, 0.50 as miserable, and below 0.50 as unacceptable (Marija 1988).

6.4 Estimation of Poverty, Reproductive Health and Demographic Factors

The correlation matrix for the 27variables is shown in appendix-C. Since one of the goals of factor analysis is to obtain "factor" that help explain these correlation's the variables must be related to each other for the factor model to be appropriate. If the correlations between the variables are small, it is unlikely that they share common factors. Appendix-C shows that most of the coefficients are greater than 0.5 in absolute value. All variables have large correlations with at least some of the other variables in the set.

Bartlett's test of sphericity can be used to test the hypothesis that the correlation matrix is an identity matrix. That is all diagonal terms are 1 and the off- diagonal terms are 0. The test requires that the data be a sample from a multivariate normal population. Our computed value of the test statistics for sphericity (based on the chi-square transformation of the determinant of the correlation matrix) is very large (1902.520) and the associated significance level is smaller than 0.01. So, it appears that the population matrix is not an identity. That is, in this situation use of the factor model should be appropriate. Again since our computed value of Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy gives a value of 0.704 which indicates that factor analysis can be proceed comfortably.

Table-6.1: KMO and Bartlett's test of sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.704
Bartlett's Test of Sphericity	Approx. Chi-Square	1902.520
	df	351
	Sig.	0.000

Determinant of the Correlation matrix = 0.00000172

Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.704

Bartlett's Test of Sphericity = 1902.520, Degree of Freedom 351, Significance=0.000

The next step is to factor extraction to determine the factors and obtained estimates of the initial factors from principal components analysis. The first principal component is the combination that accounts for the largest amount of variance in the sample. The

second principal component accounts for the next largest amount of variance and is uncorrelated with the first. Successive components explain progressively smaller portions of the total sample variance, and all are uncorrelated with each other. The initial Statistic (Communality, Eigen values corresponding to each factor, percentage of variation accounted by the factors and cumulative percentage) are shown in Table-6.2. First two columns of the table give the information about the variables whereas the last four columns give information about the factors that are interested. It is possible to compute, as many principal components as there are variables. If all the principal components are used, each variable can be exactly represented by them, but nothing has been gained since there are as many factors (Principal components) as variables. Several procedures have been proposed for determining the number of factors to use in a model. One criterion suggests that only factors that for variance greater than or equal to unity (eigen value is greater than or equal to unity) should be included. But it is not always a good solution. Another procedure is to examine the scree plot (plot of the eigen values).

Table-6.2: Initial statistics for selected variables

Variable	Communality	Factor	Eigen value	Pct of var	Cum pct of var
C_age	1.000	1	4.371	16.187	16.187
M_status	1.000	2	3.393	12.567	28.754
A_marriage	1.000	3	2.835	10.499	39.254
CEB	1.000	4	1.817	6.730	45.984
L_child	1.000	5	1.432	5.303	51.287
P_resi	1.000	6	1.388	5.139	56.426
Religion	1.000	7	1.245	4.611	61.037
F_size	1.000	8	1.131	4.189	65.226
H_elec	1.000	9	1.024	3.791	69.017
H_radio	1.000	10	0.955	3.537	72.555
H_tele	1.000	11	0.920	3.409	75.963
H_refri	1.000	12	0.855	3.167	79.130
H_bicy	1.000	13	0.698	2.585	81.715
H_cook	1.000	14	0.647	2.396	84.111
H_drink	1.000	15	0.570	2.112	86.223
H_toilet	1.000	16	0.534	1.979	88.201
H_Floor	1.000	17	0.506	1.875	90.076
M_media	1.000	18	0.463	1.714	91.790
VAC	1.000	19	0.420	1.556	93.347
PD	1.000	20	0.362	1.341	94.688
HCAD	1.000	21	0.321	1.189	95.877
CUCM	1.000	22	0.305	1.128	97.005
DC	1.000	23	0.245	0.906	97.911
PCRF	1.000	24	0.229	0.849	98.760
PFPC	1.000	25	0.212	0.787	99.547
CMT	1.000	26	0.105	0.388	99.935
FPS	1.000	27	0.017	0.065	100.000

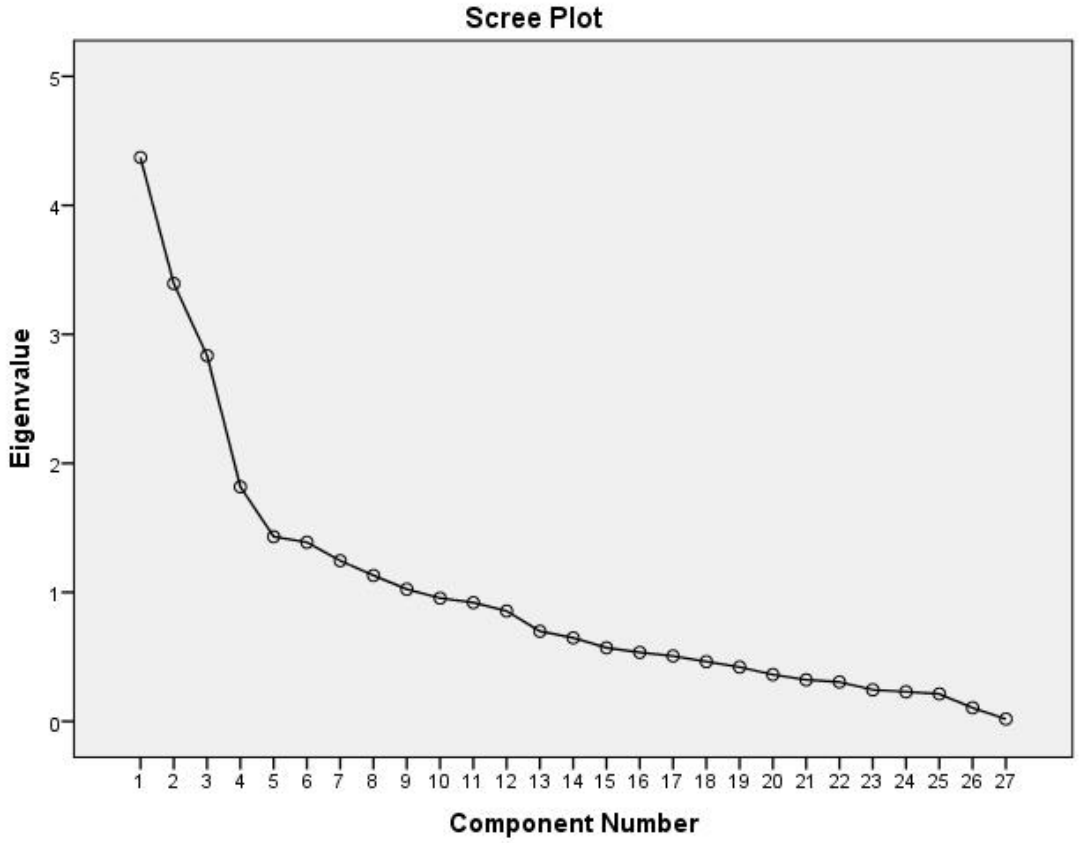


Figure-6.1: Scree plot for selected variables

The total variance explained by each factor is listed in the column labeled eigen value in Table-6.2. The next column contains the percentage of the total variance attributable to each factor. Table-6.2 also shows that variance due to first factor is 4.371, variance due to second factor is 3.393, variance due to third factor is 2.835, variance due to fourth factor is 1.817, variance due to fifth factor is 1.432, variance due to sixth factor is 1.388, variance due to seventh factor is 1.245, variance due to eight factor is 1.131, and variance due to nine factor is 1.024 as explained out of total variance 15. Note that total variance is 15, because all the variables are expressed in standardized form. To decide the number of common factors we take the criteria of eigen value greater than or equal to one.

From the table-6.2 it is observed that there are nine eigen value greater than unity and almost 69.017 percent of the total variance is attributable to these nine factors. Also the scree plot shown in Figure-6.1 suggests that a model with five factors may be adequate to represent the data.

Table-6.3: Factors matrix for selected variables

	Factor								
	1	2	3	4	5	6	7	8	9
C_age	-0.378	-0.121	0.704	-0.071	-0.006	-0.010	-0.051	0.065	-0.057
M_status	-0.066	0.161	-0.199	-0.030	0.009	-0.562	-0.086	0.322	0.148
A_marriage	0.040	-0.063	-0.110	-0.258	0.387	0.502	-0.305	-0.168	0.106
CEB	-0.056	-0.229	0.659	0.051	-0.124	-0.051	0.008	0.032	0.017
L_child	-0.135	-0.236	0.663	0.058	-0.076	-0.028	0.010	0.028	0.004
P_resi	-0.493	-0.254	-0.257	0.241	0.407	-0.044	0.149	0.014	0.277
Religion	0.024	-0.153	0.116	0.207	-0.172	0.559	-0.262	0.818	0.074
F_size	-0.095	-0.194	0.635	0.137	-0.301	0.263	0.110	-0.130	0.249
H_elec	0.651	-0.064	0.267	-0.027	-0.125	-0.061	0.037	-0.270	-0.009
H_radio	0.155	-0.048	0.119	0.247	0.360	-0.221	0.532	0.288	0.210
H_tele	0.722	0.036	0.315	0.189	-0.188	0.065	0.109	0.032	0.171
H_refri	0.576	-0.073	0.327	0.376	0.251	0.137	-0.096	0.089	0.107
H_bicy	-0.011	-0.057	-0.051	0.263	0.277	0.151	0.416	-0.158	-0.498
H_cook	-0.548	-0.192	-0.281	0.203	0.415	0.103	-0.112	-0.120	0.031
H_drink	0.090	0.116	0.160	0.190	0.622	-0.385	-0.508	-0.074	-0.273
H_toilet	-0.471	-0.003	-0.301	-0.039	-0.156	-0.070	-0.559	0.355	-0.093
H_Floor	0.682	0.085	0.286	-0.127	-0.118	-0.254	0.104	0.140	0.119
M_media	0.419	0.028	0.259	0.072	0.484	-0.086	-0.017	0.335	-0.249
VAC	-0.237	0.510	0.117	-0.015	0.137	0.403	-0.001	0.143	-0.295
PD	-0.105	0.800	0.132	-0.002	0.005	0.012	0.059	-0.005	-0.039
HCAD	-0.201	0.832	0.186	0.091	0.051	0.056	0.064	-0.065	0.169
CUCM	-0.105	-0.224	0.405	-0.557	0.233	0.211	0.072	0.017	0.096
DC	-0.184	0.821	0.137	-0.054	0.084	-0.025	-0.036	0.002	0.052
PCRF	-0.142	0.836	0.179	0.038	0.040	0.038	0.054	-0.104	0.189
PFPC	0.054	-0.558	0.157	0.091	0.296	0.283	-0.325	-0.075	-0.065
CMT	0.082	-0.222	0.251	-0.678	0.118	0.177	0.246	0.040	0.017
FPS	0.338	0.572	-0.159	-0.180	-0.109	0.352	0.138	0.119	0.006

Table-6.3 contains the coefficients that relate the variables to the first nine factors where each row contains the coefficients use to express a standardized variable in terms of the factors.

These coefficients are called factor loadings, since they indicate how much weight is assigned to each factor. Factors with large coefficients (in absolute value) for a value are closely related to the variable. The matrix of factor loadings is called the pattern matrix. It is observed from the Table-6.3 that Factor 1 contains larger loadings for the variables household electricity (H_elec), household television (H_tele), household refrigerator (H_refri), household cooking fuel (H_cook), and household floor materials (H_floor). Factor 2 contains larger loadings for the variables visit antenatal care (VAC), place of delivery (PD), health checkup after delivery (HCAD), delivery by caeser (DC), postnatal care providers (PCRF), place of first postnatal care (PFPC), and fertility planning status (FPS). Factor 3 contains larger loadings for the variables current age of respondents (C_age), children ever born (CEB), number of living children (L_child), and place of residence (P_resi), and family size (F_size) of the respondents. Factor 4 contains larger loadings for the variables current use of contraceptive methods (CUCM) and contraceptive methods types (CMT). Factor 5 contains larger loadings for household drinking water (H_drink) and respondent's mass media exposure (M_media). Factor 6 contains larger loadings for respondent's marital status (M_status) and age at marriage (A_marriage). Factor 7 contains larger loading for the variables respondents' household has radio (H_radio) and household toilet facility (H_toilet). Factor 8 and Factor 9 contain larger loadings for the variables respondents' religion (Religion) and household has bicycle (H_bicy) respectively.

To judge how well the nine factors model describes the original variables, it can be compute the proportion of the variance of each variable explained by the nine factors model.

Since the factors are uncorrelated, the total proportion of variance explained is just the sum of the variance proportions explained by the common factor is called the communality of the variables.

The communalities for selected variables are shown in Table-6.4 together with the percentage of variances accounted for by each of the retained factors. It can be shown that the communalities for the selected variables are very high. That is maximum portion of variation for those variables are explained by the nine factors. It is observed that almost 69.017 percent of the total variation is explained by these nine factors.

Table-6.4: Final statistics for selected variables

Variable	Communality	Factor	Eigen value	Pct of var	Cum pct of var
C_age	0.669	1	4.371	16.187	16.187
M_status	0.520	2	3.393	12.567	28.754
A_marriage	0.627	3	2.835	10.499	39.254
CEB	0.913	4	1.817	6.730	45.984
L_child	0.908	5	1.432	5.303	51.287
P_resi	0.698	6	1.388	5.139	56.426
Religion	0.735	7	1.245	4.611	61.037
F_size	0.722	8	1.131	4.189	65.226
H_elec	0.594	9	1.024	3.791	69.017
H_radio	0.690	10			
H_tele	0.740	11			
H_refri	0.695	12			
H_bicy	0.629	13			
H_cook	0.669	14			
H_drink	0.619	15			
H_toilet	0.482	16			
H_Floor	0.693	17			
M_media	0.691	18			
VAC	0.662	19			
PD	0.674	20			
HCAD	0.818	21			
CUCM	0.649	22			
DC	0.740	23			
PCRF	0.806	24			
PFPC	0.626	25			
CMT	0.686	26			
FPS	0.680	27			

Although the factor matrix obtained in the extraction phase indicates the relationship between the factors and the individual variable, it is usually difficult to identify meaningful factors based on this matrix.

Often the variables are factors do not appear correlated with maximum variables. Since one of the goals of factor analysis is to identify factors that are substantively

meaningful (in the sense that they summarize sets of closely related variables) the rotation phase of factor analysis attempts to transform the initial matrix into one that is easier to interpret. Table-6.5 gives the Rotation (Varimax Rotation) factor matrix for these selected variables and they are sorted in descending order of magnitude. From the above results it is observed that variables-household electricity (0.649), household television (0.755), household refrigerator (0.397), household cooking fuel (0.782), and household floor materials (0.773) have larger loading and associated with Factor1. Similarly, in case of Factor 2, it is seen that the variables number of visit antenatal care (0.527), place of delivery (0.804), health care after delivery (0.892), delivery by caesar (0.845), postnatal care provider (0.884), place of first postnatal care (0.496), and fertility planning status (0.754) have larger loading and associated with Factor 2.Table-6.5 also shows that the variables current age of respondents (0.775), children ever born (0.919), number of living children (0.919), and place of residence (0.663), and family size (0.538) of the respondents have larger loading and associated with Factor 3. It is also observed that the variables current use of contraceptive methods (0.710) and contraceptive methods types (0.784) have larger loadings associated with Factor 4. Table-6.5 also reveals that the variables household drinking water (0.678) and respondent's mass media exposure (0.630) have larger loadings associated with Factor 5. Also, respondent's marital status (0.681) and age at marriage (0.716) have higher loadings and associated with Factor 6. Table-6.5 also shows that the variables respondents' household has radio (0.816) and household toilet facilities (0.496) have larger loadings associated with Factor 7. It is also observed that the variables respondents religion (0.837) and household has bicycle (0.539) have larger loadings associated with Factor 8 and Factor 9 respectively.

Thus, it may conclude that rotated factor matrix presents the nine factors after rotation. To identify what these factors represent, it would be necessary to consider what items loaded on each of the nine factors. Five variables; household electricity (0.649), household television (0.755), household refrigerator (0.397), household cooking fuel (0.782), household floor materials (0.773) are loaded on Factor 1 and an inspection of these items clearly shows that the majority of these items reflect the socio-economic characteristics. Factor 2 contains seven variables; number of visits antenatal care (0.527), place of delivery (0.804), health care after delivery (0.892), delivery by caesar (0.845), postnatal care provider (0.884), place of first postnatal care

(0.496),and fertility planning status (0.754) with larger loading that clearly reflect the reproductive health. Factor 3 contains five variables; current age of respondents (0.775), total children ever born (0.919), number of living children (0.919), place of residence (0.663), and family size (0.538) with larger loading that clearly reflect the demography. Factors 5, 7, and 9 contain the variables; household drinking water (0.678), respondents mass media exposure (0.630), household radio (0.816), household toilet facility (0.496), and household bicycle (0.539) with larger loading that appear to reflect the related motives of socio-economic and an inspection of these items clearly shows that these items reflect socio-economic conditions. Factor 4 contains two variables current use of contraceptive (0.710) and contraceptive method types (0.784) with larger loading that clearly reflect the related motive of reproductive health. Factor 6 and 8 contain the variables current marital status (0.681), age at marriage (0.716), and religion (0.837) with higher loading that appear to reflect the changing pattern in composition of population and an inspection of these items clearly shows that these items reflect the Demography.

Now it is to be noted that whether the factors are orthogonal or not, the factor loading are the standardized regression coefficient in the multiple regression equation with the original variable as the dependent variable and factors as the independent variables. The amount of variation explained by these nine factors for each variable are obtained from the column labeled communality in Table-6.4 earlier.

Table-6.5: Rotated factor matrix for selected variables

	Factor								
	1	2	3	4	5	6	7	8	9
C_age	0.007	0.080	0.775	0.160	0.056	-0.028	0.050	0.090	0.015
M_status	-0.049	0.072	-0.109	-0.082	0.084	-0.681	-0.394	0.013	-0.007
A_marriage	-0.153	-0.010	-0.103	0.182	0.054	0.716	0.119	-0.001	0.215
CEB	-0.178	0.004	0.922	0.032	-0.155	-0.026	-0.014	0.070	-0.070
L_child	-0.179	0.004	0.921	0.030	-0.114	-0.004	0.019	0.082	-0.074
P_resi	-0.644	-0.148	-0.663	-0.167	-0.133	0.401	-0.020	-0.059	0.171
Religion	0.013	-0.101	0.060	0.002	-0.010	-0.058	-0.104	0.837	0.027
F_size	0.051	-0.117	-0.538	-0.482	-0.364	0.160	0.267	0.373	-0.078
H_elec	0.670	-0.142	-0.093	-0.035	0.143	-0.021	0.292	-0.115	-0.012
H_radio	0.089	-0.004	0.023	0.021	0.005	0.823	-0.067	-0.054	-0.037
H_tele	0.771	-0.028	-0.114	-0.099	0.043	0.219	0.163	0.213	0.025
H_refri	0.424	-0.080	-0.033	-0.141	0.404	0.351	0.243	0.342	0.111
H_bicy	-0.221	-0.014	-0.100	0.044	0.053	0.334	0.455	-0.072	-0.483
H_cook	-0.763	-0.098	0.057	-0.163	0.053	0.080	0.102	0.015	0.097
H_drink	0.035	0.052	0.135	-0.197	0.651	-0.131	-0.090	-0.168	0.016
H_toilet	-0.422	-0.019	0.011	-0.001	-0.155	-0.134	-0.482	0.079	-0.215
H_Floor	0.769	-0.015	-0.096	0.124	0.137	0.191	-0.116	-0.081	0.051
M_media	0.268	-0.009	-0.069	0.206	0.639	0.371	-0.013	0.133	-0.098
VAC	-0.258	0.538	0.003	0.166	0.110	-0.132	0.159	0.373	-0.231
PD	0.053	0.808	-0.027	-0.022	0.026	-0.036	-0.052	-0.056	-0.094
HCAD	0.002	0.887	0.049	-0.116	-0.058	0.051	-0.011	-0.013	0.025
CUCM	0.070	-0.073	0.061	0.870	-0.053	0.012	0.047	0.040	0.090
DC	-0.022	0.845	0.023	0.003	0.063	-0.048	-0.107	-0.079	0.047
PCRF	0.056	0.878	0.017	-0.093	-0.059	0.025	0.012	-0.054	0.066
PFPC	0.279	-0.096	-0.193	-0.049	0.518	-0.031	0.342	0.275	0.184
CMT	0.141	-0.126	0.067	0.847	-0.092	0.033	0.089	-0.005	0.046
FPS	0.030	0.034	-0.750	0.162	-0.209	-0.075	-0.025	0.187	-0.040

Table-6.6: Factor transformation matrix

Factor	1	2	3	4	5	6	7	8	9
1	0.744	-0.180	-0.510	0.005	0.293	0.193	0.149	0.062	0.068
2	0.107	0.948	-0.223	-0.098	0.065	-0.115	-0.076	-0.062	-0.060
3	0.428	0.191	0.792	0.208	0.179	0.216	0.107	0.139	-0.007
4	-0.101	-0.002	0.102	-0.845	0.121	0.203	0.347	0.253	-0.160
5	-0.441	0.092	-0.101	0.312	0.574	0.199	0.514	-0.092	0.219
6	-0.172	0.109	-0.190	0.250	-0.220	0.465	-0.144	0.758	-0.025
7	0.072	0.055	-0.074	0.212	-0.530	0.148	0.604	-0.226	-0.473
8	0.049	-0.045	-0.004	0.138	0.114	-0.758	0.298	0.521	-0.169
9	0.095	0.087	0.030	-0.096	-0.439	-0.093	0.320	0.066	0.816

Table-6.7: Factor score coefficient matrix for selected variables

	Factor								
	1	2	3	4	5	6	7	8	9
C_age	0.040	0.018	0.248	0.089	0.064	-0.016	-0.024	0.052	-0.036
M_status	0.036	-0.004	-0.009	-0.021	0.069	-0.534	0.170	0.090	0.073
A_marriage	-0.109	0.045	-0.056	0.100	0.009	0.092	0.041	0.013	0.626
CEB	0.023	-0.006	0.289	-0.003	-0.054	-0.023	-0.005	0.028	-0.025
L_child	0.010	-0.003	0.287	0.011	-0.030	-0.001	0.009	0.037	-0.028
P_resi	-0.229	-0.016	-0.007	-0.042	-0.048	0.019	0.338	-0.034	0.202
Religion	0.002	-0.028	0.003	-0.012	-0.009	-0.164	-0.047	0.631	0.034
F_size	0.047	-0.009	0.084	-0.320	-0.289	0.208	0.089	0.197	0.070
H_elec	0.186	-0.028	0.017	-0.029	-0.022	0.197	-0.066	-0.137	0.014
H_radio	0.008	0.023	0.010	0.040	-0.074	-0.128	0.610	-0.051	-0.037
H_tele	0.235	0.012	0.015	-0.088	-0.120	0.047	0.112	0.105	0.054
H_refri	0.038	0.006	0.022	-0.084	0.166	0.094	0.191	0.202	0.121
H_bicy	-0.148	0.002	-0.076	0.069	0.056	0.321	0.198	-0.091	-0.488
H_cook	-0.303	-0.013	-0.026	-0.038	0.127	0.141	0.076	0.007	0.125
H_drink	-0.046	-0.019	0.097	-0.171	0.506	-0.051	-0.189	-0.150	0.010
H_toilet	-0.064	-0.042	-0.011	-0.009	-0.004	-0.330	-0.048	0.113	-0.131
H_Floor	0.260	-0.003	0.028	0.031	-0.031	-0.159	0.116	-0.073	0.041
M_media	-0.017	-0.008	-0.010	0.128	0.394	-0.122	0.210	0.095	-0.172
VAC	-0.135	0.161	-0.059	0.169	0.114	0.104	-0.076	0.310	-0.255
PD	0.024	0.237	-0.010	0.004	0.008	-0.004	-0.001	-0.019	-0.068
HCAD	0.009	0.281	0.016	-0.045	-0.074	0.049	0.078	0.015	0.101
CUCM	-0.017	0.012	0.062	0.389	-0.033	0.063	0.042	0.046	0.129
DC	-0.002	0.252	0.004	0.014	0.039	-0.038	0.002	-0.026	0.055
PCRF	0.026	0.280	0.009	-0.035	-0.084	0.060	0.058	-0.031	0.130
PFPC	-0.043	-0.004	-0.054	0.029	0.284	0.203	-0.077	0.185	0.124
CMT	0.042	-0.016	-0.010	0.443	-0.117	0.031	0.047	-0.013	-0.006
FPS	-0.011	0.018	-0.272	0.113	-0.171	-0.016	-0.024	0.177	-0.069

Finally the factor Scores for these nine factors are computed by regression method for each of the respondents based on the factor score coefficient matrix Table-6.7.

For each factor the factor scores are obtained by multiplying the standardized values by the corresponding factor score coefficient. It is to be noted that for some of the respondents the factor scores are missing, this is due to the missing observation.

The present factor structure appears to be represented by three dimensions (Socio-economic, Reproductive health, and Demography). So, it was decided to rerun Factor analysis, stipulating the extraction of only three factors and the results presented in the total variance explained section are identical to those obtained in the first run. This is not surprising as the same extraction method (Principal components analysis) was applied to the same 27 variables. Thus, the same nine factors were extracted; accounting for a combined 69.017% of the total variance and the rotated component matrix presents only three rotated factors. Factor 1 contains ten variables i.e., household electricity (0.697), household radio (0.819), household television (0.787), household refrigerator (0.658), household bicycle (0.536), household cooking fuel (0.624), household drinking water (0.675), household toilet facility (0.557), household floor materials (0.740), and respondents mass media exposure (0.554) with larger loadings that clearly reflect the socio-economic conditions and was thus Factor 1, labeled as Poverty Factor. Factor 2 contains nine variables i.e., number of visit antenatal care (0.503), place of delivery (0.806), health checkup after delivery (0.872), current use of contraceptive (0.706), delivery by caesar (0.843), postnatal care providers (0.862), place of first postnatal care (0.561), contraceptive method types (0.781), and fertility planning status (0.686) with larger loadings that reflect the reproductive health conditions, and was thus Factor 2, labeled as Reproductive health Factor. Factor 3 contains eight variables i.e., current age of respondents (0.788), marital status (0.619), age at marriage (0.711), children ever born (0.888), number of living children (0.901), place of residence (0.491), religion (0.814), and family size (0.535) with larger loadings that reflect the demographic conditions, and was thus Factor 3 labeled as Demographic Factor. This three-factor model represents the combination of the nine original factors and appears to reflect adequately the underlying factor structure of the 27 variables.

Table-6.8: Rotated factor matrix for three factors

	Factor 1	**Factor 2**	**Factor 3**
C_age	0.019	0.121	0.788
M_status	-0.154	0.119	-0.619
A_marriage	-0.020	-0.101	-0.711
CEB	-0.258	0.054	0.888
L_child	-0.232	0.051	0.901
P_resi	-0.571	-0.210	0.491
Religion	0.077	-0.122	0.814
F_size	-0.025	-0.122	0.535
H_elec	0.697	-0.106	-0.070
H_radio	0.819	-0.042	0.058
H_tele	0.787	-0.012	-0.067
H_refri	0.658	-0.083	0.042
H_bicy	-0.536	-0.065	-0.002
H_cook	-0.624	-0.148	0.064
H_drink	0.675	0.140	0.072
H_toilet	-0.557	0.004	-0.030
H_Floor	0.740	0.027	-0.105
M_media	0.554	0.001	-0.014
VAC	-0.131	0.503	0.059
PD	0.004	0.806	-0.080
HCAD	-0.056	0.872	-0.008
CUCM	0.178	-0.706	0.139
DC	-0.061	0.843	-0.048
PCRF	-0.008	0.862	-0.045
PFPC	0.243	-0.561	-0.128
CMT	0.230	-0.781	0.149
FPS	0.018	-0.686	-0.705

6.5 Summary

This study includes poverty, reproductive health and demography related 34 variables and 27 variables have been selected for factor analysis and factor matrix presents nine factors after rotation of the factors. Using factor analysis, three possible factors have determined to represent the combination of the nine factors in the rerun and appear to reflect adequately the underlying factor structure of the 27 variables. The correlation matrix for the selected 27 variables shows that most of the coefficients are greater than 0.5 in absolute value. All variables have large correlations and the correlation matrix has significant correlations among at least some of the variables in the set. Bartlett's test of sphericity is very large (1902.520) and the associated significance level is smaller than 0.01. Again since computed value of Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy gives a value of 0.704 which gives the evidence that factor analysis can be proceed comfortably. From the factor analysis it is observed that there are nine eigen values greater than unity and almost 69.017 percent of the total variance is attributable to the nine factors. Also the scree plot suggests that a model with five factors may be adequate to represent the data.

Since one of the goals of factor analysis is to identify factors that are substantively meaningful in the sense that they summarize sets of closely related variables. Thus, it may conclude that rotated factor matrix presents the nine factors after rotation. To identify what these factors represent, it would be necessary to consider what items loaded on each of the nine factors. Five variables; household electricity (0.649), household television (0.755), household refrigerator (0.397), household cooking fuel (0.782), household floor materials (0.773) are loaded on Factor 1 and an inspection of these items clearly shows that the majority of these items reflect the socio-economic characteristics. Factor 2 contains seven variables; number of visits antenatal care (0.527), place of delivery (0.804), health care after delivery (0.892), delivery by caesar (0.845), postnatal care provider (0.884), place of first postnatal care (0.496),and fertility planning status (0.754) with larger loading that clearly reflect the reproductive health. Factor 3 contains five variables; current age of respondents (0.775), total children ever born (0.919), number of living children (0.919), place of residence (0.663), and family size (0.538) with larger loading that clearly reflect the demography. Factors 5, 7, and 9 contain the variables; household drinking water (0.678), respondents mass media exposure (0.630), household radio (0.816),

household toilet facility (0.496), and household bicycle (0.539) with larger loading that appear to reflect the related motives of socio-economic and an inspection of these items clearly shows that these items reflect socio-economic conditions. Factor 4 contains two variables current use of contraceptive (0.710) and contraceptive method types (0.784) with larger loading that clearly reflect the related motive of reproductive health. Factor 6 and 8 contain the variables current marital status (0.681), age at marriage (0.716), and religion (0.837) with higher loading that appear to reflect the changing pattern in composition of population and an inspection of these items clearly shows that these items reflect the Demography.

The present factor structure appears to be represented by three dimensions (Socio-economic, Reproductive health, and Demography). So, it was decided to rerun Factor analysis, stipulating the extraction of only three factors and rotated component matrix presents only three rotated factors. Factor 1 contains ten variables i.e., household electricity (0.697), household radio (0.819), household television (0.787), household refrigerator (0.658), household bicycle (0.536), household cooking fuel (0.624), household drinking water (0.675), household toilet facility (0.557), household floor materials (0.740), and respondents mass media exposure (0.554) with larger loadings that clearly reflect the socio-economic conditions and was thus Factor 1, labeled as Poverty Factor. Factor 2 contains nine variables i.e., number of visit antenatal care (0.503), place of delivery (0.806), health checkup after delivery (0.872), current use of contraceptive (0.706), delivery by caesar (0.843), postnatal care providers (0.862), place of first postnatal care (0.561), contraceptive method types (0.781), and fertility planning status (0.686) with larger loadings that reflect the reproductive health conditions, and was thus Factor 2, labeled as Reproductive health Factor. Factor 3 contains eight variables i.e., current age of respondents (0.788), marital status (0.619), age at marriage (0.711), children ever born (0.888), number of living children (0.901), place of residence (0.491), Religion (0.814), and family size (0.535) with larger loadings that reflect the demographic conditions, and was thus Factor 3 labeled as Demographic Factor. Finally, this three-factor model represents the combination of the nine original factors and appears to reflect adequately the underlying factor structure of the 27 variables.

Key findings of this chapter:

- Factor analysis selects 27 variables including poverty, reproductive health, and demographic variables out of 34 variables and after nineteen iterations factor matrix presents nine factors.
- Factor analysis stipulate the extraction of only three factors and rotated component matrix presents only three rotated factors.
- Factor 1 represents ten variables i.e., household electricity, radio, television, refrigerator, bicycle, cooking fuel, drinking water, toilet facility, floor materials, and respondents mass media exposure with larger loadings that clearly reflect the socio-economic conditions and was thus Factor 1, labeled as Poverty Factor.
- Factor 2 represents nine variables i.e., number of visit antenatal care, place of delivery, health checkup after delivery, current use of contraceptive, delivery by caesar, postnatal care providers, place of first postnatal care, contraceptive method types, and fertility planning status with larger loadings that clearly reflect the reproductive health conditions, and was thus Factor 2, labeled as Reproductive health Factor.
- Factor 3 represents eight variables namely current age of respondents, marital status, age at marriage, children ever born, number of living children, place of residence, religion, and family size with larger loadings that clearly reflect the demographic conditions, and was thus Factor 3 labeled as Demographic Factor.

Chapter 7

Structural Equation Modeling
(Path Analysis)

7.1 Introduction

The purpose of Structural Equation Modeling (Path Analysis) is to examine and determine the direct and indirect effects of exogenous and endogenous variables on dependent variable through causal linkages among the interrelated variables. Structural equation modeling (SEM) has been employed in this study based on path analysis to extract the significant direct and indirect effects of demographic factors on poverty, reproductive health and health of ever-married women in Bangladesh. Path analysis is an applied multivariate technique of showing causal linkages among the interrelated variables. It was developed by Sewall Wright in 1920s. The model is usually depicted in a circle-and-arrow figure in which single arrows indicate causation. A regression is done for each variable in the model as a dependent on others which the model indicates are causes. The regression weights predicted by the model are compared with the observed correlation matrix for the variables, and a goodness-of-fit statistic is calculated. The best-fitting of two or more models is selected by the researcher as the best model for advancement of theory.

Path analysis requires the usual assumptions of regression. It is particularly sensitive to model specification because failure to include relevant causal variables or inclusion of extraneous variables often substantially affects the path coefficients, which are used to assess the relative importance of various direct and indirect causal paths to the dependent variable. Such interpretations should be undertaken in the context of comparing alternative models, after assessing their goodness of fit discussed in the section on structural equation modeling (SEM packages are commonly used today for path analysis in lieu of stand-alone path analysis programs). When the variables in the model are latent variables measured by multiple observed indicators, path analysis is termed structural equation modeling, treated separately. The conventional terminology followed by which path analysis refers to single-indicator variables.

7.2 Key Concepts and Terms

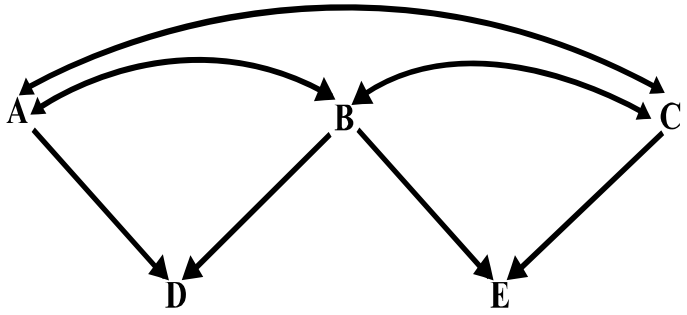
Path estimates may be calculated by OLS regression or by MLE maximum likelihood estimation, depending on the computer package. Two-stage least squares (2SLS) discussed separately, is another path estimation procedure designed to extend the OLS regression model into the situations where non-recursively is introduced because the researcher must assume the co-variances of some disturbance terms are not zero.

7.2.1 Path model

A path model is a diagram relating independent, intermediary and dependent variables. Single arrows indicate causation between exogenous or intermediary variables and the dependent. Arrows also connect the error terms with their respective endogenous variables. Double arrows indicate correlation between pairs of exogenous variables. Sometimes the width of the arrows in the path model is drawn in a width which is proportional to the absolute magnitude of the corresponding path coefficients (see below).

7.2.2 Causal paths

Causal paths to a given variable include (1) the direct paths from arrows leading to it, and (2) correlated paths from endogenous variables correlated with others which have arrows leading to the given variable. Consider this model:



This model has correlated exogenous variables A, B, and C, and endogenous variables D and E. Error terms are not shown. The causal paths relevant to variable D are the paths from A to D, from B to D, and the paths reflecting common anteceding causes - the paths from B to A to D, from C to A to D, and from C to B to D. Paths involving two correlations (C to B to A to D) are not relevant. Likewise, paths that go backward (E to B to D, or E to B to A to D) reflect common effects and are not relevant.

7.2.3 Exogenous and endogenous variables

Exogenous variables in a path model are those with no explicit causes (no arrows going to them, other than the measurement error term). If exogenous variables are correlated, this is indicated by a double-headed arrow connecting them. Endogenous variables, then, are those which do have incoming arrows. Endogenous variables include intervening causal variables and dependents. Intervening endogenous variables have both incoming and outgoing causal arrows in the path diagram. The dependent variable(s) have only incoming arrows.

7.2.4 Path coefficient

A path coefficient is a standardized regression coefficient (beta) showing the direct effect of an independent variable on a dependent variable in the path model. Thus when the model has two or more causal variables, path coefficients are partial regression coefficients which measure the extent of effect of one variable on another in the path model controlling for other prior variables, using standardized data or a correlation matrix as input. Recall that for bivariate regression, the beta weight (coefficient for standardized data) is the same as the correlation coefficient, so for the case of a path model with a variable as a dependent of a single exogenous variable (and an error residual term), the path coefficient in this special case is a zero-order correlation coefficient.

7.2.5 Disturbance terms

The error terms, also called disturbance terms, reflect unexplained variance (the effect of unmeasured variables) plus measurement error. Note that the dependent in each equation is an endogenous. Note also that the independents in each equation are all the variables with arrows to the dependent.

The effect size of the disturbance term for a given endogenous variable, which reflects unmeasured variables, is $(1 - R^2)$, and its variance is $(1 - R^2)$ times the variance of that endogenous variable, where R^2 is based on the regression in which it is the dependent and those variables with arrows to it are independents. The path coefficient is SQRT $(1 - R^2)$.

The correlation between two disturbance terms is the partial correlation of the two endogenous variables, using as controls all their common causes (all variables with arrows to both). The covariance estimate is the partial covariance: the partial correlation times the product of the standard deviations of the two endogenous variables.

In this chapter, the direct and indirect effects of the selected variables have been examined. Thus, present study is interested to identify their causal links by a multivariate technique, which is path model analysis. A path analysis is one of such techniques of showing causal linkages among the interrelated variables. The technique of path analysis which was developed as an aid to the quantitative

development of genetics gained popularity in scientific studies with the further expositions made by Duncan and Land. Recently its application is gained popularity in demography (Leobner and Driver 1973; Kendall and Muircheartiagh 1977; Sivamurthy and Ahmed 1979; Balakrishnan *et al*., 1980; Ahmed and Peters 1980; Rob and Kabir 1988).

Path analysis presumes the existence of causal framework interlinking different predictor variables with the response variables. Such representation of the causal variable is called as a path model and it is both stochastic and explanatory and it is said to be an extension of the multiple regression model (Hermalian 1975; Retherford and Choe 1993). It helps in estimating the magnitudes of the linkages between interrelated variables and provides information about the underlying causal processes. This technique explores a chain of relationship among the variables by using standardized regression coefficients of a set of regression equations. The fundamental to the path analysis is the path diagram which is the outcome of a set of linearly interrelated variables and the assumed causal relationship among them. In the path diagram the following principles are considered:

i. The variables are arranged from left in such a way that all the endogenous variables are to the right of their exogenous variables.
ii. The unidirectional straight arrows called henceforth as causal paths that go from left to the right represent the endogenous variables.
iii. On the other hand, the two-headed curvilinear arrows represent the non-causal (correlated) relationship among the exogenous variables.

This study employs a recursive path model relating to demographic, socio-economic and reproductive health related variables.

7.3 Methods and Model Specification for Path Analysis

Path analysis is a straightforward extension of multiple regressions. Its aim is to provide estimates of the magnitude and significance of hypothesized causal connection between sets of variables. Path analysis provides a theoretical model specified as a system of simultaneous regression equations, which are linear, additive and usually recursive (Boyle 1970). This is best explained by considering a path diagram.

Since the present study is mainly demography, poverty, reproductive health, and health of ever-married women related so only ever-married women are included in this study. Among the eleven variables at first nine variables has been taken into consideration in the present study in order to construct a path model. Table-7.1 gives a detailed description of the selected variables. From the nine variables named: current age, marital status, age at marriage, place of residence, religion, and family size of the respondents are considered as the exogenous variables and the demographic variables as well as endogenous variables regarded in this analysis are children ever born and number of living children. Finally the standard of living status of ever-married women aged 15-49 years is considered as a dependent variable.

Path coefficients are standardized regression coefficients in a system of linear regression equations, usually denoted P_{ij}, where the first subscript shows the dependent variable and the second subscript indicates to the variable whose direct effect on the variable is measured. On the other hand, P_{ij} are path coefficients representing the direct effect of j on variable i. A path coefficient gives the proportion of the standard deviation of the dependent variable for which the independent variable is directly responsible. In other words,

$$P_{ij} = \sigma_j / \sigma_i$$

where, σ_i and σ_j denote the standard deviation of the dependent and independent variables respectively (Chandrasekaran and Hermalin 1975). The path estimation equations are useful (i) in deriving path coefficients, (ii) in deriving the direct, indirect effects and residual and (iii) in predicting the implied effects. The path estimation equations are derived from the Alwin and Hauser's (1975) methods.

7.4 Path Model Analysis for Standard of Living of Ever-married Women

According to the causal ordering of variables the selected set of variables can be divided into three groups that are given below in the Table-7.1:

Table-7.1: Variables used in path analysis for standard of living of ever-married women

Types of variable	Variables
Exogenous variable	X_1 = Current age X_2 = Marital status X_3 = Age at marriage X_4 = Place of residence X_5 = Religion X_6 = Family size
Endogenous variable	X_7 = Children ever born X_8 = Living children
Dependent variable	X_9 = Standard of living score of ever-married women

Path model is a recursive model in which each variable is assumed to be dependent upon all prior causal variables. The system of equations for the path model can be written as:

$$X_7 = P_{76}X_6 + P_{75}X_5 + P_{74}X_4 + P_{73}X_3 + P_{72}X_2 + P_{71}X_1 + P_{7u}R_u$$

$$X_8 = P_{87}X_7 + P_{86}X_6 + P_{85}X_5 + P_{84}X_4 + P_{83}X_3 + P_{82}X_2 + P_{81}X_1 + P_{8v}R_v$$

$$X_9 = P_{98}X_8 + P_{97}X_7 + P_{96}X_6 + P_{95}X_5 + P_{94}X_4 + P_{93}X_3 + P_{92}X_2 + P_{91}X_1 + P_{9w}R_w$$

where, P_{ij} are the path coefficients, R_u, R_v and R_w are random disturbance terms and P_{7u}, P_{8v} and P_{9w} are the path coefficients of random disturbance terms R_u, R_v and R_w respectively. All the random disturbance terms are mutually independent and are independent of their corresponding explanatory variables. The residual of path coefficients can also be estimated with case from the regression equation as square root of $(1 - R^2)$, where R^2 (unadjusted) is the multiple correlation coefficients (square) of the regression equation. From the path analysis the direct, indirect, implied and total effects of each selected explanatory variables on standard of living of ever-married women are obtained separately for demographic impact.

The systems of fitted equations are as follows:

$$X_7 = 0.190X_6 - 0.046X_5 + 0.092X_4 - 0.038X_3 - 0.083X_2 + 0.638X_1$$

$$X_8 = 0.904X_7 + 0.221X_6 - 0.061X_5 + 0.086X_4 - 0.035X_3 - 0.103X_2 + 0.620X_1$$

$$X_9 = -0.084X_8 - 0.275X_7 + 0.173X_6 - 0.038X_5 - 0.188X_4 + 0.002X_3 - 0.075X_2 + 0.253X_1$$

The zero order correlation coefficients of selected demographic variables on standard of living are presented in the Table-7.2. From Table-7.2, it is observed that with few expectations of the zero order correlation coefficient between standard of living and each of the selected demographic variables generally does not differ much from their corresponding total effects. The different types of effects are represented in the Table-7.3. Also the Table-7.4 depicts the percentages of the total absolute effect on standard of living of ever-married women.

From the Table-7.2, it is revealed that respondent's current age (X_1) and family size (X_6) are positively significant and age at marriage (X_3) is positively insignificant on standard of living of ever-married women in Bangladesh. Table-7.2 also shows that respondent's marital status (X_2), place of residence (X_4), religion (X_5), children ever born (X_7) and number of living children (X_8) are negatively significant on standard of living of ever-married women. This table also shows the interrelationship among the selected variables. The zero order correlation coefficients among the selected demographic variables and standard of living score are given below:

Table-7.2: Zero order correlation coefficients between demographic variables and standard of living score of ever-married women

	1.000	0.169**	-0.033**	-0.021**	0.043**	-0.087**	0.638**	0.620**	0.061**
		1.000	-0.017	-0.036**	-0.001	-0.069**	0.027**	0.005	-0.046**
			1.000	-0.022*	0.001	-0.008	-0.059**	-0.054**	0.012
				1.000	-0.012	0.044**	0.107**	0.097**	-0.201**
					1.000	-0.013	-0.038**	-0.046**	-0.024**
						1.000	0.133**	0.157**	0.117**
							1.000	0.948**	-0.104**
								1.000	-0.165**
									1.000

Note: ** Significant at the 0.01 level, * Significant at the 0.05 level.

For standard of living, total effects of exogenous variables like as respondent's marital status (X_2), respondent's place of residence (X_4) and religion (X_5) are observed negative direction on standard of living of ever-married women (X_9) and the remaining variables like as respondent's current age (X_1), age at marriage (X_3) and family size of the respondent's (X_6) are observed positive direction on standard of living of ever-married women (X_9). Again it also observed that the total effects of endogenous variables like as children ever born (X_7) and number of living children (X_8) show negative direction on standard of living of ever-married women (X_9) in Bangladesh.

Total effects of the respondent's current age (X_1) on standard of living of ever-married women (X_9) is 0.253, of which about 67.9% is transmitted through its implied effect and about 24.8% is acts through children ever born (X_7) in the opposite direction and about 7.4% is transmitted through number of living children (X_8) in the opposite direction (Table-7.3). Again total effects of respondent's marital status (X_2) on standard of living of ever-married women (X_9) is -0.075, of which about 77.0% is transmitted through its implied effect and a very little percent that is only 16.5% acts through children ever born (X_7) in the opposite direction and about 6.5% is transmitted in the opposite direction through number of living children (X_8) on standard of living of ever-married women (X_9).

From the Table-7.3, it is observed that the total effects of respondent's age at marriage (X_3) on standard of living (X_9) is 0.002, of which about 45.8% is conducted through its implied effect and about 41.7% acts through children ever born (X_7) in the same direction and about 12.5% is transmitted through living children (X_8) in the same direction. Again total effects of respondent's place of residence (X_4) on standard of living of ever-married women (X_9) is -0.188, of which about 83.0% is conducted through its implied effect and about 13.3% and 3.7% are transmitted in the same direction through children ever born (X_7) and living children (X_8) respectively.

Table-7.3 shows that the total effects of religion (X_5) on standard of living of ever-married women (X_9) is -0.038, of which about 75.7% is transmitted through its implied effect and about 17.6% and about 6.8% are transmitted in the opposite direction through children ever born (X_7) and living children (X_8) respectively

(Table-7.4). Again total effects of respondent's family size (X_6) on standard of living of ever-married women (X_9) is 0.173, of which about 77.5% is transmitted through its implied effect in the same direction and about 16.5% and about 6.0% are transmitted in the opposite direction through children ever born (X_7) and living children (X_8) respectively.

Direct effect of endogenous variables children ever born (X_7) and number of living children (X_8) are observed negative direction. Total effect of children ever born (X_7) and number of living children (X_8) on standard of living of ever-married women (X_9) are -0.253 and -0.084, of which both are about 100.0% transmitted through its direct effect. Analysis of demographic variables and standard of living of ever-married women and their corresponding percentage values are given below:

Table-7.3: Direct, indirect and implied effect of demographic variables on standard of living of ever-married women

Dependent variable	Selected variable	Total association	Non-causal effect	Total effect	Indirect effect via		Implied effect	Direct effect
					X_7	X_8		
X_9		0.061**	-0.192	0.253	-0.175	-0.052	0.480	
		-0.046**	0.029	-0.075	0.023	0.009	-0.107	
		0.012	0.010	0.002	0.010	0.003	-0.011	
		-0.201**	-0.013	-0.188	-0.025	-0.007	-0.156	
		-0.024**	0.014	-0.038	0.013	0.005	-0.056	
		0.117**	-0.056	0.173	-0.052	-0.019	0.244	
		-0.104**	0.171	-0.275	-	-	-	-0.275
		-0.165**	-0.081	-0.084	-	-	-	-0.084

Note: Non-causal effect = Total association – Total effect

Table-7.4: Percentages of the total absolute effect on standard of living of ever-married women through endogenous and exogenous variables

Dependent variable	Selected variable	Percentage of indirect effect via		Implied effect	Direct effect
X_9		24.8	7.4	67.9	
		16.5	6.5	77.0	
		41.7	12.5	45.8	
		13.3	3.7	83.0	
		17.6	6.8	75.7	
		16.5	6.0	77.5	
		-	-	-	100.0
		-	-	-	100.0

Path coefficients are shown in Figure-7.1. In Path analysis, path coefficients obtain direct, indirect, and implied effect of the selected explanatory variables.

According to the Figure-7.1, it is observed that there are 20 paths out of 21 hypothesized paths are found to be statistically significant for standard of living of ever-married women. The significant coefficients of the direct and indirect effects are discussed only. It is worth mentioning that the estimation of the non-significant path has only a small effect on the power of the explanation of the model.

In Figure-7.1, seven variables out of eight variables are found to have significant direct effect on standard of living of ever-married women. Among those respondent's current age (X_1) and respondent's family size (X_6) have direct significant ($p < 0.000$) positive effect on standard of living of ever-married women (X_9). It is also observed that respondent's marital status (X_2), place of residence (X_4), religion (X_5), children ever born (X_7), and number of living children (X_8) have direct significant ($p < 0.000$) negative effect and only respondent's age at marriage (X_3) has positive insignificant ($p < 0.121$) on standard of living of ever-married women (X_9) in Bangladesh. The path diagram for standard of living of ever-married women and various demographic characteristics are given below:

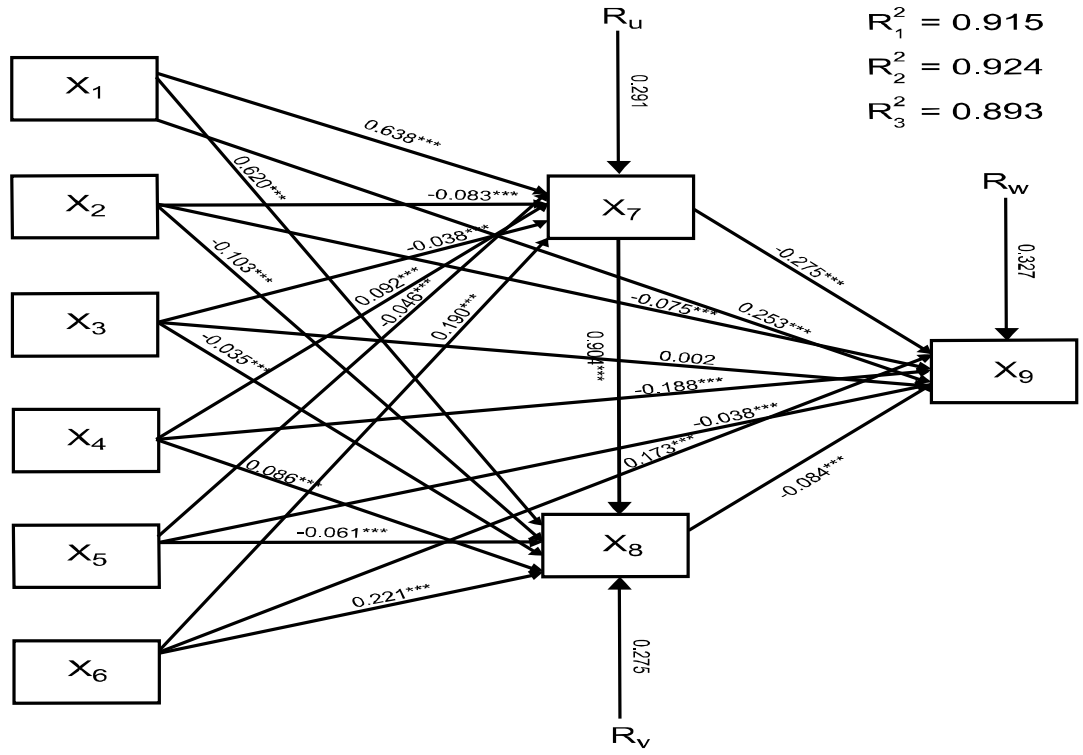


Figure-7.1: Path diagram for standard of living of ever-married women with selected demographic characteristics

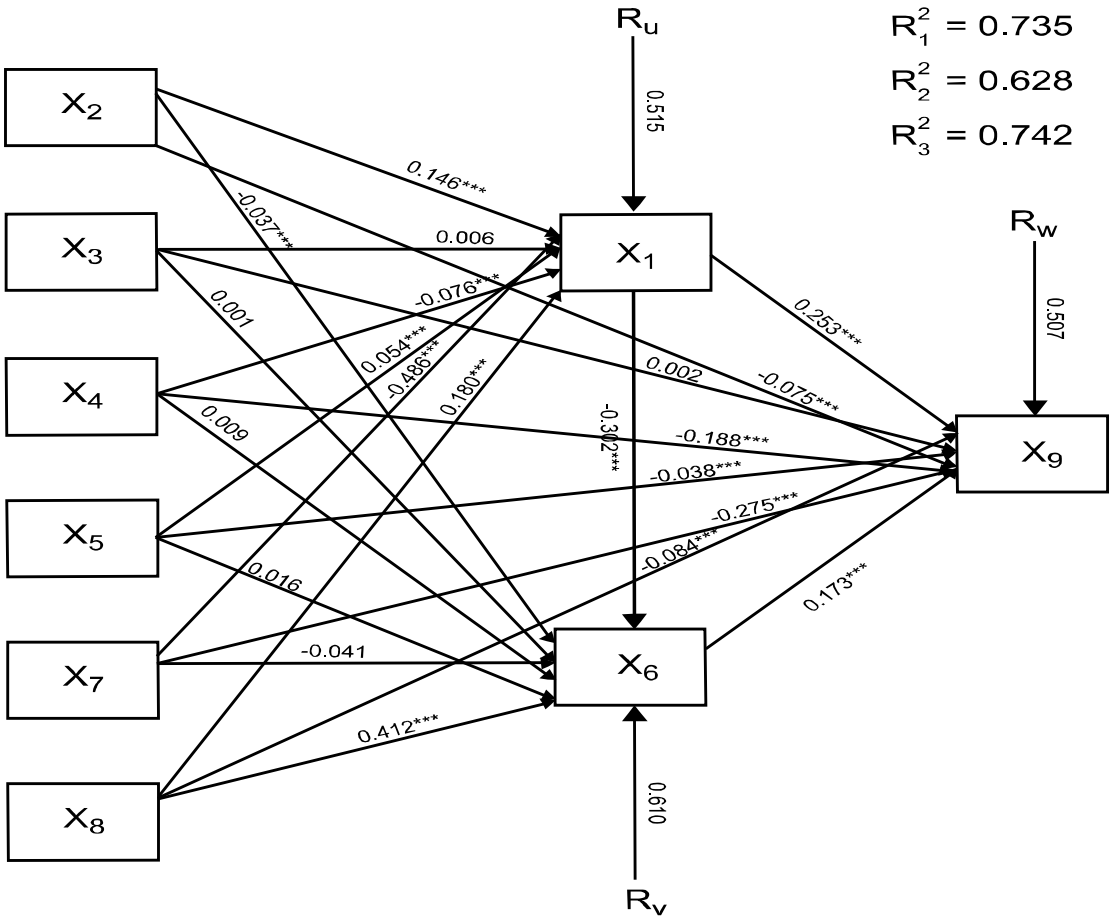


Figure-7.2: Path diagram for standard of living of ever-married women with selected demographic characteristics

It is observed from Figure-7.2 that there are 15 paths out of 21 hypothesized paths are found to be statistically significant for standard of living of ever-married women. Figure-7.2 also reveals that seven variables out of eight variables are found to have significant direct effect on standard of living of ever-married women. Among those respondent's current age (X_1) and respondent's family size (X_6) have direct significant ($p < 0.000$) positive effect on standard of living of ever-married women. It is also observed that respondent's marital status (X_2), place of residence (X_4), religion (X_5), children ever born (X_7), and number of living children (X_8) have direct significant ($p < 0.000$) negative effect and only respondent's age at marriage (X_3) has positive insignificant ($p < 0.221$) on standard of living of ever-married women in Bangladesh. The values of $R_1^2 = 0.735$ for endogenous variable respondent's current age (X_1), $R_2^2 = 0.628$ for endogenous variable family size of the respondent's (X_6), and $R_3^2 = 0.742$ for dependent variable standard of living score (X_9) are smaller than in Figure-7.1. So, it can be conclude that the path diagram represents in Figure-7.1 better than in Figure-7.2.

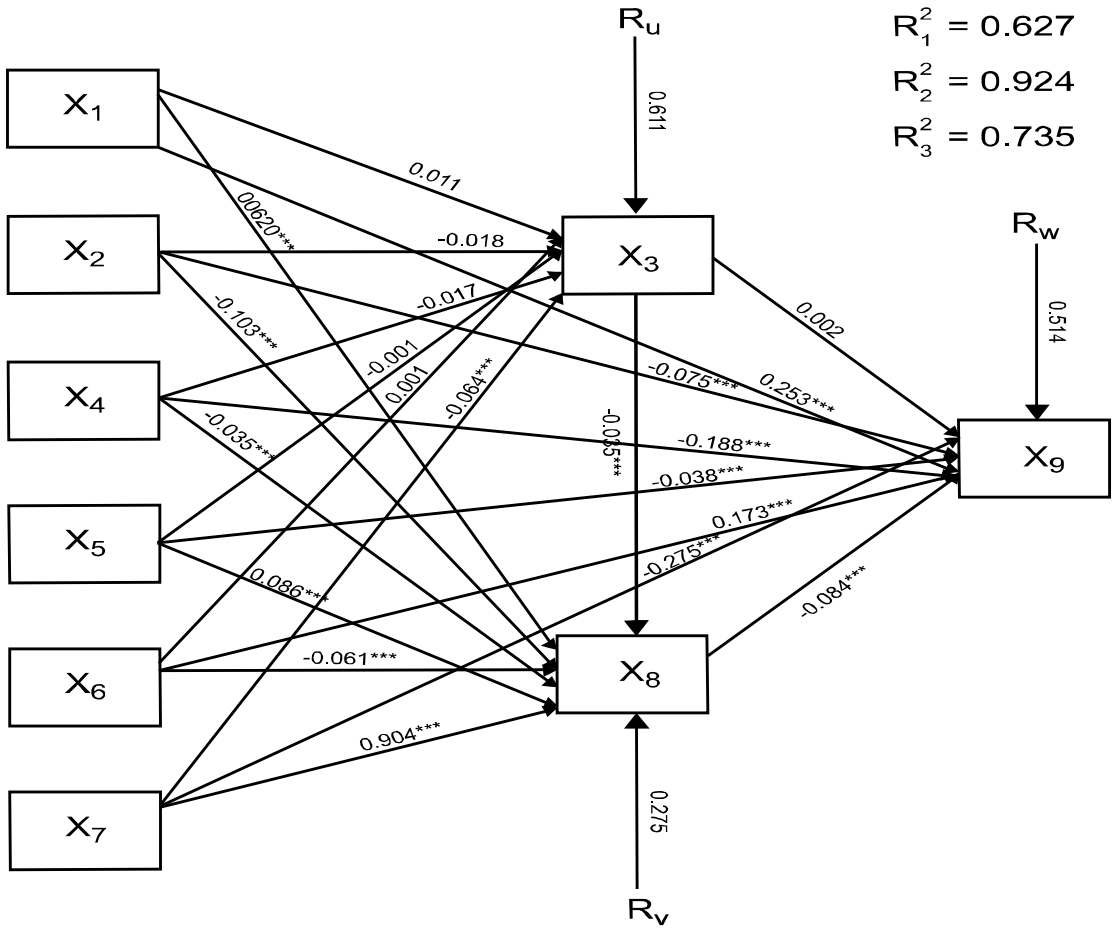


Figure-7.3: Path diagram for standard of living of ever-married women with selected demographic characteristics

There are 15 paths out of 21 hypothesized paths are found to be statistically significant for standard of living of ever-married women and seven variables out of eight variables are found to have significant direct effect on standard of living of ever-married women (Figure-7.3). Among those respondent's current age (X_1) and respondent's family size (X_6) have direct significant (p < 0.000) positive effect on standard of living of ever-married women (X_9). It is also observed that respondent's marital status (X_2), place of residence (X_4), religion (X_5), children ever born (X_7), and number of living children (X_8) have direct significant (p < 0.000) negative effect and only respondent's age at marriage (X_3) has positive insignificant (p < 0.221) effect on standard of living of ever-married women (X_9) in Bangladesh. The value of R_1^2, R_2^2 and R_3^2 are 0.627, 0.924 and 0.735 for endogenous variables respondent's age at marriage (X_3), number of living children (X_8), and dependent variable standard of living score (X_9) respectively which show that the path diagram represents in Figure-7.1 better than in Figure-7.3.

7.5 Path Model Analysis for Reproductive Health of Ever-married Women

According to the causal ordering of variables the selected set of variables can be divided into three groups that are given below in the Table-7.5:

Table-7.5: Variables used in path analysis for reproductive health of ever-married women

Types of variable	Variables
Exogenous variable	X_1 = Current age X_2 = Marital status X_3 = Age at marriage X_4 = Place of residence X_5 = Religion X_6 = Family size
Endogenous variable	X_7 = Children ever born X_8 = Living children
Dependent variable	X_9 = Reproductive health score of ever-married women

The systems of fitted equations are as follows:

$$X_7 = 0.190X_6 - 0.046X_5 + 0.092X_4 - 0.038X_3 - 0.083X_2 + 0.638X_1$$

$$X_8 = 0.904X_7 + 0.221X_6 - 0.061X_5 + 0.086X_4 - 0.035X_3 - 0.103X_2 + 0.620X_1$$

$$X_9 = -0.048X_8 - 0.314X_7 + 0.049X_6 + 0.030X_5 - 0.176X_4 + 0.061X_3 - 0.094X_2 + 0.237X_1$$

The zero order correlation coefficients of selected demographic variables on reproductive health of ever-married women are presented in the Table-7.6. From Table-7.6, it is observed that with few expectations of the zero order correlation coefficient between reproductive health score and each of the selected variables generally does not differ much from their corresponding total effects. The different types of effects (direct, indirect and implied) are represented in the Table-7.7. Also the Table-7.8 depicts the percentages of the total absolute effect on reproductive health of ever-married women through endogenous and exogenous variables.

From the Table-7.6, it is observed that respondent's marital status (X_2), place of residence (X_4), children ever born (X_7), and number of living children (X_8) are

negatively significant ($p < 0.01$) on reproductive health of ever-married women (X_9) in Bangladesh. Table-7.6 also shows that respondent's age at marriage (X_3) and religion (X_5) are positively significant ($p < 0.01$ & $p < 0.05$) on reproductive health of ever-married women and respondent's current age (X_1) and family size (X_6) are positively insignificant on reproductive health of ever-married women (X_9) in Bangladesh. This table also shows the interrelationship among the selected variables. The zero order correlation coefficients among the selected demographic variables and reproductive health score of ever-married women are given below:

Table-7.6: Zero order correlation coefficient between demographic variables and reproductive health score of ever-married women

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
X_1	1.000	0.169**	-0.033**	-0.021**	0.043**	-0.087**	0.638**	0.620**	0.033
X_2		1.000	-0.017	-0.036**	-0.001	-0.069**	0.027**	0.005	-0.067**
X_3			1.000	-0.022*	0.001	-0.008	-0.059**	-0.054**	0.095**
X_4				1.000	-0.012	0.044**	0.107**	0.097**	-0.228**
X_5					1.000	-0.013	-0.038**	-0.046**	0.043*
X_6						1.000	0.133**	0.157**	0.014
X_7							1.000	0.948**	-0.203**
X_8								1.000	-0.193**
X_9									1.000

Note: ** Significant at the 0.01 level, * Significant at the 0.05 level.

For reproductive health, total effect of exogenous variables like as respondent's marital status (X_2) and respondent's place of residence (X_4) are observed negative direction on reproductive health of ever-married women (X_9) and the remaining variables like as respondent's current age (X_1), age at marriage (X_3), religion (X_5), and respondent's family size (X_6) are observed positive direction on reproductive health of ever-married women in Bangladesh. Again it also observed that the total effects of endogenous variables like as children ever born (X_7) and number of living children (X_8) show negative direction on reproductive health of ever-married women (Table-7.7).

Total effects of the respondent's current age (X_1) on reproductive health of ever-married women (X_9) is 0.237, of which about 67.0% is transmitted through its

implied effect in the same direction and about 28.7% and about 4.3% are acts through children ever born (X_7) and number of living children (X_8) in the opposite direction respectively (Table-7.7 and Table-7.8). Again total effects of respondent's marital status (X_2) on reproductive health of ever-married women (X_9) is -0.094, of which about 80.1% is transmitted through its implied effect in the same direction and a very little percent that is only 16.7% acts through children ever born (X_7) in the opposite direction and about 3.2% is transmitted in the opposite direction through number of living children (X_8) on reproductive health of ever-married women.

From the Table-7.7, it is found that the total effects of respondent's age at marriage (X_3) on reproductive health (X_9) is 0.061, of which about 77.0% is conducted through its implied effect in the same direction and about 19.7% and about 3.3% acts through children ever born (X_7) and number of living children (X_8) in the same direction respectively (Table-7.8). Again total effects of respondent's place of residence (X_4) on reproductive health of ever-married women (X_9) is -0.176, of which about 81.3% is conducted through its implied effect and about 16.5% and about 2.3% are transmitted in the same direction through children ever born (X_7) and number of living children (X_8) respectively.

Table-7.7 shows that the total effects of religion (X_5) on reproductive health of ever-married women (X_9) is 0.030, of which about 43.3% is transmitted through its implied effect and about 46.7% and about 10.0% are transmitted in the same direction through children ever born (X_7) and living children (X_8) respectively (Table-7.8). Again total effects of respondent's family size (X_6) on reproductive health of ever-married women (X_9) is 0.049, of which about 62.6% is transmitted through its implied effect in the same direction and about 31.6% and about 5.8% are transmitted in the opposite direction through children ever born (X_7) and living children (X_8) respectively.

Direct effect of endogenous variables as like as children ever born (X_7) and number of living children (X_8) are observed in negative direction. Total effect of children ever born (X_7) and number of living children (X_8) on reproductive health of ever-married women (X_9) are -0.314 and -0.048, of which both are about 100.0% transmitted through its direct effect. Analysis of demographic variables through the selected

variable reproductive health of ever-married women and their corresponding percentage value are given below:

Table-7.7: Direct, indirect and implied effect of demographic variables on reproductive health of ever-married women

Dependent variable	Selected variable	Total association	Non-causal effect	Total effect	Indirect effect via		Implied effect	Direct effect
X_9		0.033	-0.204	0.237	-0.200	-0.030	0.467	
		-0.067**	0.027	-0.094	0.026	0.005	-0.125	
		0.095**	0.034	0.061	0.012	0.002	0.047	
		-0.228**	-0.052	-0.176	-0.029	-0.004	-0.143	
		0.043*	0.013	0.030	0.014	0.003	0.013	
		0.014	-0.035	0.049	-0.060	-0.011	0.119	
		-0.203**	0.111	-0.314	-	-	-	-0.314
		-0.193**	-0.145	-0.048	-	-	-	-0.048

Note: Non-causal effect = Total association – Total effect

Table-7.8: Percentages of the total absolute effect on reproductive health of ever-married women through endogenous and exogenous variables

Dependent variable	Selected variable	Percentage of indirect effect via		Implied effect	Direct effect
X_9		28.7	4.3	67.0	
		16.7	3.2	80.1	
		19.7	3.3	77.0	
		16.5	2.3	81.3	
		46.7	10.0	43.3	
		31.6	5.8	62.6	
		-	-	-	100.0
		-	-	-	100.0

Path coefficients are shown in Figure-7.4. In Path analysis, path coefficients obtain direct, indirect, and implied effect of the selected explanatory variables.

According to the Figure-7.4, it is observed that there are 18 paths out of 21 hypothesized paths are found to be statistically significant for reproductive health of ever-married women. The significant coefficients of the direct and indirect effect are

discussed only. It is worth mentioning that the estimation of the non-significant path has only a small effect on the power of the explanation of the model.

In Figure-7.4, five variables out of eight variables are found to have significant direct effect on reproductive health of ever-married women. Among those respondent's current age (X_1) has direct significant ($p < 0.000$) positive effect and age at marriage (X_3) has also direct significant ($p < 0.032$) positive effect on reproductive health of ever married women. The figure also reveals that respondent's marital status (X_2), place of residence (X_4), and children ever born (X_7) have direct significant ($p < 0.000$) negative effect on reproductive health of ever-married women. The path diagrams for the reproductive health of ever-married women with various demographic characteristics are given below:

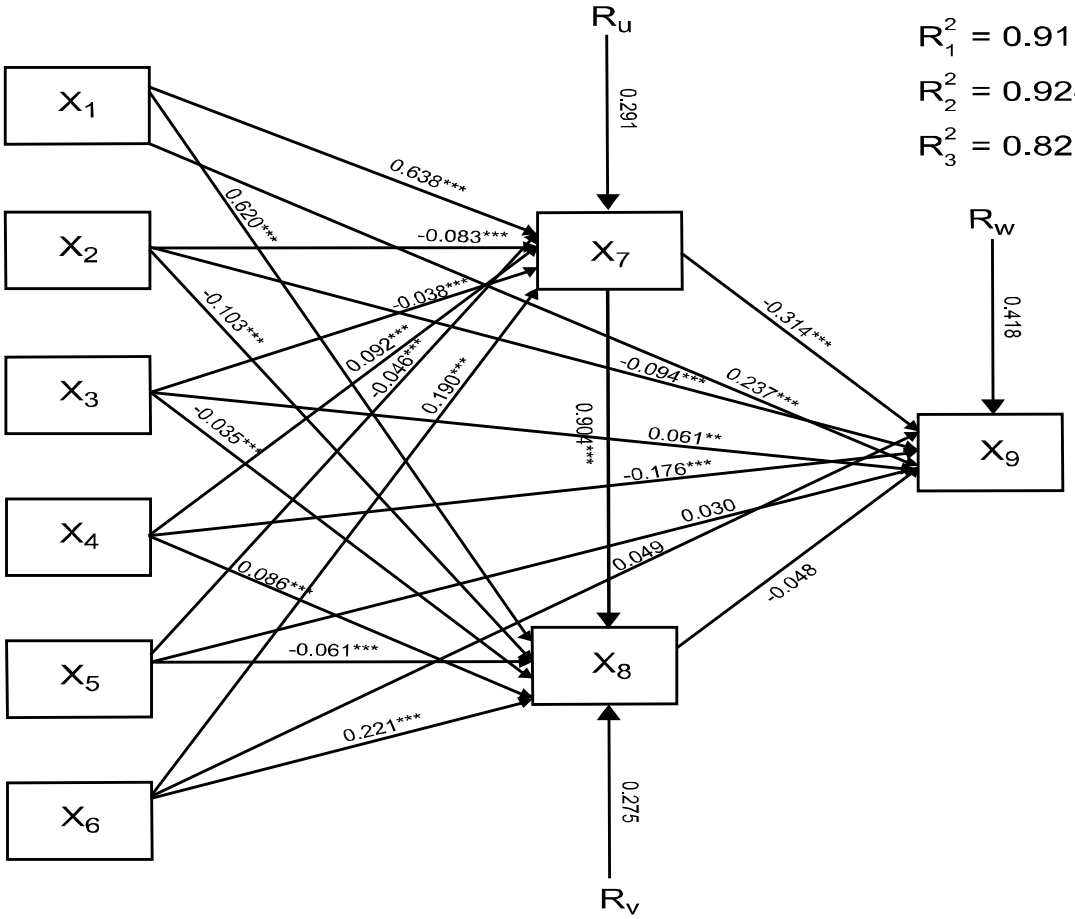


Figure-7.4: Path diagram for reproductive health with selected demographic characteristics

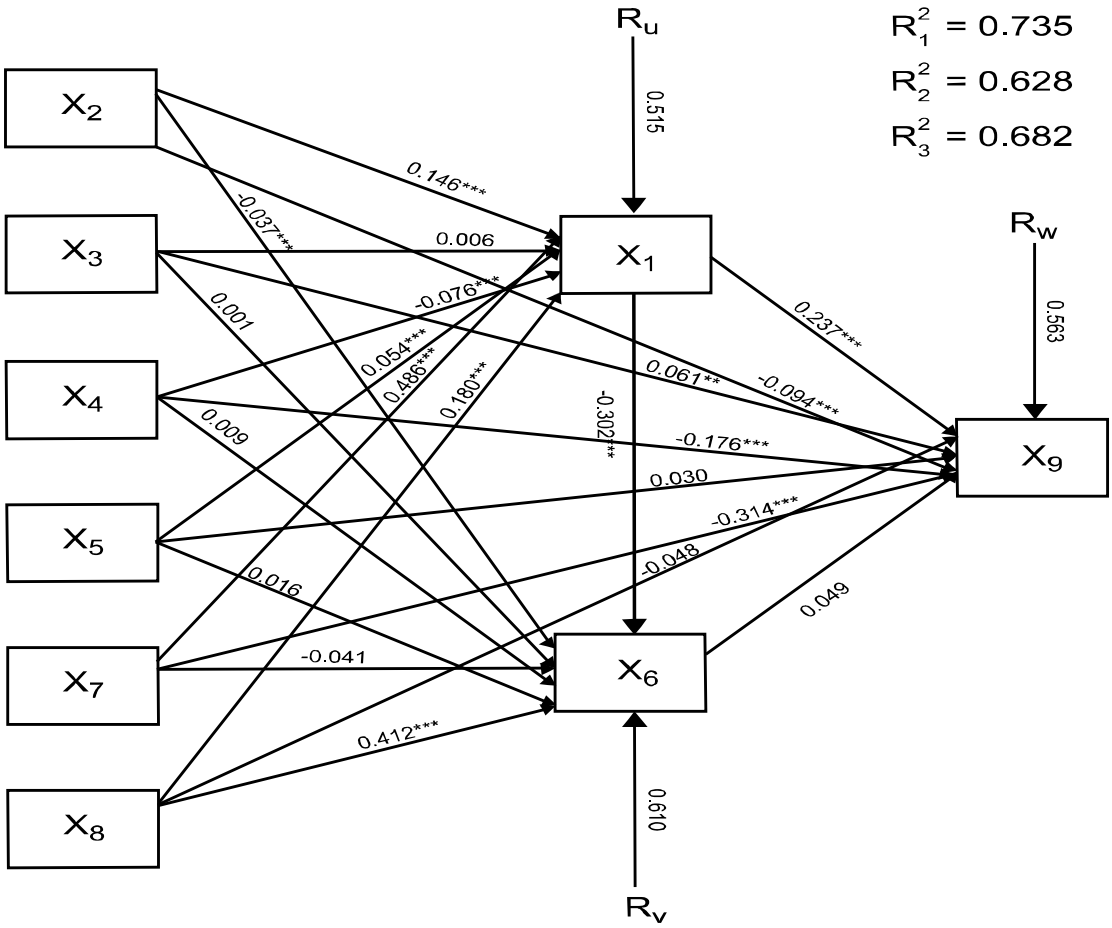


Figure-7.5: Path diagram for reproductive health with selected demographic characteristics

It is observed that there are 13 paths out of 21 hypothesized paths are found to be statistically significant for reproductive health of ever-married women and five variables out of eight variables are found to have significant direct effect on reproductive health of ever-married women (Figure-7.5). Among those respondent's current age (X_1) and age at marriage (X_3) have direct significant ($p < 0.01$ & $p < 0.05$) positive effect on reproductive health of ever-married women (X_9). It is also observed that respondent's marital status (X_2), place of residence (X_4), and children ever born (X_7) have direct significant ($p < 0.000$) negative effect on reproductive health of ever-married women in Bangladesh. The values of $R_1^2 = 0.735$ for endogenous variable respondent's current age (X_1), $R_2^2 = 0.628$ for endogenous variable family size of the respondent's (X_6), and $R_3^2 = 0.682$ for dependent variable reproductive health score (X_9) are smaller than in Figure-7.4. So, it may be conclude that the path diagram represents in Figure-7.4 better than in Figure-7.5.

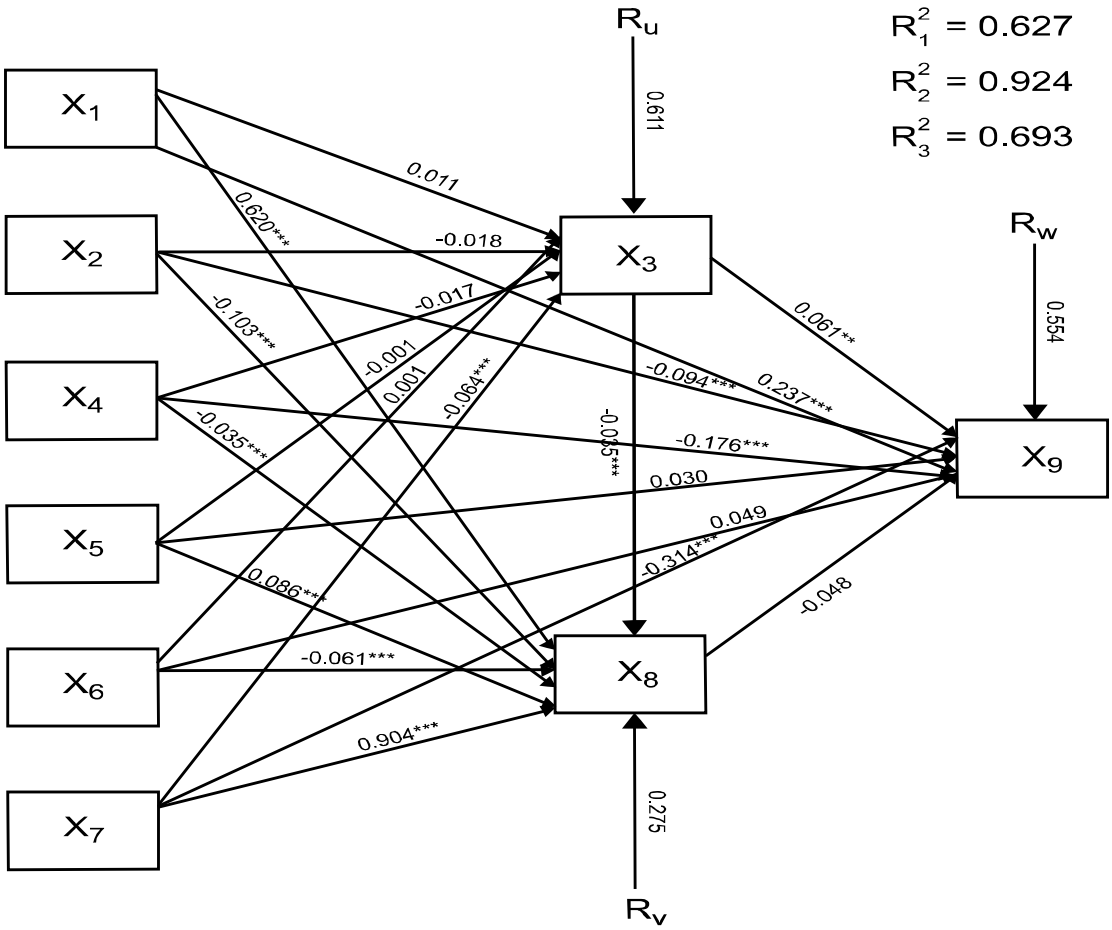


Figure-7.6: Path diagram for reproductive health with selected demographic characteristics

There are 13 paths out of 21 hypothesized paths are found to be statistically significant for reproductive health of ever-married women and five variables out of eight variables are found to have significant direct effect on reproductive health of ever-married women (Figure-7.6). Among those respondent's current age (X_1) and age at marriage (X_3) have direct significant (p < 0.000) positive effect on reproductive health of ever-married women (X_9). It is also observed that respondent's marital status (X_2), place of residence (X_4), and children ever born (X_7) have direct significant (p < 0.000) negative effect on reproductive health of ever-married women in Bangladesh. The value of R_1^2, R_2^2 and R_3^2 are 0.627, 0.924 and 0.693 for endogenous variable respondent's age at marriage (X_3), number of living children (X_8), and dependent variable reproductive health score (X_9) respectively which show that the path diagram represents in Figure-7.4 better than in Figure-7.6.

7.6 Path Model Analysis for Health of Ever-married Women

According to the causal ordering of variables the selected set of variables can be divided into three groups that are given below in the Table-7.9:

Table-7.9: Variables used in path analysis for health of ever-married women

Types of variable	Variables
Exogenous variable	X_1 = Current age X_2 = Marital status X_3 = Age at marriage X_4 = Place of residence X_5 = Religion X_6 = Family size
Endogenous variable	X_7 = Children ever born X_8 = Living children
Dependent variable	X_9 = Health of ever-married women (BMI)

The systems of fitted equations are as follows:

$$X_7 = 0.190X_6 - 0.046X_5 + 0.092X_4 - 0.038X_3 - 0.083X_2 + 0.638X_1$$

$$X_8 = 0.904X_7 + 0.221X_6 - 0.061X_5 + 0.086X_4 - 0.035X_3 - 0.103X_2 + 0.620X_1$$

$$X_9 = 0.086X_8 - 0.247X_7 + 0.014X_6 - 0.009X_5 - 0.187X_4 + 0.020X_3 - 0.096X_2 + 0.300X_1$$

The zero order correlation coefficients of selected demographic variables on health of ever-married women are presented in the Table-7.10. From Table-7.10, it is observed that with few expectations of the zero order correlation coefficients between health of ever-married women and each of the selected variables generally does not differ much from their corresponding total effects. The different types of effects are represented in the Table-7.11. Also the Table-7.12 depicts the percentages of the total absolute effect (direct, indirect and implied) on health of ever-married women.

From the Table-7.10, it is revealed that respondent's marital status (X_2), place of residence (X_4), and family size (X_6) are negatively significant ($p < 0.01$) on health of ever-married women (X_9) in Bangladesh. It is also observed that respondent's religion (X_5) and children ever born (X_7) are negatively insignificant on health of ever-married women. Table-7.10 shows that respondent's current age (X_1) and age at marriage (X_3) are positively significant ($p < 0.01$ & $p < 0.05$) and number of living

children (X_8) is positively insignificant on health of ever-married women in Bangladesh. This table also shows the interrelationship among the selected variables. The zero order correlation coefficients among the selected demographic variables and health of ever-married women are given below:

Table-7.10: Zero order correlation coefficient between demographic variables and health of ever-married women

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
X_1	1.000	0.169**	-0.033**	-0.021**	0.043**	-0.087**	0.638**	0.620**	0.170**
X_2		1.000	-0.017	-0.036**	-0.001	-0.069**	0.027**	0.005	-0.048**
X_3			1.000	-0.022*	0.001	-0.008	-0.059**	-0.054**	0.025*
X_4				1.000	-0.012	0.044**	0.107**	0.097**	-0.221**
X_5					1.000	-0.013	-0.038**	-0.046**	-0.002
X_6						1.000	0.133**	0.157**	-0.038**
X_7							1.000	0.948**	-0.008
X_8								1.000	0.009
X_9									1.000

Note: ** Significant at the 0.01 level, * Significant at the 0.05 level.

For ever-married women health, total effects of exogenous variables like as respondent's marital status (X_2), respondent's place of residence (X_4), and religion (X_5) are observed negative direction on health of ever-married women (X_9) and the remaining variables like as respondent's current age (X_1) and age at marriage (X_3), and family size (X_6) are observed positive direction on health of ever-married women (X_9). Again it is also observed that the total effects of endogenous variables like as children ever born (X_7) shows the negative direction and number of living children (X_8) shows the positive direction on health of ever-married women (Table-7.11).

Total effects of the respondent's current age (X_1) on health of ever-married women (X_9) is 0.300, of which about 65.7% is transmitted through its implied effect in the same direction and about 25.7% is acts through children ever born (X_7) in opposite direction and about 8.6% is transmitted through number of living children (X_8) in the same direction (Table-7.11 and Table-7.12). Again total effects of respondent's marital status (X_2) on health of ever-married women (X_9) is -0.096, of which about 78.3% is transmitted through its implied effect in the same direction and a very little

percent that is only 15.2% acts through children ever born (X_7) in the opposite direction and about 6.5% is transmitted in the same direction through number of living children (X_8) on health of ever-married women (X_9).

From the Table-7.11, it is found that the total effects of respondent's age at marriage (X_3) on health of ever-married women (X_9) is 0.020, of which about 53.8% is conducted through its implied effect in the same direction and about 34.6% is act through children ever born (X_7) in same direction and about 11.5% is transmitted through number of living children (X_8) in the opposite direction (Table-7.12). Again total effects of respondent's place of residence (X_4) on health of ever-married women (X_9) is -0.187, of which about 85.1% is conducted through its implied effect in the same direction and about 11.4% is act through children ever born (X_7) in the same direction and remaining 3.5% is transmitted in the opposite direction through number of living children (X_8).

Table-7.11 shows that the total effects of respondent's religion (X_5) on health of ever-married women (X_9) is -0.009, of which about 48.4% is transmitted through its implied effect in the same direction and about 35.5% is act in the opposite direction through children ever born (X_7) and about 16.1% is transmitted in the same direction through living children (X_8). Again total effects of respondent's family size (X_6) on health of ever-married women (X_9) is 0.014, of which about 38.9% is transmitted through its implied effect in the same direction and about 43.5% is act in opposite direction through children ever born (X_7) and about 17.6% is transmitted in the same direction through number of living children (X_8).

Direct effect of endogenous variables as like as children ever born (X_7) is observed in negative direction and number of living children (X_8) as in positive direction. Total effect of children ever born of ever-married women (X_7) and number of living children of ever-married women (X_8) on health of ever-married women (X_9) are -0.247 and 0.086, of which both are about 100.0% transmitted through its direct effect. Analysis of demographic variables through the selected variables for health of ever-married women and their corresponding percentage values are given below:

Table-7.11: Direct, indirect and implied effect of demographic variables on health of ever-married women

Dependent variable	Selected variable	Total association	Non-causal effect	Total effect	Indirect effect via		Implied effect	Direct effect
X_9		0.170**	-0.130	0.300	-0.158	0.053	0.404	
		-0.048**	0.048	-0.096	0.021	-0.009	-0.108	
		0.025*	0.005	0.020	0.009	-0.003	0.014	
		-0.221**	-0.034	-0.187	-0.023	0.007	-0.172	
		-0.002	0.007	-0.009	0.011	-0.005	-0.015	
		-0.038**	-0.052	0.014	-0.047	0.019	0.042	
		-0.008	0.239	-0.247	-	-	-	-0.247
		0.009	-0.077	0.086	-	-	-	0.086

Note: Non-causal effect = Total association – Total effect

Table-7.12: Percentages of the total absolute effect on health of ever-married women through endogenous and exogenous variables

Dependent variable	**Selected variable**	**Percentage of indirect effect via**		**Implied effect**	**Direct effect**
X_9		25.7	8.6	65.7	
		15.2	6.5	78.3	
		34.6	11.5	53.8	
		11.4	3.5	85.1	
		35.5	16.1	48.4	
		43.5	17.6	38.9	
		-	-	-	100.0
		-	-	-	100.0

Path coefficients are shown in Figure-7.7. In Path analysis, path coefficients obtain direct, indirect, implied effect for the selected explanatory variables.

According to the Figure-7.7, it is observed that there are 19 paths out of 21 hypothesized paths are found to be statistically significant for health of ever-married women. The significant coefficients of the direct and indirect effect are discussed only. It is worth mentioning that the estimation of the non-significant path has only a small effect on the power of the explanation of the model.

In Figure-7.7, six variables out of eight variables are found to have significant direct effect on health of ever-married women. Among those respondent's marital status (X_2), place of residence (X_4), and children ever born (X_7) have direct significant ($p <$ 0.000) negative effects on health of ever-married women (X_9). From the Figure-7.7, it is also observed that respondent's current age (X_1), age at marriage (X_3), and number of living children (X_8) have direct significant ($p <$ 0.000 & $p <$ 0.021) positive effects on health of ever-married women in Bangladesh. The path diagram for health of ever-married women and various demographic characteristics are given below:

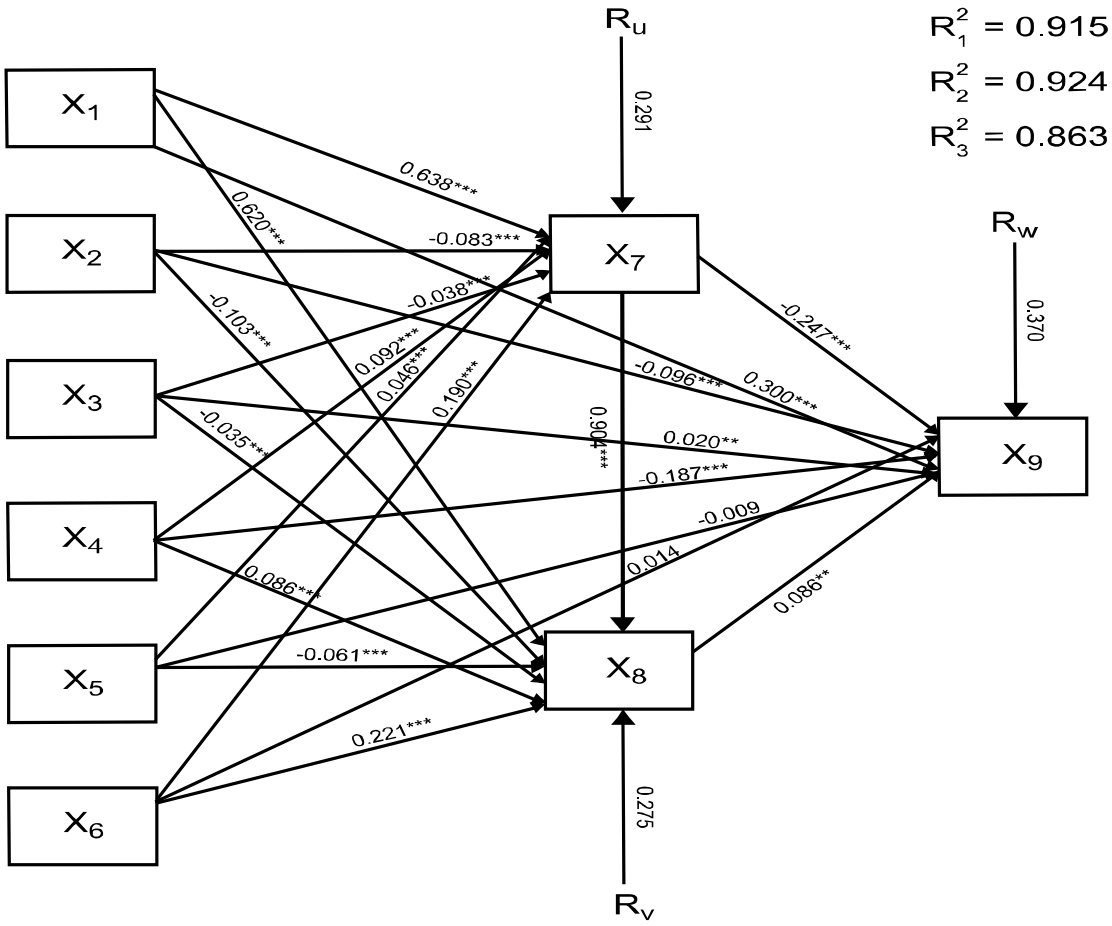


Figure-7.7: Path diagram for health of ever-married women with selected demographic characteristics

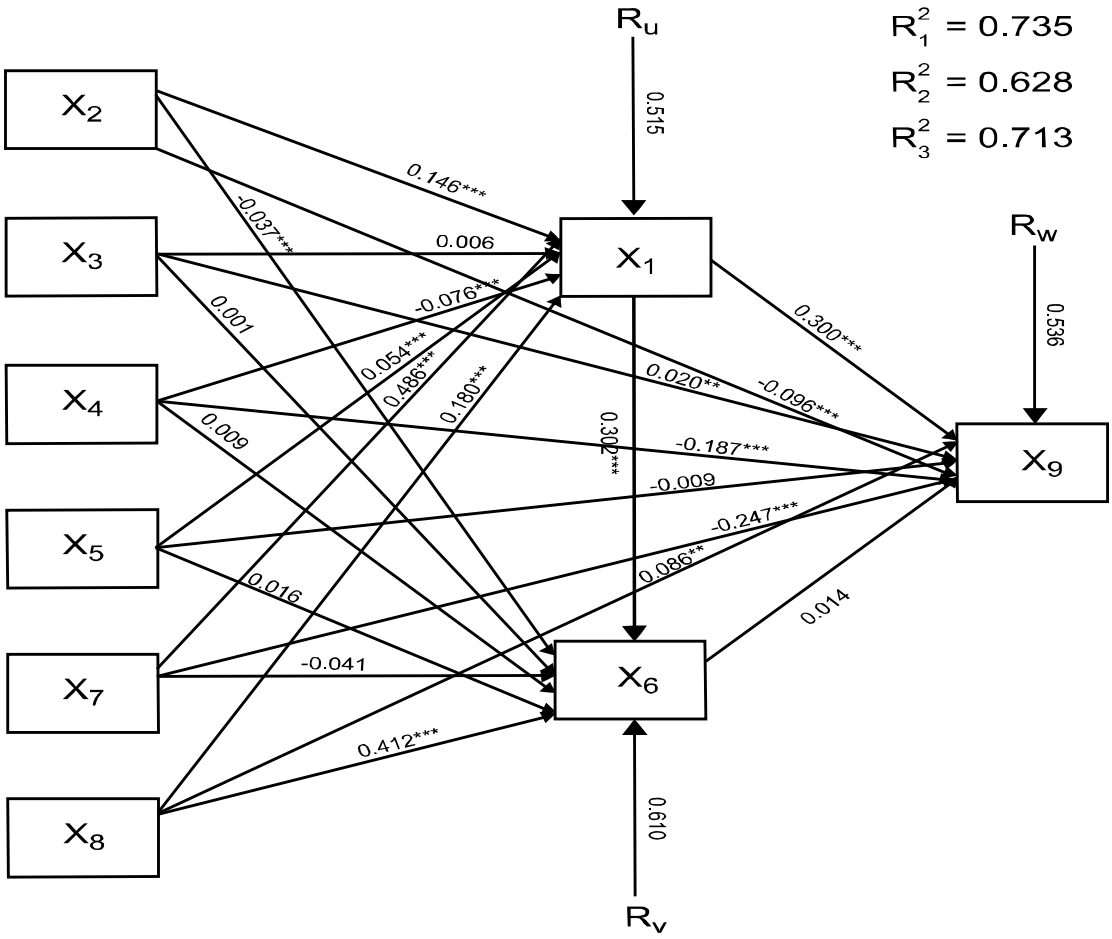


Figure-7.8: Path diagram for health of ever-married women with selected demographic characteristics

It is observed that there are 14 paths out of 21 hypothesized paths are found to be statistically significant for health of ever-married women and six variables out of eight variables are found to have significant direct effect on health of ever-married women (Figure-7.8). Among those respondent's current age (X_1), age at marriage (X_3), and number of living children (X_8) have direct significant ($p < 0.01$ & $p < 0.05$) positive effect on health of ever-married women (X_9). It is also observed that respondent's marital status (X_2), place of residence (X_4), and children ever born (X_7) have direct significant ($p < 0.01$) negative effect on health of ever-married women in Bangladesh. The value of $R_1^2 = 0.735$ for endogenous variable respondent's current age (X_1), $R_2^2 = 0.628$ for endogenous variable family size of the respondent's (X_6), and $R_3^2 = 0.713$ for dependent variable health of ever-married women (X_9) are smaller than in Figure-7.7. So, it may be conclude that the path diagram represents in Figure-7.7 better than in Figure-7.8.

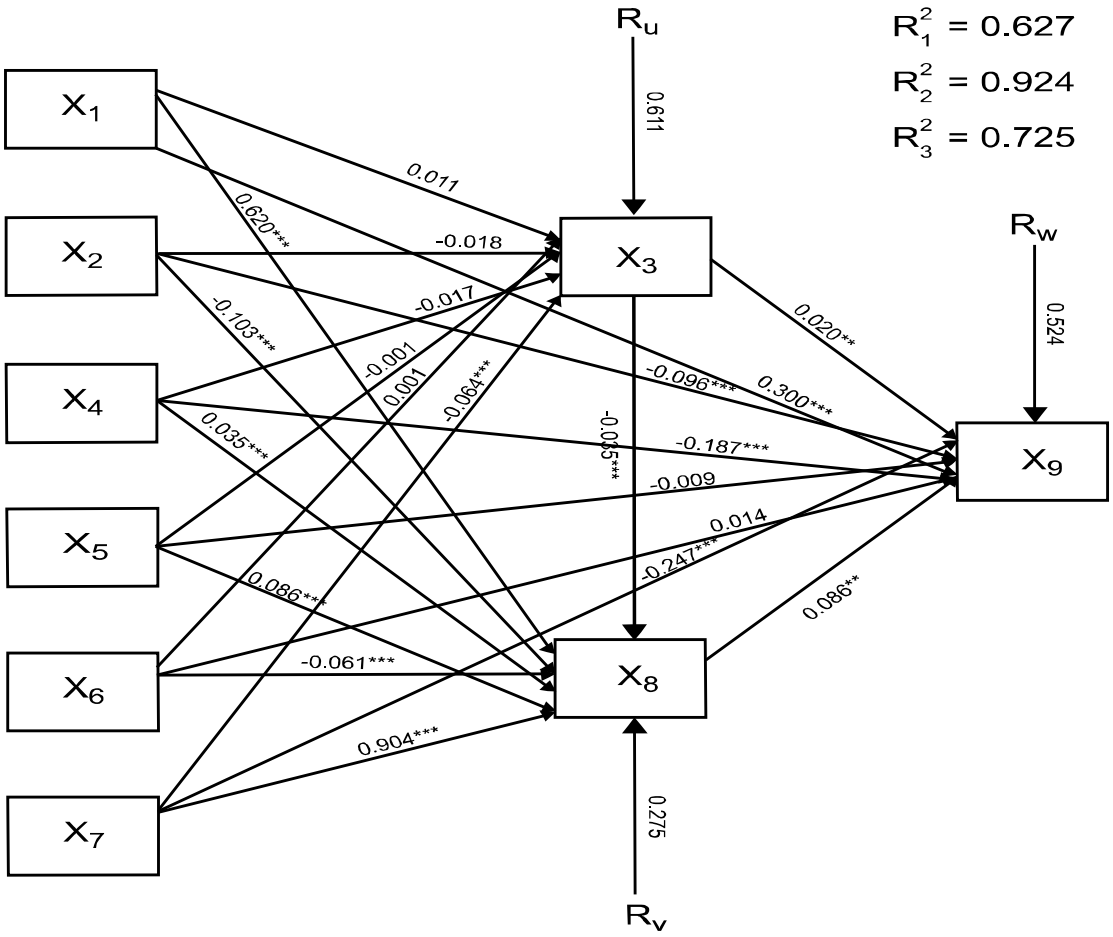


Figure-7.9: Path diagram for health of ever-married women with selected demographic characteristics

There are 14 paths out of 21 hypothesized paths are found to be statistically significant for health of ever-married women and six variables out of eight variables are found to have significant direct effect on health of ever-married women (Figure-7.9). Among those respondent's current age (X_1), age at marriage (X_3), and number of living children (X_8) have direct significant ($p < 0.01$ & $p < 0.05$) positive effect on health of ever-married women (X_9). It is also observed that respondent's marital status (X_2), place of residence (X_4), and children ever born (X_7) have direct significant ($p < 0.01$) negative effect on health of ever-married women in Bangladesh. The value of R_1^2, R_2^2 and R_3^2 are 0.627, 0.924 and 0.725 for endogenous variable respondent's age at marriage (X_3), number of living children (X_8), and dependent variable health of ever-married women (X_9) respectively which show that the path diagram represents in Figure-7.7 better than in Figure-7.9.

7.7 Summary

The structural equation modeling (path analysis) has been applied to examine the causal effects (direct and indirect) of demographic factor on poverty and reproductive health of ever-married women in Bangladesh. The results of SEM analysis for standard of living of ever-married women reveal that there are 20 paths out of 21 hypothesized paths statistically significant ($p < 0.01$). Out of eight demographic variables six variables are exogenous and these exogenous variables have direct and indirect effects on standard of living and two variables are endogenous and these two endogenous variables have direct effects on standard of living of ever-married women. The results of this findings also show that respondent's marital status, place of residence, religion, children ever born, and number of living children have direct significant ($p < 0.01$) negative effects on standard of living of ever-married women and respondent's current age and family size of the respondents have direct significant ($p < 0.01$) positive effects on standard of living of ever-married women in Bangladesh.

Total effects of the respondent's current age, marital status, age at marriage, place of residence, religion, and family size of the respondent's on standard of living of ever-married women are transmitted through its implied effects about 67.9%, 77.0%, 45.8%, 83.0%, 75.7% and 77.5% respectively and indirect effects of those exogenous variables through endogenous variable children ever born on standard of living of ever-married women are 24.8%, 16.5%, 41.7%, 13.3%, 17.6% and 16.5% respectively. But indirect effects of the respondent's current age, marital status, age at marriage, place of residence, religion, and family size of the respondent's on standard of living of ever-married women through endogenous variable number of living children are 7.4%, 6.5%, 12.5%, 3.7%, 6.8% and 6.0% respectively. Total effect of children ever born and number of living children on standard of living of ever-married women are about -0.275 and -0.084 of which both are 100.0% transmitted through its direct effect on standard of living of ever-married women in Bangladesh.

For reproductive health of ever-married women, it is seen that there are 18 paths out of 21 hypothesized paths statistically significant ($p < 0.01$ & $p < 0.05$) on reproductive health of ever-married women and out of eight variables, five variables are found to have significant ($p < 0.01$ & $p < 0.05$) direct effects on reproductive

health of ever-married women. Among those respondent's marital status, place of residence, and children ever born have direct significant ($p < 0.05$) negative effects and respondent's current age and age at marriage have direct significant ($p < 0.01$) positive effects on reproductive health of ever-married women in Bangladesh.

Total effects of the respondent's current age, marital status, age at marriage, place of residence, religion, and respondents' family size on reproductive health of ever-married women are transmitted through its implied effects about 67.0%, 80.1%, 77.0%, 81.3%, 43.3% and 62.6% respectively and indirect effects of those exogenous variables through endogenous variable children ever born on reproductive health of ever-married women are 28.7%, 16.7%, 19.7%, 16.5%, 46.7% and 31.6% respectively. But indirect effects of the respondent's current age, marital status, age at marriage, place of residence, religion, and family size of the respondent's on reproductive health of ever-married women through endogenous variable number of living children are 4.3%, 3.2%, 3.3%, 2.3%, 10.0% and 5.8% respectively. Total effect of children ever born and number of living children on reproductive health of ever-married women are about -0.314 and -0.048 of which both are 100.0% transmitted through its direct effect on reproductive health of ever-married women.

It is also found for health of ever-married women that there are 19 paths out of 21 hypothesized paths statistically significant ($p < 0.01$ & $p < 0.05$) on health of ever-married women and six variables out of eight variables are found to have significant ($p < 0.01$ & $p < 0.05$) direct effects on health of ever-married women. Among those respondent's marital status, place of residence, and children ever born have direct significant ($p < 0.01$) negative effect and respondent's current age, age at marriage, and number of living children have direct significant ($p < 0.01$ & $p < 0.01$) positive effects on health of ever-married women in Bangladesh.

Total effects of the respondent's current age, marital status, age at marriage, place of residence, religion, and respondents' family size on health of ever-married women are transmitted through its implied effects about 65.7%, 78.3%, 53.8%, 85.1%, 48.4% and 38.9% respectively and indirect effects of those exogenous variables through endogenous variable children ever born on health of ever-married women are 25.7%, 15.2%, 34.6%, 11.4%, 35.5% and 43.5% respectively. But indirect effects of the respondent's current age, marital status, age at marriage, place of residence, religion,

and family size of the respondent's on health of ever-married women through endogenous variable number of living children are 8.6%, 6.5%, 11.5%, 3.5%, 16.1% and 17.6% respectively. Total effect of children ever born and number of living children on health of ever-married women are about -0.247 and 0.086 of which both are 100.0% transmitted through its direct effects on health of ever-married women.

Key findings of this chapter:

- Current age of ever-married women is positively significant ($p < 0.01$) on standard of living i.e., standards of living of ever-married women increase when their ages are increased.
- Women's children ever born and living children are negatively significant ($p < 0.01$) on standard of living i.e., standard of living of ever-married women decrease when their children ever born and living children are increased.
- Place of residence and religion of the respondents are negatively significant ($p < 0.01$) on standard of living of ever-married women i.e., when urbanization decreases, standard of living also decreases in the same direction.
- In case of reproductive health of ever-married women, current age and age at marriage are positively significant ($p < 0.01$ & $p < 0.05$) on reproductive health i.e., reproductive health of women improve when their current age and age at marriage are increased.
- Women's children ever born and place of residence are negatively significant ($p < 0.01$) on reproductive health i.e., reproductive health of ever-married women decrease when women's children ever born and number of rural women are increased. Similar scenarios are found in the case health of ever-married women in Bangladesh.

Chapter 8

Conclusions, Policy Implications and Recommendations

8.1 Conclusions

The present study is an attempt to investigate the influencing factors for poverty, reproductive health and health of ever-married women through different methods with respect to some selected demographic characteristics. Univariate, bivariate and multivariate analyses have been done to examine the relative importance and impact of demographic factors as the determinants of poverty, reproductive health and health of ever-married women in Bangladesh. The data on these aspects of socio-economic, demographic, reproductive health and health related variables are available from BDHS 2014 data. This study focuses some important causes of poverty, reproductive health and health of ever-married women based on the BDHS 2014 data. In this study, an attempt is made to examine the association and determinants of standard of living status, reproductive health status and health status of ever-married women with respect to some selected demographic characteristics.

In this study, it has been developed an analytical framework for analyzing demographic characteristics for standard of living status, reproductive health status and health status of ever-married women. This framework is based on widely used univariate, bivariate and multivariate analysis i.e., logistic regression analysis, multiple classification analysis, factor analysis and structural equation modeling (path analysis) to analyze the impact of demographic factors which have extended with five features. The first feature is attempted to investigate association with respect to some selected demographic characteristics i.e., bivariate analysis. The second feature is examined to identify the determinants of living standard, reproductive health and health of ever-married women with selected demographic variables by logistic regression analysis. The third feature is attempted to measure and isolate the intensity of the effect of selected demographic characteristics on standard of living, reproductive health and health of ever-married women i.e., multiple classification analysis. The fourth feature is to identify the responsible factors for demographic, poverty and reproductive health related variables by factor analysis. Finally, the fifth feature is to investigate and determine the direct and indirect effects of demographic factors on standard of living, reproductive health and health of ever-married women using structural equation modeling (path analysis). The present study is to summarize some major findings of the study and to draw conclusions.

Univatiate analysis for this study gives the evidence that the distribution of the ever-married women according to their age at marriage 71.3% were married within 18 years of age and only 29% women married after age of 18 years in Bangladesh. A substantial proportion of ever-married women included in the study have started childbearing at early age, thus it might happen that they have a high number of children born. The percent of children ever born to the ever-married women aged 15-49 years shows that more than 48% ever-married women have one or two children ever born, 41.4% ever-married women have three or more children ever born, and 10% ever-married women have no children ever born. Place of residence is an important determinant of reproductive health status of the women which increases outlook in terms of education, employment, healthy life styles, and also access to information and then it affects the reproductive behaviour of women. From this study it is found that only 34.5% ever-married women live in urban areas and 65.5% ever-married women live in rural areas in Bangladesh. In poverty and reproductive health studies number of family members is also an important demographic characteristic. Higher the family member, lower the quality of life. Distribution of the respondents by their family size is shown that about 42.6% of the respondents have family size with 1-4 members, 33.4% have family size with 5-6, and 24.0% ever-married women live with family members 7 or above.

Socio-economic characteristics of the respondents play an important role to analyze the reflecting picture of social and economic status of a community that are termed as socio-economic characteristics. The distributions of economic condition and social benefits are closely related to the knowledge of poverty. The standard of living of the ever-married women is used as background characteristic with information on durables of the respondent's households. The present study shows that more than 36 percent ever-married women are in the low status of living standard in study areas. However about 38.6 percent and 25.2 percent ever-married women are living with medium and high status of living standard respectively in Bangladesh. Finally, there are some health related variables selected which are closely related with reproductive health of ever-married women. The percentage distribution of the reproductive health status shows that about 33 percent ever-married women live with low status, 35.1 percent with medium and remaining 32 percent ever-married women live with high status of reproductive health in Bangladesh.

Bivariate analysis highlights the relationship with demographic characteristics and poverty, reproductive health and health of ever-married women. Findings of this study revealed that women's current age, marital status, age at marriage, children ever born, number of living children, place of residence, religion and family size of ever-married women are statistically significantly associated with standard of living status in Bangladesh. Furthermore the values of contingency coefficient give the evident that women's age at marriage, children ever born, number of living children, place of residence and family size have strong association with standard of living status of ever-married women. From the results it is found that low status of living standard of ever-married women decreases with the increasing of their current age. On the other hand, women high status of living increases with increasing trend of their current age. However women desire for standard of living increase with the increasing of their current age. Findings also indicate that more than one third of women who are getting marriage early or at the age of 18 years are lower standard of living status and this is much higher who are getting marriage after age of 18 years. Results also show that women percentage of low status of living increases while their number of children ever born increase and on the other hand women percentage of high status of living standard decrease with the increasing their number of children ever born. Besides, the percentage of ever-married women of high standard of living status decreases with the increasing of their number of living children in Bangladesh.

For reproductive health status, bivariate analysis shows that women's current age, age at marriage, children ever born, number of living children and place of residence are statistically significantly associated with reproductive health status of ever-married women. Moreover contingency coefficients indicate that women's current age, age at marriage, children ever born, number of living children and place of residence are strongly associated with their reproductive health status in Bangladesh. The results also show that women reproductive health status increase with the increasing trend of their reproductive age. Another demographic characteristic such as age at marriage revealed that the percentage of ever-married women with low reproductive health status is higher than those women who are getting marriage after age of 18 years. Women percentage of low status of reproductive health increases while their number of children ever born increasing and on the other hand women percentage of high status of reproductive health decreases while the number of children ever born

increases. Besides this, the percentage of ever-married women with high status of reproductive health decreases while their number of living children increases. The present study also reveals that percentage of women for low status of reproductive health increases with the increasing of their family size in Bangladesh.

The present study also investigates the association and strength of relationship between selected demographic characteristics and health status of ever-married women in Bangladesh. From the bivariate analysis, it is noted that women's current age, marital status, children ever born, number of living children, place of residence and family size are statistically significant and strongly association with health status of ever-married women in Bangladesh. Findings of the study indicate that the lower health status of women increase with the increasing of their children ever born. Moreover the risk of being severe health problem is comparatively high among women with three or more living children in Bangladesh. Our study also showed that the risk of health problems among rural women is higher than urban women and this would most likely due to poverty and lack of resources on maternal health or general health in Bangladesh.

Multinomial logistic regression model shows that current age, marital status, children ever born and place of residence of ever-married women have significant ($p < 0.01$) impact on their health status in Bangladesh. Findings revealed that ever-married women in Bangladesh are suffering severe health problems at their final stage of reproduction. Moreover, adolescent mothers of Bangladesh are suffering severe health problems than the old age mothers. Another demographic factor such as women's children ever born is an important determinant that affecting their health status. The relative chance to the risk of health problem of ever-married women increases with the increasing of their children ever born in Bangladesh. With regards to the place of residence, urban women are less likely to face severe health problem compared to those women who are live rural areas in Bangladesh. Family size has an important effect on ever-married women health status and health problem is severe among the ever-married women with larger family size. Findings confirm the existence of health problems among ever-married women of reproductive age group in Bangladesh and health problems specifically for women in reproductive age group must be taken into consideration so that health interventions may be adopted through appropriate policy.

Ordinal logistic regression model shows that current age, marital status, age at marriage, children ever born, place of residence, religion and family size of ever-married women have highly significant ($p < 0.001$) influence on their standard of living status in Bangladesh. The ordinal logistic regression results also revealed that women deserve for high status of living standard increase with the increasing of their current age. Married women are more likely to expect high status of living standard compared to those women who are divorced or separated. Another demographic factor such as age at marriage affirmed that the early married women (age below or at age of 18 years) are less likely to being high status of living than those women who married after age of 18 years in Bangladesh. Women who have one to two children ever born are more likely to desire high standard of living status compared to women with three or more children ever born and higher the children ever born of ever-married women lower the standard of living in Bangladesh. Demographic factor such as women's number of living children has an important effect on standard of living status of ever-married women in Bangladesh. The women who have one and two living children are more likely to deserve high standard of living status compared to the women with three or more living children in Bangladesh. Standard of living status of ever-married women decreases with the increasing of their number of living children. Women who are live in urban areas are more likely to deserve high standard of living status compared to those women who are live in rural areas. Findings indicate that women's current age, marital status, age at marriage, children ever born, number of living children, and place of residence are influential demographic predictors in producing higher level of living standard of ever-married women in Bangladesh.

For reproductive health status of ever-married women, ordinal logistic regression model shows that marital status, age at marriage, number of living children and place of residence of ever-married women have significant ($p < 0.05$) influence on their reproductive health status in Bangladesh. Women's current age has an important effect on their reproductive health status and women expectation for high status of reproductive health increase with the increasing of their current age. The results also show that the married women are more likely to expect high status of reproductive health compared to those women who are divorced or separated. Another important demographic factor such as age at marriage revealed that the early married women

(age below or at age of 18 years) are less likely to being higher reproductive health status compared to those women who married after age of 18 years. Women who have one to two children ever born more likely to being high status of reproductive health compared to the women with three or more children ever born. Women's expectation for higher reproductive health status decreases with the increasing of their number of living children in Bangladesh. Women who are live in urban areas more likely to deserve higher reproductive health status compared to those women who are live in rural areas in Bangladesh. The results of ordinal logistic regression show that Muslim women are less likely to have high status of reproductive health compared to Non-Muslim women. The results also reveal that family size emerged as an important factor for determining the effects on reproductive health status of ever-married women. Women having larger family size are less likely to being high status of reproductive health compared to women having smaller family size in Bangladesh.

Multiple classification analysis (MCA) shows that women's current age, age at marriage, children ever born, number of living children, place of residence, religion and family size have significant ($p < 0.001$) effect on standard of living status of ever-married women. The results of MCA show that ever-married women living standard increases with the increasing of their current age. Moreover, the effect of current age is found to be the second strongest influential determinant for explaining the variation on standard of living status among the selected variables. Although the average level of age at marriage is very low, age at marriage still has a strong relationship with standard of living status. Women who are marry earlier or at the age of 18 years adjusted mean value for standard of living status lower than those women who are marry after age of 18 years and the effect of women's age at marriage is the fifth strongest influential factor for explaining the proportion of variability of ever-married women standard of living status in Bangladesh. The mean value of women standard of living status decreases with the increasing of their children ever born and women's children ever born have found to be the third strongest influential predictor for explaining variability of ever-married women standard of living among the included variables. Another demographic factor women's number of living children, the mean value of women standard of living decreases with the increasing of their number of living children. The mean value of standard of living for women's in urban residence is higher than women with rural residence and the proportion of variation for standard

of living status explained by women's place of residence is the highest among the selected variables. Demographic variable such as women's family size has an important contribution on their standard of living status and the effect of family size is the fourth strongest influential predictor on standard of living status of ever-married women among all other variables.

In the case of reproductive health status of ever-married women, MCA shows that women's marital status, age at marriage, children ever born, number of living children, place of residence and religion of ever-married women have significant ($p < 0.01$) effect on their reproductive health status in Bangladesh. Women's current age is one of the most important factors for their reproductive health status and the effect of the current age is the third strongest influential factor for explaining the proportion of variation on reproductive health status of ever-married women among all other included variables. Women's marital status has also negative contribution on reproductive health status and this is the fourth strongest determinants of reproductive health status of ever-married women among selected demographic variables. The results of MCA model also revealed that the higher age at marriage requires the higher reproductive health status. Among the included variables, age at marriage is the fifth strongest influential predictor for explaining the proportion of variation on reproductive health status of ever-married women in Bangladesh. The mean value of reproductive health status of ever-married women decreases with the increasing of their number of children ever born. Moreover, women children ever born are the sixth strongest influential determinant for explaining the variation on reproductive health status of ever-married women among the selected demographic variables. Although the average level of living children is high, women's number of living children still has an important contribution on their reproductive health status and it is negatively associated with reproductive health status of ever-married women. Among the included variables women's number of living children is the first strongest influential determinant for explaining the variability on reproductive health status of ever-married women in Bangladesh. Women in rural areas have lower reproductive health status compared to women in urban areas in Bangladesh. Findings also indicate that the effect of place of residence is found to be the second strongest influential factors for explaining the proportion of variation on reproductive health status of ever-married women among all other selected variables.

For health status of ever-married women, MCA shows that women's current age, marital status, children ever born, number of living children, and place of residence of ever-married women have highly significant ($p < 0.001$) effect on their health status in Bangladesh. The findings give the evidence that ever-married women health status increase with the increasing of their current age. From the selected variables current age is the first strongest influential predictor for explaining the variation on health status of ever-married women among all other selected variables. Women who are married show higher health status and it is lower for the divorced or separated women. Furthermore, marital status is the fifth strongest predictor of health status of ever-married women among all other selected demographic variables. The mean health status of ever-married women decreases with the increasing of their children ever born in Bangladesh and the effect of women's children ever born is the fourth strongest influential determinant on health status of ever-married women among the selected variables. Results of MCA also show that ever-married women health status decrease with the increasing their number of living children in Bangladesh. Among the included variables women's number of living children is the second most important determinant for explaining the variation on health status of ever-married women in Bangladesh. Women in rural areas are lower health status than women in urban areas in Bangladesh. Among the included variables place of residence is the third strongest influential factor for explaining the variation on health status of ever-married women.

Factor analysis has been used in this study to identify demographic, poverty, and reproductive health related factors that are substantively meaningful in the sense that they summarize sets of closely related variables. Thus, it may conclude that rotated factor matrix presents the nine factors after rotation. To identify what these factors represent, it would be necessary to consider what items loaded on each of the nine factors. Five variables; household electricity, household television, household refrigerator, household cooking fuel, household floor materials are loaded on Factor 1 and an inspection of these items clearly shows that the majority of these variables reflect the socio-economic characteristics. Factor 2 contains seven variables; number of visits antenatal care, place of delivery, health care after delivery, delivery by caesar, postnatal care provider, place of first postnatal care, and fertility planning status with larger loading that clearly reflect the reproductive health characteristics.

Factor 3 contains five variables; current age of respondents, total children ever born, number of living children, place of residence, and family size with larger loading that clearly reflect the demography characteristics. Factors 5, 7, and 9 contain the variables; household drinking water, respondents mass media exposure, household radio, household toilet facility, and household bicycle with larger loading that appear to reflect the related motives of socio-economic and an inspection of these items clearly shows that these items reflect socio-economic conditions. Factor 4 contains two variables current use of contraceptive and contraceptive method types with larger loading that clearly reflect the related motive of reproductive health. Factor 6 and 8 contain the variables current marital status, age at marriage, and religion with higher loading that appear to reflect the changing pattern in composition of population and an inspection of these items clearly shows that these items reflect the demography characteristics.

The present factor structure appears to be represented by three dimensions (Socio-economic, Reproductive health, and Demography). So, it was decided to rerun factor analysis, stipulating the extraction of only three factors and rotated component matrix presents only three rotated factors. Factor 1 contains ten variables i.e., household electricity, household radio, household television, household refrigerator, household bicycle, household cooking fuel, household drinking water, household toilet facility, household floor materials, and respondents mass media exposure with larger loadings that clearly reflect the socio-economic conditions and was thus Factor 1, labeled as Poverty Factor. Factor 2 contains nine variables i.e., number of visit antenatal care, place of delivery, health checkup after delivery, current use of contraceptive, delivery by caesar, postnatal care providers, place of first postnatal care, contraceptive method types, and fertility planning status with larger loadings that reflect the reproductive health conditions, and was thus Factor 2, labeled as Reproductive health Factor. Factor 3 contains eight variables i.e., respondents current age, marital status, age at marriage, children ever born, number of living children, place of residence, religion, and family size with larger loadings that reflect the demographic conditions, and was thus Factor 3 labeled as Demographic Factor. Finally, this three-factor model represents the combination of the nine original factors and appears to reflect adequately the underlying factor structure of the 27 variables.

Structural equation modeling (Path analysis) examines and determines the direct, indirect and total effects of demographic factors on poverty, reproductive health and health of ever-married women in Bangladesh. SEM for standard of living of ever-married women shows that there are 20 paths out of 21 hypothesized paths statistically significant on standard of living of ever-married women. Out of eight demographic variables six variables are exogenous and these exogenous variables have direct and indirect effects on standard of living and two variables are endogenous and these two endogenous variables have direct effects on standard of living of ever-married women. Findings also indicate that exogenous variables such as women's marital status, place of residence and religion have direct significant negative effects while current age and family size have direct significant positive effects on standard of living of ever-married women in Bangladesh. Total effects of the women's current age, marital status, age at marriage, place of residence, religion, and family size on standard of living of ever-married women are transmitted through its implied effect and indirect effects of those exogenous variables conduct through endogenous variables children ever born and number of living children on standard of living of ever-married women. Total effects of endogenous variables such as children ever born and number of living children have transmitted through its direct significant negative effect on standard of living of ever-married women.

SEM for reproductive health of ever-married women shows that there are 18 paths out of 21 hypothesized paths statistically significant on reproductive health of ever-married women and out of eight variables, five variables are found to have significant direct effect on reproductive health of ever-married women. Among those women's marital status, place of residence, and children ever born have direct significant negative effects and women's current age and age at marriage have direct significant positive effects on reproductive health of ever-married women in Bangladesh. Total effects of the women's current age, marital status, age at marriage, place of residence, religion, and family size on reproductive health of ever-married women are transmitted through its implied effect and indirect effects of those exogenous variables acts through endogenous variables such as children ever born and number of living children on reproductive health of ever-married women. Total effects of children ever born and number of living children are transmitted through its direct effect on reproductive health of ever-married women.

For health of ever-married women, SEM reveals that there are 19 paths out of 21 hypothetical paths statistically significant on health of ever-married women and out of eight variables six variables are found to have significant direct effect on health of ever-married women. Among those women's marital status, place of residence, and children ever born have direct significant negative effects and women's current age, age at marriage, and number of living children have direct significant positive effects on health of ever-married women in Bangladesh. Total effects of the women's current age, marital status, age at marriage, place of residence, religion, and family size on health of ever-married women are transmitted through its implied effect and indirect effects of those exogenous variables conducted through endogenous variables such as children ever born and number of living children on health of ever-married women. Total effects of children ever born and number of living children on health of ever-married women are transmitted through its direct effect on health of ever-married women.

The main purpose of logistic regression analysis is to assess the effects of demographic factors on poverty, reproductive health and health of ever-married women in Bangladesh. Multinomial logistic regression model shows that current age, marital status, children ever born and place of residence of ever-married women have significant effect on their health status. Findings also revealed that adolescent women are suffering severe health problems at their final stage of reproduction in Bangladesh. Moreover, adolescent mothers of Bangladesh are suffering severe health problems than the old age mothers. Another demographic factor such as women's children ever born is an important determinant that affecting on their health status. The relative chance to the risk of health problem of ever-married women increases with the increasing of their children ever born. With regards to the place of residence, urban women are less likely to face severe health problem compared to those women who live in rural areas of Bangladesh.

Ordinal logistic regression model shows that current age, marital status, age at marriage, children ever born, place of residence, religion and family size of ever-married women have significant effect on their standard of living status. From the results of ordinal logistic regression model it is found that women deserve for higher living status increase with the increasing of their current age. Another demographic

factor such as age at marriage affirmed that the early married women (age below or at age of 18 years) are less likely to being high status of living than those women who married after age of 18 years. Women who have one to two children ever born more likely to desire high standard of living status compared to women with three or more children ever born. However, higher the children ever born of ever-married women lower the standard of living status. Women's standard of living status decreases with the increasing of their number of living children. Women who live in urban areas more likely to deserve high standard of living status compared to those women who live in rural areas in Bangladesh.

For reproductive health status of ever-married women, ordinal logistic model shows that marital status, age at marriage, number of living children and place of residence of ever-married women have significant effect on their reproductive health status. Women's current age has an important effect on their reproductive health status and women expectation for high status of reproductive health increase with the increasing of their current age. Another important demographic factor such as age at marriage revealed that the early married women (age below or at age of 18 years) are less likely to being higher reproductive health status compared to those women who married after age of 18 years. Women's expectation for higher reproductive health status decreases with the increasing of their number of living children. Women who are living in urban areas more likely to deserve higher reproductive health status compared to those women who live in rural areas in Bangladesh.

The purpose of Multiple Classification Analysis (MCA) is to measure the intensity of the effect of various demographic factors affecting on poverty, reproductive health and health of ever-married women in Bangladesh. In MCA women's place of residence, current age, children ever born and family size are the most important determinants which have first, second, third and fourth strongest effect for explaining the variability on standard of living of ever-married women among the selected variables respectively. Although the average level of age at marriage is very low, age at marriage still has a strong relationship with standard of living status. Moreover, women's age at marriage is the fifth strongest influential factor for explaining variability of standard of living in Bangladesh. Other demographic predictors have

also importance on reducing disaggregated level of living standard such as number of living children, religion and marital status of ever-married women in Bangladesh.

For reproductive health status of ever-married women, MCA shows that women's number of living children, place of residence, current age and marital status are the most important factors which have first, second, third and fourth strongest effect for explaining the variability on reproductive health of ever-married women among the included demographic variables. The results of MCA model also revealed that the higher age at marriage requires the higher reproductive health status. Among the included variables, age at marriage is the fifth strongest influential predictor for explaining the proportion of variation on reproductive health status of ever-married women in Bangladesh. Other demographic predictors have also importance on reducing disaggregated level of reproductive health status such as children ever born, religion and family size of ever-married women in Bangladesh.

For health status of ever-married women, MCA shows that current age, number of living children, place of residence, children ever born and marital status are the most influential predictors which have the first, second, third and fourth strongest effect for explaining the variation on health of ever-married women in Bangladesh among the selected variables respectively. Results of MCA also show that women's age at marriage, religion and family size have also some importance on reducing disaggregated level of health status of ever-married women in Bangladesh.

The main purpose of factor analysis in this study is to investigate and identify responsible factors for demographic, poverty and reproductive health related variables of ever-married women that substantively meaningful in the sense that they summarize sets of closely related variables. Using factor analysis based on principal components analysis three factors has been determined. They are named according to their loadings from rotated component matrix. Factor 1 contains ten indicators: household electricity, household radio, household television, household refrigerator, household bicycle, household cooking fuel, household drinking water, household toilet facility, household floor materials, and respondent's mass media exposure with larger loading that clearly reflect the socio-economic conditions and was thus Factor 1, labeled as Poverty Factor. Factor 2 contains nine indicators: number of visit antenatal care, place of delivery, health checkup after delivery, current use of

contraceptive, delivery by caesar, postnatal care providers, place of first postnatal care, contraceptive method types, and fertility planning status with larger loading that reflect the reproductive health conditions and was thus Factor 2, labeled as Reproductive health Factor. Factor 3 contains eight indicators: current age, marital status, age at marriage, children ever born, number of living children, place of residence, religion, and family size with larger loadings that reflect the demographic conditions, and was thus Factor 3 labeled as Demographic Factor. Finally, this three-factor model appears to reflect adequately the underlying factor structure of the selected 27 variables.

The purpose of using structural equation modeling (path analysis) is to examine and determine the direct and indirect effects of demographic factors on poverty, reproductive health and health of ever-married women. SEM (Path Analysis) for standard of living of ever-married women shows that women's marital status, place of residence, religion, children ever born, and number of living children have direct significant negative effects on their standard of living and women's current age and family size have direct significant positive effects on standard of living of ever-married women in Bangladesh. The indirect effects of exogenous variables such as women's current age, marital status, age at marriage, place of residence, religion, and family size are transmitted through endogenous variables children ever born and number of living children on standard of living of ever-married women in Bangladesh.

SEM (Path Analysis) for reproductive health of ever-married women shows that women's marital status, place of residence, and children ever born have direct significant negative effects and women's current age and age at marriage have direct significant positive effects on reproductive health of ever-married women in Bangladesh. The effects of exogenous variables such as women's current age, marital status, age at marriage, place of residence, religion, and family size are conducted indirectly through endogenous variables children ever born and number of living children on their reproductive health in Bangladesh.

For health of ever-married women, SEM (Path Analysis) revealed that women's marital status, place of residence, and children ever born have direct significant negative effects and women's current age, age at marriage, and number of living

children have direct significant positive effects on health of ever-married women in Bangladesh. The indirect effects of exogenous variables such as women's current age, marital status, age at marriage, place of residence, religion, and family size are conducted through endogenous variable children ever born and number of living children on their health of ever-married women.

SEM (Path model) presented in Figure-7.1 fits relatively well to the poverty of ever-married women in Bangladesh with highest value of adjusted R^2. In addition, twenty paths out of twenty one hypothesized paths have found to be statistically significant on standard of living of ever-married women. Moreover, most of the exogenous variables: current age, marital status, place of residence, religion, family size and endogenous variables: children ever born and number of living children have significant effect on standard of living of ever-married women in Bangladesh. In the case of reproductive health of ever-married women, the path model represented in Figure-7.4 fits well to the model with highest value of adjusted R^2. Moreover, eighteen paths out of twenty one hypothesized paths have found to be statistically significant on reproductive health of ever-married women. In additionally all most exogenous variables: current age, marital status, age at marriage, place of residence and endogenous variables: children ever born have significant effect on reproductive health of ever-married women in Bangladesh. In similar fashion, the path model presented in Figure-7.7 fits relatively well to the health of ever-married women in Bangladesh with highest value of adjusted R^2 and nineteen paths out of twenty one hypothesized paths have found to be statistically significant for health of ever-married women. In addition most of the exogenous variables: current age, marital status, age at marriage, place of residence and endogenous variables: children ever born and number of living children have significant effect on health of ever-married women in Bangladesh.

From the above discussions for the purposes of using different methods of analyses, the present study found that structural equation modeling based on path analysis is more suitable for the mentioned hypotheses and data set.

8.2 Policy Implications and Recommendations

Bangladesh is a developing country with a huge population. Women constitute half of the country's total population and they possess a much lower status than men. Tradition and socio-cultural norms limit their access to education, skills training, health and employment. Gender equity is getting better day by day in Bangladesh, however still it is a long way to go. The findings of this study have significant contribution to portray the dynamics of interrelationships that exist and consequently policy implications. Many of demographers can better handle most of these issues raised. In this context, the active participation in all stages of researchers by the consumers of government would help in putting the research findings into practice more readily. From the forgoing discussion, the study recommends some policy implications that are:

1. Children ever born, number of living children and family size need to be control for standard of living as well as reproductive health status of ever-married women.
2. Age at marriage and urbanization particularly for women should be enhanced in Bangladesh for the development of socio-economic and reproductive health status of ever-married women.
3. In Bangladesh, the above issues need immediate attention to reduce poverty and improve the health situation particularly for women reproductive health.

Bibliography

Anwar J., Mpofu E., Matthews R. L., Shadoul F. A. and Brock E. K. (2011). Reproductive health and access to healthcare facilities: Risk factors for depression and anxiety women with an earthquake experience. Journal of Bio-Med Central Public Health, **11**(1): 523-537.

Audinarayana N. (1997). The effect of status of women on fertility in an urban setting in Tamil Nadu. Indian Journal of Social Work, **58**(4): 542-556.

Akhter H. H., Hafizur M. H. and Ahmed, S. (1996). Reproductive Health Issues and Implementation Strategies in Bangladesh. Dhaka*:* BIRPEHRT.

Akhter H. H. (1997). Reproductive Rights, Reproductive Health, Morbidity and Mortality' in Barkat and Ranjan edited *Population and Development Issues in Bangladesh,* Dhaka, Bangladesh, Government of Bangladesh.

Anderson R. L. and Bancraft T. A. (1952). A Statistical Theory in Research. New York, McGrow Hill.

Ahmed K. N. and Peters J. M. (1980). Reduced basis technique for non-linear analysis of structures. Aiaa Journal, **18**(4): 455-462. https://doi.org/10.2514/3.50778.

Alwin D. F. and Hauser R. M. (1975). The Decomposition of Effects in Path Analysis. American Sociological Review, **40(1)**: 37-47.

BBS (2002). Preliminary report 2001, population census of Bangladesh. Bangladesh national nutritional survey.

BDHS (2014). Bangladesh Demographic and Health Survey 2014. National Institution of Population Research and Training, Mitra and associates, ORC-Macro, Calverton, Maryland, USA. www.DHSprogram.com.

BDHS (2004). Bangladesh Demographic and Health Survey 2004. National Institute of Population Research and Training, Government of Bangladesh and ORC Macro, Calverton, Maryland, USA. www.dhsprogram.com/publications.

Becker H., Stuifbergen A., Oh H. S. and Hall S. (1993). Self-Rated Abilities for Health Practices: A Health Self-Efficacy Measure. The Journal of Health Behavior, Education & Promotion, **17**(5): 42-50. https://www.researchgate.net/publication.

Bhuiya A. (1989). Factors affecting acceptance of immunization among children in rural Bangladesh. Health policy and planning, **10**: 304-311.

BFS (1975). Bangladesh fertility Survey-1975: First Country Report. Ministry of Health and Population Control, Dhaka, Bangladesh.

Blanc A. K. (2000). Sexual Behavior and Contraceptive Knowledge and Use among Adolescents in Developing Countries. Studies in Family Planning, **29**(2): 106-116.

BDHS (2011). Bangladesh Demographic and Health Survey 2011. National Institute of Population Research and Training, Government of Bangladesh and ORC Macro, Calverton, Maryland, USA. www.dhsprogram.com/publications.

Bogue D. (1969). Principles of Demography. New York: John Wiley and Sons.

Balakrishnan T. R., Ebanks G. E. and Grindstaff C. F. (1980). A Multivariate Analysis of the 1971 Canadian Census Fertility Data. Canadian Studies in Population, **7**: 81-98.

Boyle R. P. (1970). Path Analysis and Ordinal Data. American Journal of Sociology, **75**(4): 461-480.

Country Report (2012). South Asia Conference on Adolescents, UNFPA**,** Dehli, 21-23 July.

Cornelius D., Wontuo P., Akazili J. and Nyarko P. (2005). Health inequalities in the Kessena-Nankana district of northern Ghana. In: de Savingny CD, Mwageni E, Nathan R., Razzaque A. and Setel P. W. (2005). Measuring health equity in small areas-findings from demographic surveillance systems. Aldershot: Hants Ashgate Publishing Limited. pp 67-85.

Cox D. R. (1958). The Regression Analysis of Binary Sequences. J. R. Stat. Soc. Ser. B., **20**: 215-242.

Cox D. R. (1970). The Analysis of Binary Data. New York: Chapman & Hall.

Chandrasekaran C. and Hermalin A. I. (1975). Measuring the Effect of Family Planning Programs on Fertility. Liege, Belgium: Ordina Editions.

Cramer H. (1946). Mathematical Methods of Statistics. Princeton: Princeton University Press, p. 282.

Dixon R. B. (1971). Explaining Cross-Cultural Variations in Age at Marriage and Proportions Never Marriage. Populations Studies, **25**(2): 215-233.

Fraser A. M., Brockert J. E. and Ward R. H. (1995). Association of young maternal age with adverse reproductive outcomes. N. Engl. J. Med., **332**: 1113-1117.

Fox J. (1984). Linear statistical models and related methods: With applications to social research. New York: Wiley.

Ghosh S. (1995). Integrated Health of the Women. Social Change, **25**(2&3): 44–54.

Glasier A., Gulmezoglu A., Schmid G., Moreno C. and Van Look P. (2006). Sexual and Reproductive Health: A Matter of Life and Death. Lancet **368**(1): 595-607.

Genece E. and Rohde J. E. (1988). Growth monitoring as an entry point for primary health care. Indian Journal of pediatrics, **55**: S78-S83.

Greene C. P. (1998). Counseling Makes a Difference, Population Reports. Series J, **35**: 2-31.

Guttmacher A. (1998). Into a New World: Young Women's Sexual and Reproductive Lives. New York. www.guttmacher.org

Gage A. J. and Meekers D. (1994). Sexual activity before marriage in Sub-Saharan Africa. Social Biology, **41**: 44-60.

Goodman, L. A. and Kruskal W. H. (1963). Measures of Association for Cross Classifications III. Journal of the American Statistical Association, **58**: 310–364.

HPSP (2003). Annual progress of review. www.researchgate.net/profile.

HPSP (2000). Annual Progress Review, Bangladesh. https://www.researchgate.net/publication/290036932.

HPSP (2001). Status of Performance Indicators: Annual Progress Review, Bangladesh. https://www.researchgate.net/publication/290036932.

Hossain M. and Hassan K. (2005). Reproductive Rights and Decision Making: A Comparative Study in Urban and Rural Bangladesh. *Journal of Social Science*, University of Dhaka, **8**(3): 161-175.

Hewe L. D., Hargreaves J. R. and Huttly S. R. A. (2008). Issues in the construction of wealth indices for the measurement of socio-economic position in low-income countries. Emerg Themes Epidemiol, **5**(1): 3.

Hosmer D. W. and Lemeshow S. (2000). Applied Logistic Regression Analysis. 2nd edition, New York: John Wiley & Sons, Inc.

Hermalin A. I. (1975). Regression Analysis of Areal Data. In Chandrasekaran and Hermalin A. I. (eds.), Measuring the Effect of Family Planning Programs on Fertility. Liege, Belgium: Ordinal Editions.

ICPD (1994). International Conference on Population and Development, Cairo, Egypt from 5-13 September.

Islam M. M. and Mahmud M. (1993). Contraception among Adolescents in Bangladesh. Asia-Pacific Population Journal, **10**(1): 21-38.

Kabir A. A. (2000). Reproductive Health Services for Adolescents: Recent Experience from a Pilot Project in Bangladesh. Paper presented at the International Conference on Adolescent Reproductive Health: Evidence and Programme Implications for South Asia. Mumbai, India.

Khan M. A. (2001). Knowledge on AIDS among Female Adolescents in Bangladesh: Evidence from the Bangladesh Demographic and Health Survey Data. J Health Popul Nutr, **20**(2): 130-137.

Kishor S. and Neitzel K. (1996). The status of women: Indicators for twenty-five countries. Comparative Studies No. 21, Demographic and Health Surveys, Calverton, U. S. A.: Macro International, Inc.

Khan M. M. and Kraemer A. (2009). Factors associated with being underweight, overweight and obese among ever-married non-pregnant urban women in Bangladesh. Singapore Medical Journal, **50**(8): 804-813.

Kleinbaum D. G. and Ananth C. V. (1997). Regression Models for Ordinal Responses: A Review of Methods and Applications. International Journal of Epidemiology, **26**(6): 1323-1333.

Kaiser H. F. (1974). An index of factorial simplicity. Psychometrika, **39**(1): 31-36.

Kendall M. G. and Muircheartiagh C. A. O. (1977). Path Analysis and Model Building. World Fertility Survey Technical Bulletin No. 2/Tech. 414, Voorburg. The Netherlands: International Statistical Institute.

Kendall M. G. (2005). Rank Correlation Methods, Charles Griffin & Co.

Lee L. F. (1980). Specification error in multinomial logit models: Analysis of the omitted variable bias. Center for Economic Research, Minnesota, pp 80-131.

Leobner H. and Driver E. D. (1973). Differential Fertility in Central India: A Path Analysis. Demography, **10**(3): 329-350.

Linacre J. (2008). The Expected Value of a Point-Biserial (or Similar) Correlation. Rasch Measurement Transactions. **22**(1): 1154.

Merrick T. W. (2002). Population and Poverty: New Views on an Old Controvers. A Journal of International perspectives on Sexual and Reproductive Health, The World Bank Institute, Washington, DC. **28**(1): 41-46.

Malthus T. R. (1976). An Essay on the Principle of Population. Oxfordshire, England: Oxford World's Classics. p. 13. ISBN 978-1450535540.

MOHFW (1998a). Adolescent's Health and Development: Issues and Strategies: Empowering Adolescent Girls for Sustainable Human Development, Bangladesh.

MOHFW (2003). Health, Nutrition and Population Sector Program, July 2003; Program Implementation Plan (PIP). Dhaka, Bangladesh: MOHFW. http://www.dgfp.gov.bd.

Mahmud S. and Mahmud W. (2000). Policies, Programs, and Financing Since the International Conference on Population and Development: Bangladesh Case Study, in S. Forman and R. Ghosh (eds.) Promoting Reproductive Health: Investing in Health for Development, Lynne Reinner Publishers, Boulder and London. www.rienner.com

Monteith R. S., Anderson J. E., Pineda M. A., Santiso R. and Oberle M. (1985). Contraceptive use and fertility in Guatemala. Studies in Family Planning, **16**(5):279-288.

Miller J. E. (1998). Birth Outcomes by Mother's Age at First Birth in the Philippines. International Family Planning Perspectives, **19**(3): 98-102.

McFadden D. (1974). Conditional logit analysis of qualitative choice behavior. Frontiers in econometrics, New York: Academic Press. pp 105-142.

Marija J. N. (1988). SPSS-X Advanced Statistical Guide. TECHNOMETRICS, New York: McGraw-Hill, Vol. 30, No. 2, pp505.

Obaidullah M., Rochat R. W., Jabeen S., Rosenberg M. J. and Gould P. (1978). Maternal and abortion related deaths in Bangladesh. International Journal of Gynecology and Obstetrics, **19**(2): 155-164.

Population Reports (1995). Population Profile: The Asian and Pacific Population, Special Studies Series, U.S. Government Printing Office, Washington, DC. P 24-26. www.census.gov/programs-surveys/popest/library/.

Rahaman, P. K. M. (1994). Poverty issues in Rural Bangladesh. Dhaka university press Limited.

Rochat R. W. and Akter H. H. (1999). Research letter on "Tetanus and Pregnancy-related mortality in Bangladesh". The Lancet, August, 14. Vol. 354, P 565. DOI: 10.1016/S0140-6736(98)05193-9.

Rawal L. B. and Tiwari S. K. (2004). Women's educational status and maternal and child health care practices in Jumla district of West Nepal. Journal of Nepal Health Research Council, **2**(2): 19-22.

Rao P. S. S. and Richard J. (1984). Socio-economic and demographic correlates of medical care and health practices. Journal of Biosocial Science, **16**(3): 344-355.

Rehan N. (1984). Knowledge, attitude and practice of family planning in Hausa women. Journal of Social Science & Medicine, **18**(10): 839-844.

Rob A. K. U. and Kabir M. (1988). A path model for analyzing sequential fertility in Bangladesh. Journal of Statistical Studies, **8**: 8-21.

Retherford D. R. and Choe M. K. (1993). Statistical Models for Causal Analysis. John Wiley & Sons, ISBN: 0-471-55802-8, XIV, 258.

Sedgh G., Henshaw H., Singh S., Ahman E. and Shah I. (2007). Induced Abortion: Estimated Rates and Trends Worldwide. The Lancent, **370**: 1338-1345.

Sivamurthy M. and Ahmed S. (1979). Path Analysis for Explaining Fertility Differentials: Illustrated with Bangladesh Data. Paper presented at the Seminar on Intermediate Variables Affecting Fertility, Institute of Statistical Studies and Research, Cairo University, Cairo, Egypt.

Trussell J. (1998). Teen-age Pregnancy in the United States. Family Planning Perspectives, New York, **20**(6): 262-272.

Tilson D. and Larsen U. (2000). Divorce in Ethiopia: the impact of early marriage and childlessness. Journal of Bioscience, **32**(3): 355-69.

Takane Y. and Leeuw D. J. (1987). On the Relationship Between Item Response Theory and Factor Analysis of Discretized Variables. Psychometrika Journal, **52**(3): 393-408.

UNFPA (1995). Reproductive Health and Family Planning: Directions for UNFPA Assistance. Report on Expert Consultation. New York. www.un.org/popin/unfpa/pubs/unfrepr.html.

United Nations (1998). Health and mortality: a concise report. New York: Population Division, 45p.

United Nations (1995a). Report of the International Conference on Population and Development. New York: UN Population Fund, 193 p.

United Nations (2000a). Monitoring Reproductive Health: Asian Population studies Series No. 155; Economic and Social Commission for Asia and the Pacific, Bangkok.

UNICEF (2001). Early Marriage: Child Spouse. No. 7, Florence, Italy.

World Bank (2000). World Development Report 2000. Oxford University Press. World Bank. https://openknowledge.worldbank.org/handle/10986/5982.

World Bank (1998). The World Bank annual report 1998. Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/390771468320070967.

WHO (2004). Reproductive health strategy to accelerate progress towards the attainment of international development goals and targets. Geneva, World Health Organization, http://www.who.int/reproductive-health/A57_13_en.pdf.

WHO (2003). WHO multi-country study on women's health and domestic violence against women. Initial results on prevalence, health outcomes and women's responses. Geneva. www.who.int/reproductivehealth/publications.

Yinger N. V. (2001). Making Motherhood Safer: Overcoming obstacles on the Pathway to Care. Population Reference Bureau, p-17.

Yates F. (1934). The analysis of multiple classification with unequal numbers in the different classes. Journal of American Statistical Association, **29**: 51-66.

Yule G. U. and Kendall M. G. (2005). An Introduction to the Theory of Statistics, 14th Edition. Charles Griffin & Co. pp 258–270.

Zabin L. and Kiragu K. (1998). The Health Consequences of Adolescent Sexual and Fertility Behavior in Sub-Saharan Africa. Studies in Family Planning, **29**(2): 210-32.

Appendix

Appendix-A

Output of Principal Component Analysis for Calculation of Standard of Living Index

Correlation Matrix

Correlation	H_electricity	H_radio	H_television	H_refrigerator	H_ bicycle	H_ cooking fuel	H_ drinking water	H_ toilet facility	H_floor material	Mass media
H_ electricity	1.000									
H_ radio	0.014	1.000								
H_ television	0.569	0.063	1.000							
H_ refrigerator	0.380	0.054	0.482	1.000						
H_ bicycle	0.024	0.059	0.045	-0.050	1.000					
H_ cooking fuel	-0.351	-0.008	-0.370	-0.437	0.178	1.000				
H_ drinking water	-0.191	0.028	-0.141	-0.157	0.017	0.220	1.000			
H_toilet facility	-0.371	-0.035	-0.361	-0.397	0.013	0.451	0.169			
H_floor material	0.438	0.044	0.488	0.526	-0.034	-0.544	-0.209	-0.502	1.000	
Mass media	0.187	0.084	0.255	0.355	-0.002	-0.287	-0.084	-0.266	0.302	1.000

Total Variance Explained

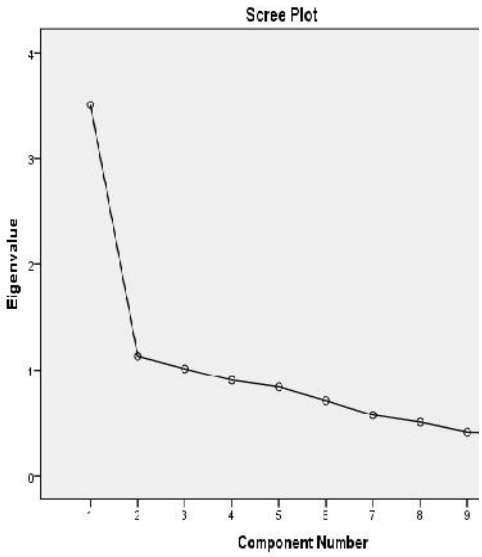
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.507	35.066	35.066	3.507	35.066	35.066	3.498	34.979	34.979
2	1.132	11.316	46.382	1.132	11.316	46.382	1.094	10.938	45.917
3	1.013	10.133	56.515	1.013	10.133	56.515	1.060	10.598	56.515
4	0.904	9.036	65.551						
5	0.840	8.404	73.955						
6	0.712	7.122	81.077						
7	0.574	5.736	86.813						
8	0.507	5.069	91.882						
9	0.412	4.120	96.003						
10	0.400	3.997	100.000						

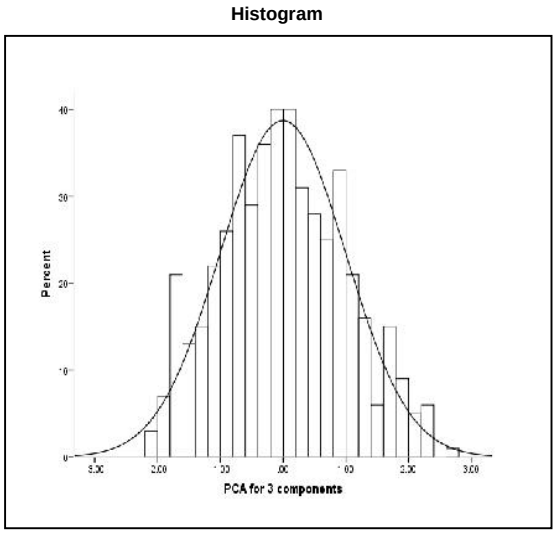
Extraction Method: Principal Component Analysis.

Component Matrix

	Component		
	1	**2**	**3**
H_ electricity	0.796	-0.028	0.009
H_ radio	0.736	0.028	0.113
H_ television	0.724	0.214	-0.166
H_ refrigerator	0.717	0.284	-0.142
H_ bicycle	0.686	0.023	-0.010
H_ cooking fuel	0.679	0.125	-0.300
H_ drinking water	0.493	0.133	0.370
H_toilet facility	-0.061	0.764	-0.480
H_floor material	0.075	0.571	0.580
Mass media	-0.330	0.243	0.398

Extraction Method: Principal Component Analysis. a. 3 components extracted.





Appendix-B

Output of Principal Component Analysis for Calculation of Reproductive Health Index

Correlation Matrix

Correlation	Visit antenatal care	Place of delivery	Health checkup after delivery	Current use of contraceptive methods	Delivery by caesar	Postnatal care received from	Place of first postnatal care	Contraceptive method type	Fertility planing status
Visit antenatal care	1.000								
Place of delivery	0.289	1.000							
Health checkup after delivery	0.258	0.693	1.000						
Current use of contraceptive methods	0.035	0.014	0.017	1.000					
Delivery by caesar	0.281	0.719	0.543	-0.021	1.000				
Postnatal care received from	0.262	0.626	0.707	-0.014	0.593	1.000			
Place of first postnatal care	0.289	0.854	0.701	-0.008	0.664	0.633	1.000		
Contraceptive method type	0.020	0.027	0.049	0.733	0.027	0.013	0.027	1.000	
Fertility planning status	-0.144	-0.076	-0.079	-0.011	-0.063	-0.079	-0.067	0.048	1.000

Total Variance Explained

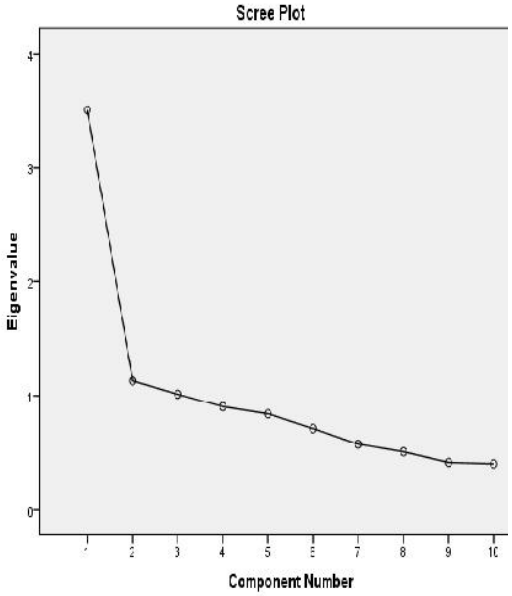
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.861	42.897	42.897	3.861	42.897	42.897	3.740	41.553	41.553
2	1.444	16.049	58.945	1.444	16.049	58.945	1.443	16.031	57.584
3	1.030	11.450	70.395	1.030	11.450	70.395	1.153	12.811	70.395
4	0.802	8.912	79.307						
5	0.568	6.306	85.614						
6	0.513	5.698	91.312						
7	0.396	4.402	95.714						
8	0.246	2.730	98.444						
9	0.140	1.556	100.000						

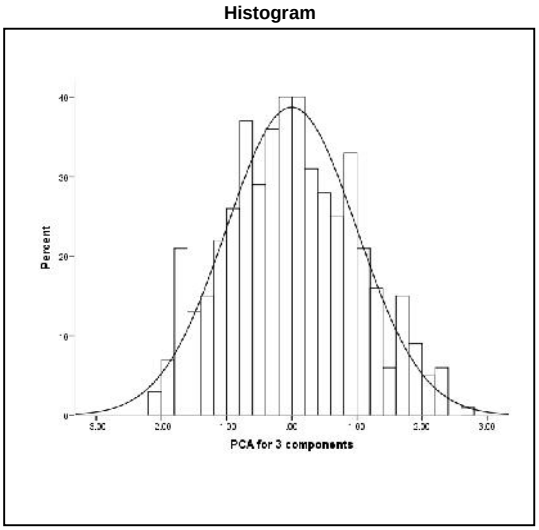
Extraction Method: Principal Component Analysis.

Component Matrix

	Component		
	1	**2**	**3**
Place of delivery	0.903	-0.026	0.092
Health check up after delivery	0.894	-0.026	0.097
Current use of contraceptive methods	0.840	-0.011	0.075
Delivery by caesar	0.817	-0.041	0.072
Postnatal care received from	0.812	-0.015	0.067
Place of first postnatal care	0.128	0.826	-0.109
Contraceptive method type	0.063	0.820	-0.201
Fertility planning status	-0.125	0.292	0.824
Visit antenatal care	0.421	-0.046	-0.515

Extraction Method: Principal Component Analysis. a 3 components extracted.





Appendix-C

C.1: Correlation matrix of 27 selected variables

Correlation	C_ age	M_status	A_marriage	CEB	L_child	P_resi	Religion	F_size	H_elec
C_age	1.000	-0.117	0.269	0.681	0.669	0.010	0.126	-0.017	-0.098
M_status	-0.117	1.000	-0.026	-0.065	-0.062	0.060	-0.014	-0.149	-0.134
A_marriage	0.269	-0.026	1.000	-0.108	-0.104	0.088	-0.010	-0.161	-0.098
CEB	0.681	-0.065	-0.108	1.000	0.978	0.160	0.069	0.232	-0.221
L_child	0.669	-0.062	-0.104	0.978	1.000	0.158	0.064	0.240	-0.199
P_resi	0.010	0.060	0.088	0.160	0.158	1.000	-0.053	0.138	-0.352
Religion	0.126	-0.014	-0.010	0.069	0.064	-0.053	1.000	0.217	-0.084
F_size	-0.017	-0.149	-0.161	0.232	0.240	0.138	0.217	1.000	-0.008
H_elec	-0.098	-0.134	-0.098	-0.221	-0.199	-0.352	-0.084	-0.008	1.000
H_radio	0.012	-0.017	-0.044	-0.017	0.001	0.149	-0.034	0.030	0.049
H_tele	-0.051	-0.088	-0.026	-0.246	-0.242	-0.401	0.155	0.153	0.536
H_refri	-0.042	-0.057	0.027	-0.155	-0.119	-0.120	0.149	0.177	0.395
H_bicy	-0.004	-0.034	-0.068	-0.043	-0.019	0.104	-0.069	0.075	-0.042
H_cook	-0.029	0.048	0.058	0.173	0.180	0.510	0.001	0.111	-0.357
H_drink	0.027	-0.007	-0.001	-0.015	-0.009	-0.112	-0.014	-0.061	0.050
H_toilet	-0.052	0.157	-0.093	0.139	0.115	0.243	0.015	-0.028	-0.338
H_Floor	-0.066	0.085	-0.014	-0.266	-0.256	-0.394	-0.076	-0.092	0.410
M_media	-0.001	-0.035	-0.028	-0.179	-0.153	-0.195	0.044	-0.139	0.219
VAC	0.117	-0.018	-0.035	0.082	0.109	-0.041	0.120	-0.057	-0.204
PD	-0.008	0.069	-0.079	-0.024	-0.018	-0.128	-0.113	-0.066	-0.090
HCAD	0.049	0.082	-0.044	0.048	0.043	-0.084	-0.083	-0.012	-0.105
CUCM	0.246	-0.065	0.078	0.270	0.311	0.020	0.006	-0.120	0.068
DC	0.108	0.100	-0.015	0.021	0.012	-0.092	-0.135	-0.176	-0.110
PCRF	0.036	0.081	-0.047	-0.011	-0.019	-0.130	-0.085	-0.055	-0.067
PFPC	-0.090	-0.081	0.100	-0.271	-0.216	-0.206	0.085	-0.021	0.396
CMT	0.116	-0.119	0.093	0.084	0.090	-0.109	0.025	-0.209	0.124
FPS	-0.462	0.032	0.052	-0.555	-0.572	-0.162	0.065	-0.107	0.023

Correlation matrix of 27 selected variables (Cont...)

Correlation	H_radio	H_tele	H_refri	H_bicy	H_cook	H_drink	H_toilet	H_Floor	M_media
C_age	0.012	-0.051	-0.042	-0.004	-0.029	0.027	-0.052	-0.066	-0.001
M_status	-0.017	-0.088	-0.057	-0.034	0.048	-0.007	0.157	0.085	-0.035
A_marriage	-0.044	-0.026	0.027	-0.068	0.058	-0.001	-0.093	-0.014	-0.028
CEB	-0.017	-0.246	-0.155	-0.043	0.173	-0.015	0.139	-0.266	-0.179
L_child	0.001	-0.242	-0.119	-0.019	0.180	-0.009	0.115	-0.256	-0.153
P_resi	0.149	-0.401	-0.120	0.104	0.510	-0.112	0.243	-0.394	-0.195
Religion	-0.034	0.155	0.149	-0.069	0.001	-0.014	0.015	-0.076	0.044
F_size	0.030	0.153	0.177	0.075	0.111	-0.061	-0.028	-0.092	-0.139
H_elec	0.049	0.536	0.395	-0.042	-0.357	0.050	-0.338	0.410	0.219
H_radio	1.000	0.191	0.148	0.108	-0.038	-0.017	-0.106	0.144	0.291
H_tele	0.191	1.000	0.538	0.048	-0.483	0.077	-0.328	0.578	0.250
H_refri	0.148	0.538	1.000	0.073	-0.183	0.118	-0.293	0.384	0.453
H_bicy	0.108	0.048	0.073	1.000	0.111	-0.034	-0.078	-0.097	0.033
H_cook	-0.038	-0.483	-0.183	0.111	1.000	0.048	0.191	-0.545	-0.220
H_drink	-0.017	0.077	0.118	-0.034	0.048	1.000	-0.043	0.085	0.193
H_toilet	-0.106	-0.328	-0.293	-0.078	0.191	-0.043	1.000	-0.370	-0.222
H_Floor	0.144	0.578	0.384	-0.097	-0.545	0.085	-0.370	1.000	0.332
M_media	0.291	0.250	0.453	0.033	-0.220	0.193	-0.222	0.332	1.000
VAC	-0.096	-0.148	-0.056	0.115	0.058	-0.079	0.076	-0.124	-0.023
PD	-0.036	-0.052	-0.079	-0.035	-0.178	0.069	-0.026	0.021	0.057
HCAD	0.000	0.000	-0.043	0.000	-0.031	0.082	0.065	-0.053	-0.056
CUCM	-0.033	-0.050	0.000	-0.079	0.048	-0.065	-0.043	0.041	0.031
DC	-0.028	-0.055	-0.104	-0.108	-0.025	0.100	0.040	-0.022	-0.008
PCRF	-0.003	0.012	-0.052	-0.043	-0.054	0.081	-0.039	-0.013	-0.061
PFPC	0.003	0.335	0.478	-0.032	-0.161	0.083	-0.319	0.200	0.357
CMT	-0.006	0.046	-0.040	0.002	-0.104	-0.119	-0.061	0.144	0.094
FPS	-0.020	0.105	-0.061	-0.004	-0.093	-0.209	0.013	0.024	0.004

Correlation matrix of 27 selected variables (Cont...)

Correlation	VAC	PD	HCAD	CUCM	DC	PCRF	PFPC	CMT	FPS
C_age	0.117	-0.008	0.049	0.246	0.108	0.036	-0.090	0.116	-0.462
M_status	-0.018	0.069	0.082	-0.065	0.100	0.081	-0.081	-0.119	0.032
A_marriage	-0.035	-0.079	-0.044	0.078	-0.015	-0.047	0.100	0.093	0.052
CEB	0.082	-0.024	0.048	0.270	0.021	-0.011	-0.271	0.084	-0.555
L_child	0.109	-0.018	0.043	0.311	0.012	-0.019	-0.216	0.090	-0.572
P_resi	-0.041	-0.128	-0.084	0.020	-0.092	-0.130	-0.206	-0.109	-0.162
Religion	0.120	-0.113	-0.083	0.006	-0.135	-0.085	0.085	0.025	0.065
F_size	-0.057	-0.066	-0.012	-0.120	-0.176	-0.055	-0.021	-0.209	-0.107
H_elec	-0.204	-0.090	-0.105	0.068	-0.110	-0.067	0.396	0.124	0.023
H_radio	-0.096	-0.036	0.000	-0.033	-0.028	-0.003	0.003	-0.006	-0.020
H_tele	-0.148	-0.052	0.000	-0.050	-0.055	0.012	0.335	0.046	0.105
H_refri	-0.056	-0.079	-0.043	0.000	-0.104	-0.052	0.478	-0.040	-0.061
H_bicy	0.115	-0.035	0.000	-0.079	-0.108	-0.043	-0.032	0.002	-0.004
H_cook	0.058	-0.178	-0.031	0.048	-0.025	-0.054	-0.161	-0.104	-0.093
H_drink	-0.079	0.069	0.082	-0.065	0.100	0.081	0.083	-0.119	-0.209
H_toilet	0.076	-0.026	0.065	-0.043	0.040	-0.039	-0.319	-0.061	0.013
H_Floor	-0.124	0.021	-0.053	0.041	-0.022	-0.013	0.200	0.144	0.024
M_media	-0.023	0.057	-0.056	0.031	-0.008	-0.061	0.357	0.094	0.004
VAC	1.000	0.366	0.349	0.066	0.370	0.316	0.036	-0.065	0.041
PD	0.366	1.000	0.596	-0.104	0.685	0.580	-0.092	-0.111	0.029
HCAD	0.349	0.596	1.000	-0.047	0.653	0.880	-0.107	-0.143	-0.039
CUCM	0.066	-0.104	-0.047	1.000	-0.099	-0.045	0.077	0.543	-0.144
DC	0.370	0.685	0.653	-0.099	1.000	0.642	-0.098	-0.111	0.040
PCRF	0.316	0.580	0.880	-0.045	0.642	1.000	-0.093	-0.105	-0.034
PFPC	0.036	-0.092	-0.107	0.077	-0.098	-0.093	1.000	-0.009	0.073
CMT	-0.065	-0.111	-0.143	0.543	-0.111	-0.105	-0.009	1.000	0.025
FPS	0.041	0.029	-0.039	-0.144	0.040	-0.034	0.073	0.025	1.000

C.2: Correlation measures between different types of variables

An overview of correlation measures between different types of variables shows the different ways of measuring correlation or association such as between continuous-continuous, categorical-categorical and categorical-continuous variable pairs. The ways are given bellow:

	Categorical	**Continuous**
Categorical	**Phi, Lambda, Corrected Cramer's V**	**Point Biserial, Logistic Regression**
Continuous	**Point Biserial, Logistic Regression**	**Spearman, Karl Pearson**

C.2.1: Correlation measures between categorical and categorical variables

Phi-coefficient: Phi-coefficient is a measure of association between two categorical variables (Cramer H. 1946).

If we have a 2×2 table for two random variables X and Y

	y =1	y =0	Total
x =1	n_{11}	n_{10}	n_1
x =0	n_{01}	n_{00}	n_0
Total	m_1	m_0	N

where n_{11}, n_{10}, $n_{01,}$ n_{00} are non-negative counts of number of observations that sum to N, the total number of observations. Phi-coefficient that describes the association of X and$Y$ is

$$\emptyset = \frac{n_{11}.n_{00} - n_{10}.n_{01}}{\sqrt{n_1.n_0.m_1.m_0}}.$$

Lambda coefficient: Lambda coefficient is a measure of association between two categorical variables to which the modal categories and frequencies for each value of the independent variable differ from the overall modal category and frequency, i.e. for all values of the independent variable together (Goodman L. A. and Kruskal W. H. 1963).

Lambda coefficient can be calculated with the equation;

$$\lambda = \frac{\varepsilon_1 - \varepsilon_2}{\varepsilon_1},$$

where, ε_1 is the overall non-modal frequency, and ε_2 is the sum of the non-modal frequencies for each value of the independent variable.

Cramer's V: Cramer's V is a measure of association between to categorical variables and it is used with variables having two or more categories (Cramer H. 1946).

Let a sample of size n of the simultaneously distributed variables A and E for $i = 1, 2, \dots, r$, $j = 1, 2, \dots, k$ be given by the frequencies

n_{ij} = number of times the values (A_i, B_j) were observed.

The Chi-squared statistics is

$$\chi^2 = \sum_{i,j} \frac{(n_{ij} - \frac{n_{i.}n_{j}}{n})^2}{\frac{n_{i.}n_{j}}{n}}.$$

Cramer's V is computed by taking the square root of the chi-squared statistics divided by the sample size and the minimum dimension minus 1.

$$V = \sqrt{\frac{\varphi^2}{\min(k-1,\ r-1)}} = \sqrt{\frac{\chi^2/n}{\min(k-1,\ r-1)}},$$

where, φ is phi-coefficient, χ^2 pearson's chi-squared test, n grand total ofobservations, $k$number of columns, and r number of rows.

Corrected Cramer's V:

$$\bar{V} = \sqrt{\frac{\bar{\varphi}^2}{\min(\bar{k}-1,\ \bar{r}-1)}}$$

where

$$\bar{\varphi}^2 = \max\left(0,\ \varphi^2 - \frac{(k-1)(r-1)}{n-1}\right)$$

$$\bar{k} = k - \frac{(k-1)^2}{n-1}$$

$$\bar{r} = r - \frac{(r-1)^2}{n-1}.$$

C.2.2: Correlation measures between categorical and continuous variables

Point biserial correlation: Point biserial correlation coefficient is used to measure the linear relationship between categorical and continuous variables (Linacre J. 2008). The point-biserial correlation coefficient (γ_{pb}) is a special case of the product-moment correlation.

In this case, 1 or 0 (yes/no, write/wrong) measure the categories of the variable. Then it follows that $\sum x_i$ is actually the number of individuals whose responses are measured by 1. Again, as each X is either 1 or 0, and $\sum x_i^2$ will be equal to $\sum x_i$. Let us denote this by n_p. Thus:

$$SS(X) = \sum x_i^2 - \frac{(\sum x_i)^2}{n}$$
$$= n_p - \frac{(n_p)^2}{n}$$
$$= \frac{n_p(n - n_p)}{n}.$$

where, n is the total frequency.

If n_0 denotes the number of individuals who responded to 0, then $n_0 = n - n_p$, so that:

$$SS(X) = \sum x_i^2 - \frac{(\sum x_i)^2}{n} = \frac{n_p n_0}{n}$$

Now, $SS(Y) = \sum f_i y_i - \frac{(\sum f_i y_i)^2}{n}$ and

$$SP(XY) = \sum x_i y_i - \frac{(\sum x_i)(\sum y_i)}{n}.$$

For $\sum x_i y_i$, only the values for which $x_i = 1$, are to be considered, so it can be expressed as $\sum f_p y_i$, that is each Y-value is multiplied by the frequency answered 1.

We know that the Pearson r_{xy} is given by:

$$r_{xy} = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sqrt{\left\{\sum x^2 - \frac{(\sum x)^2}{n}\right\}\left\{\sum y^2 - \frac{(\sum y)^2}{n}\right\}}}.$$

So, substituting in it, the values obtained above for Point biserial, we get:

$$\gamma_{pb} = \frac{\sum f_p y - \frac{(n_p)(\sum fy)}{n}}{\sqrt{\left\{\frac{n_p n_0}{n}\right\}\left\{\sum f y^2 - \frac{(\sum fy)^2}{n}\right\}}}$$

$$\gamma_{pb} = \frac{n(\sum f_p y) - (n_p)(\sum fy)}{\sqrt{n_p n_0\{n(\sum f y^2) - (\sum fy)^2\}}}.$$

C.2.3: Correlation measures between continuous and continuous variables

Pearson's correlation coefficient: Pearson product-moment correlation coefficient or Pearson's correlation coefficient commonly called simply the correlation coefficient. It is obtained by dividing the covariance of the two variables by the product of their standard deviations (Yule G. U. and Kendall M. G. 2005).

Given paired data $\{(x_1, y_1), (x_2, y_2), \ldots, (x_n, y_n)\}$ consisting of n pairs, r_{xy} is defined as:

$$r_{xy} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n\sum x_i^2 - (\sum x_i)^2}\sqrt{n\sum y_i^2 - (\sum y_i)^2}}.$$

Spearman's rank correlation coefficient: Spearman's rank correlation coefficient is a measure of rank correlation between the rankings of two variables (Kendall M. G. 2005).

For a sample of size n, the n raw scores X_i, Y_i are converted to ranks X_i, Y_i, and r_s is computed as:

$$r_s = 1 - \frac{6\sum d_i^2}{n(n^2-1)},$$

where, d_i is the difference between the two ranks of each observation and n is the number of observations.