MATH391 Maths Summer Industrial Research Project

# Constructing Ghana Mortality Table via Negative Binomial Regression

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November 25, 2022

**Abstract**

One of the models that commonly used in the fitting and forecasting of demographic data is the Negative Binomial model, which is a GLM (Generalized Linear Model) based on the negative binomial regression and count data. There is no dataset and constructed tables for Ghana in recent years. Hence this thesis seeks to fit the raw dataset of an insurance company during 2018-2020 into the Negative Binomial Regression Model. The better of the offset and non-offset models was selected by likelihood ratio test and the best-fit model was selected by comparing AIC and BIC. Based on this, we forecast the mortality rates between 2021-2025, and therefore construct the mortality table of Ghana for this time period.

# Contents

# 1 Introduction

Mortality not only affects the population of a country or region but also has a non-negligible impact on the structure of the population and is an integral part of the study of demography and population economics. A mortality table, also known as an actuarial table or life table, generally shows the death rates of some specific demographics, classified by variables ranging from sexes, age groups, year intervals, etc[1]. Parameters which provide more information such as life expectancy, are also embraced in the table. Generalized linear models are frequently used to process these data [11].

Linear regression models are often used to calculate variables such as mortality data for how many times something happens. However, this type of data is considered to be the amount of data that contains the offset variable. Most of the previous studies have applied the Lee-Carter model and seldom mentioned the Negative binomial model in forecasting mortality[2]. However, some did apply a negative binomial model during mortality forecasting [3, 5]. A comparison has been made between Poisson or negative binomial regression and Lee-Carter models [3], while the negative binomial model is considered to be more appropriate than other count models in the sense that its dependent variable is a count data [12]. It is assumed by [10]that the dependent variable is overdispersed and does not have an excessive number of zeros. Variables in the model also have an impact on the goodness of fit. For this problem,[7] introduced the likelihood ratio test in R, which compares the goodness of the fitness between two nested regression models based on the ratio of their likelihoods in statistics.

Most of the mortality tables over the world are constructed and enhanced by HMD (Human Mortality Database)[13]. There is a large data suggesting that the mortality rate peaks at age 0, then decreases slowly and bottoms at age 10. After that, the death rate will climb with fluctuation before age 60 and surges since then. Therefore, the model had been modified based on this common rule. First, our group applied the likelihood ratio test to the offset and non-offset models aiming to select the better. Then the tools of AIC and BIC were used on a series of models to provide the best fit.

For the evaluation of the models, residual diagnostics for hierarchical (multi-level/mixed) regression models is explained in detail [8]. The software will always produce values for the null deviance and residual deviance of the general linear model. [14] gives an example which is using student status, bank balance, and income to build a logistic regression model that predicts the probability given individual defaults. It observed that the Null deviance is 2920.6 with df = 9999, and Residual deviance is 1571,5 with df = 9996. After that using the Chi-Square to P-Value Calculator to find that a $X^2$ value of 1331.6 with 3 degrees of freedom has a p-value of 0.000000. The model is highly useful for predicting because this p-value is much less than 0.5.

Mortality tables play an essential role in the fields of the decision of insurance policies, construction of pension or annuity systems and liability management. It is also an important database for life insurance actuarial calculations which involves the pricing of life products and reserve retention. [4]introduces GLMs and addresses problems specific to insurance data. A well-fitted and forecasted mortality table would efficaciously help insurance companies lucrative, and even improve the life and well-being of people.

## 2 Processing Data

### 2.1 Description of Raw Data

The raw data was provided by a Ghana insurance company, containing over 300,000 rows of data. It includes two parts of data:

- The basic information about individual insurance policies.
- A tremendous matrix of exposure to risk.

The basic information provided by the raw data set for the individual insurance policies part is shown as the table below (for the confidential reason, the example data in this figure is simulated).

| Variable | Definition | Example |
|---|---|---|
| Policy_No | The serial number of the insurance policy | ABC00000000 |
| Product | The product related to the policy, Whole Life Insurance/Term Insurance | Term Insurance |
| DOB | The date of birth of the insurant | 1900/1/1 |
| Sex | The sex of the insurant | Male |
| PolicyStatus | Defined as Inforce/Death/Surrender/Matured/Lapsed/Cancelled/Other | Inforce |
| DateOfInception | The date when starting the policy officially | 2018/1/1 |
| DateOfExit | The date when ending the policy (if not ended yet, then it is NA) | 2019/1/1 |
| Group/Individual | The insurant of the policy (group or individual policy) | Individual |
| Medical_Underwriting? | A binary variable defining whether the insurant has medical underwriting | No |
| Smoker | A binary variable defining whether the insurant is a smoker | No |
| CauseOfDeath | Defined as categorical variables of several cause of death or NA | Cancer |
| DateOfDeath | Defined as the date of death of the insurant or NA if not dead yet | 2019/1/1 |
| ANB at entry | The "Age nearest birthday" when entering the policy | 30 |
| ANB at death | The "Age nearest birthday" when dead or NA | NA |
| Duration Inforce | The exposure to risk of this insurant's policy | 2.66 |

Table 1: The variables in the raw data and their definitions and examples

It included not only the date of the insurant death but also, for instance, their death reason, duration in force and age when taking the policy. All of these were stored in a tremendous excel file. However, the raw data was not suitable for processing since there were too many invalid items which may affect the outcome of the modelling. For example, the variable "Smoker" is somehow assigned as "No". It is not reasonable and it is useless to conclude this in our modelling process. Moreover, the massive amount of data caused much trouble to deal with. Firstly, the file is so big that standard software like Microsoft Excel and Numbers could not open it. Therefore, other programming software was adapted to handle the situation. Finally, the programme R opened the dataset, and all the useless columns and rows were deleted from it. Until then, the procedure of processing data begins.

The other part of the raw data is a gigantic matrix which represents the exposure to risk of policies for separated ages. Denote the number of insurance policies contained in this raw data is m, and the matrix contains the exposure to risk from age 20 to 73. Therefore, the matrix is denoted as:

$$A = \begin{pmatrix} a_{0,20} & a_{0,21} & \cdots & a_{0,73} \\ a_{1,20} & a_{1,21} & \cdots & a_{1,73} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m,20} & a_{m,21} & \cdots & a_{m,73} \end{pmatrix}$$

where

$$a_{0,i} = \sum_{j=1}^{m} a_{j,i}$$

represents the total exposure to risk of this age group and the other components, $a_{i,j}$, represents the exposure to risk of the $i$ insurant at age $j$.

However, some policies started before 2018, and the exposure to risk is also counted into the whole matrix. Our study time expansion is from 2018 to 2020, thus this matrix cannot be directly used for the exposure variable in the model. Therefore, this part of the raw data is not in our consideration. The calculation of exposure is done afterwards.

## 2.2 Calculation of Death Count

After obtaining the available dataset, since the software, Microsoft Excel is easy to operate with time data, the one was chosen to be the main instrument for processing the data. The death frequency was the first to be counted. During the procedure, the function in excel "**COUNTIF**" was found to be the most efficient way to calculate the death number. The principle of our calculation is (take the 2018 death count as example):

1. Select the sex of the insurants that to be considered (Male or Female).
2. Select the insurants that is in some specific age group by calculating 2018 − the date of birth.
3. Count the number of people whose policy status is stated as "Death". Every death data is counted as 1.
4. Add all together and form the integrated table of observed death count table.

So, the insureds who were dead within the policy period were filtered out and counted year by year. Then the form which contains the death count of different ages in different years is constructed. The part of the integrated data set (Age 34 - 66) is illustrated as figure 1 below. The chart was used to model the curve of death number $d_x$ in the following steps.

| 2018 | | | | 2019 | | | | 2020 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Female | | Male | | Female | | Male | | Female | | Male | |
| Age | Frequency | Age | Frequency | Age | Frequency | Age | Frequency | Age | Frequency | Age | Frequency |
| 34 | 1 | 34 | 1 | 34 | 1 | 34 | 0 | 34 | 2 | 34 | 1 |
| 35 | 1 | 35 | 3 | 35 | 0 | 35 | 1 | 35 | 2 | 35 | 0 |
| 36 | 0 | 36 | 0 | 36 | 1 | 36 | 1 | 36 | 4 | 36 | 5 |
| 37 | 1 | 37 | 1 | 37 | 1 | 37 | 0 | 37 | 0 | 37 | 2 |
| 38 | 2 | 38 | 1 | 38 | 1 | 38 | 0 | 38 | 1 | 38 | 2 |
| 39 | 2 | 39 | 5 | 39 | 2 | 39 | 0 | 39 | 0 | 39 | 2 |
| 40 | 0 | 40 | 2 | 40 | 2 | 40 | 0 | 40 | 2 | 40 | 1 |
| 41 | 1 | 41 | 2 | 41 | 2 | 41 | 1 | 41 | 0 | 41 | 2 |
| 42 | 0 | 42 | 3 | 42 | 2 | 42 | 0 | 42 | 3 | 42 | 1 |
| 43 | 0 | 43 | 2 | 43 | 3 | 43 | 2 | 43 | 0 | 43 | 1 |
| 44 | 0 | 44 | 1 | 44 | 1 | 44 | 2 | 44 | 4 | 44 | 4 |
| 45 | 2 | 45 | 0 | 45 | 4 | 45 | 5 | 45 | 1 | 45 | 7 |
| 46 | 3 | 46 | 0 | 46 | 1 | 46 | 4 | 46 | 2 | 46 | 0 |
| 47 | 2 | 47 | 4 | 47 | 3 | 47 | 1 | 47 | 3 | 47 | 1 |
| 48 | 1 | 48 | 4 | 48 | 4 | 48 | 2 | 48 | 4 | 48 | 1 |
| 49 | 2 | 49 | 4 | 49 | 2 | 49 | 4 | 49 | 1 | 49 | 3 |
| 50 | 2 | 50 | 7 | 50 | 5 | 50 | 2 | 50 | 2 | 50 | 2 |
| 51 | 1 | 51 | 3 | 51 | 6 | 51 | 2 | 51 | 7 | 51 | 6 |
| 52 | 3 | 52 | 3 | 52 | 4 | 52 | 2 | 52 | 4 | 52 | 7 |
| 53 | 5 | 53 | 6 | 53 | 9 | 53 | 3 | 53 | 9 | 53 | 7 |
| 54 | 4 | 54 | 7 | 54 | 6 | 54 | 6 | 54 | 5 | 54 | 2 |
| 55 | 7 | 55 | 6 | 55 | 6 | 55 | 6 | 55 | 13 | 55 | 9 |
| 56 | 8 | 56 | 8 | 56 | 11 | 56 | 9 | 56 | 13 | 56 | 5 |
| 57 | 3 | 57 | 5 | 57 | 9 | 57 | 5 | 57 | 8 | 57 | 13 |
| 58 | 10 | 58 | 8 | 58 | 10 | 58 | 6 | 58 | 14 | 58 | 11 |
| 59 | 5 | 59 | 4 | 59 | 14 | 59 | 14 | 59 | 9 | 59 | 8 |
| 60 | 10 | 60 | 16 | 60 | 10 | 60 | 7 | 60 | 8 | 60 | 8 |
| 61 | 9 | 61 | 11 | 61 | 16 | 61 | 13 | 61 | 14 | 61 | 9 |
| 62 | 9 | 62 | 7 | 62 | 19 | 62 | 18 | 62 | 17 | 62 | 11 |
| 63 | 5 | 63 | 13 | 63 | 11 | 63 | 12 | 63 | 22 | 63 | 13 |
| 64 | 15 | 64 | 21 | 64 | 17 | 64 | 10 | 64 | 16 | 64 | 12 |
| 65 | 4 | 65 | 12 | 65 | 15 | 65 | 14 | 65 | 21 | 65 | 20 |
| 66 | 12 | 66 | 16 | 66 | 13 | 66 | 25 | 66 | 10 | 66 | 21 |

Figure 1: Observed death count data (Age 34-66)

The observed data set rages from 2018 to 2020. To see clearly the pattern of the observed death count pattern, diagrammatic presentations of this data set is illustrated below.

**Observed number of female deaths (2018-2020)**

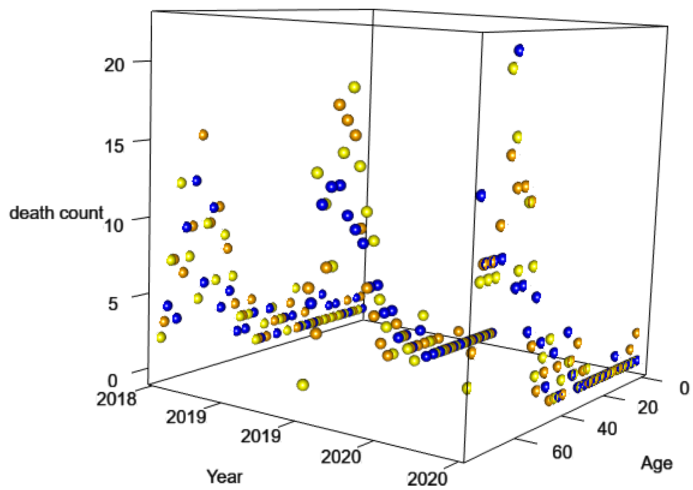



Figure 2: Observed Ghana female death counts from 2018 to 2020

**Observed number of male deaths (2018-2020)**

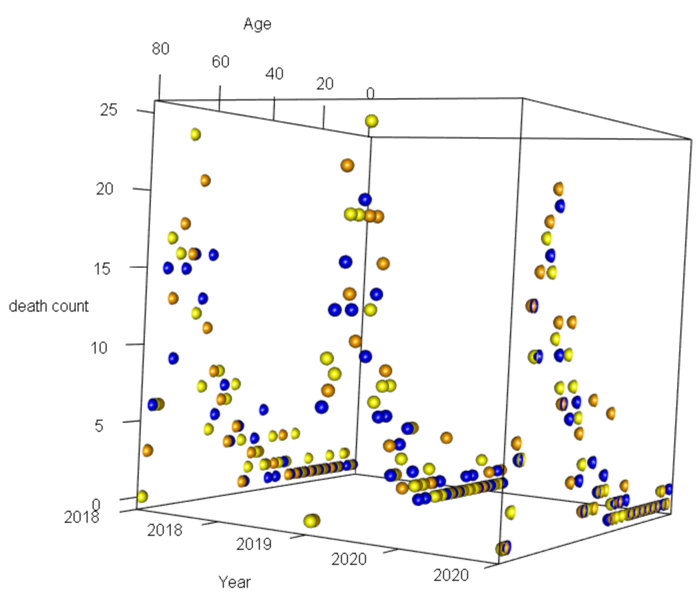



Figure 3: Observed Ghana male death counts from 2018 to 2020

**Observed number of total deaths (2018-2020)**

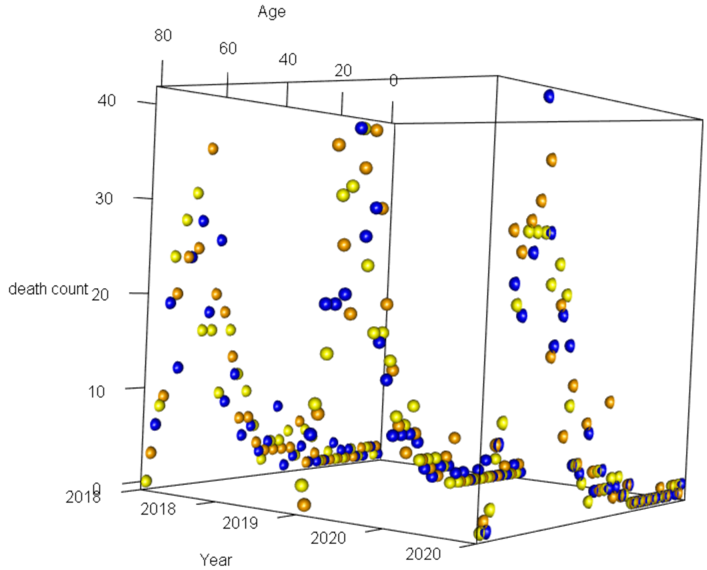



Figure 4: Observed Ghana total death counts from 2018 to 2020

Figure 25, 12 and 13 displayed above depict three-dimensional plots of observed number of death in Ghana from 2018 to 2020, for male, female and total data set, respectively. The death counts of the Ghana people against their ages are observed to be highest among the 60's and 70's age groups but decline steadily; recording minimal counts for 80's age groups. The maximum counts are recorded in 2020 and for age about 70 and the minimum counts are zeros due to the lack of data. We cannot conclude that the death rate declines from 70's to 80's steadily since the exposure to risk is different for every age group.

## 2.3 Calculation of Exposure

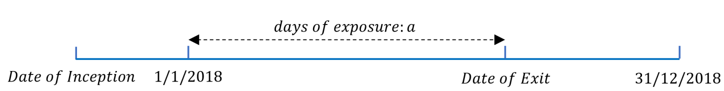
The most significant work for us to handle was the calculation of the exposure. It was a concept that represents the length of the policyholder exposed to the risk of death. However, there are lots of rules to calculate it. Below are calculation regulations provided by [1].

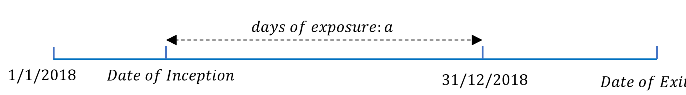
- Only consider Inception and Exit:

  i) If Date Of Inception < 1/1/20XX and Date Of Exit > 31/12/20XX, set exposure as 1.


Figure 5: Exposure Calculation Discussion 1

  ii) Only consider Inception and Exit: Otherwise, set Exposure = a/365



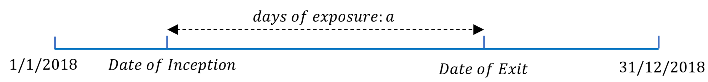



Figure 6: Exposure Calculation Discussion 2

- Add death into consideration:

  If the individual died between 2018, overlap the exposure as 1.


Figure 7: Exposure Calculation Discussion 3

As we can see from the figure above, the calculation of the exposure is complicated and requires many efforts and techniques to finish. We still chose Microsoft Excel to complete the work. The data was classified into different categories, and the corresponding techniques were applied to those data to calculate the exposure. After a step explained done above, the next step will overlap part of the results calculated before. Finally, we gained the total exposure of each year respectively.

The 3D plot of the observed exposure data set is shown as below:

**Observed Exposure of female (2018-2020)**

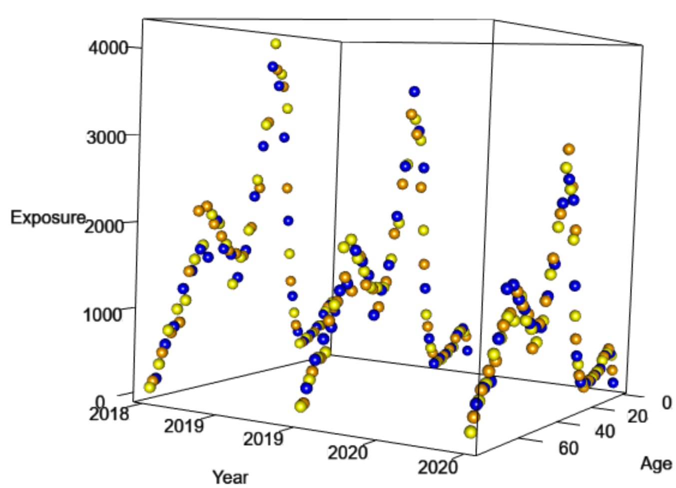



Figure 8: Observed Ghana female exposure from 2018 to 2020

**Observed Exposure of male (2018-2020)**

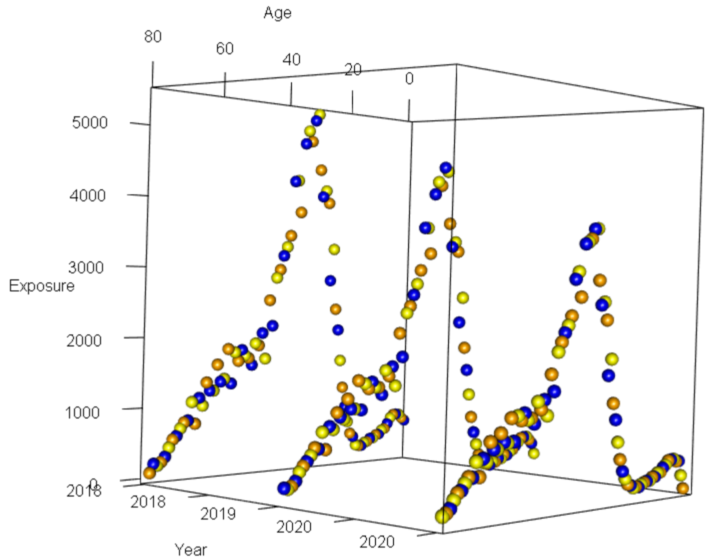



Figure 9: Observed Ghana male exposure from 2018 to 2020

**Observed Exposure of total (2018-2020)**

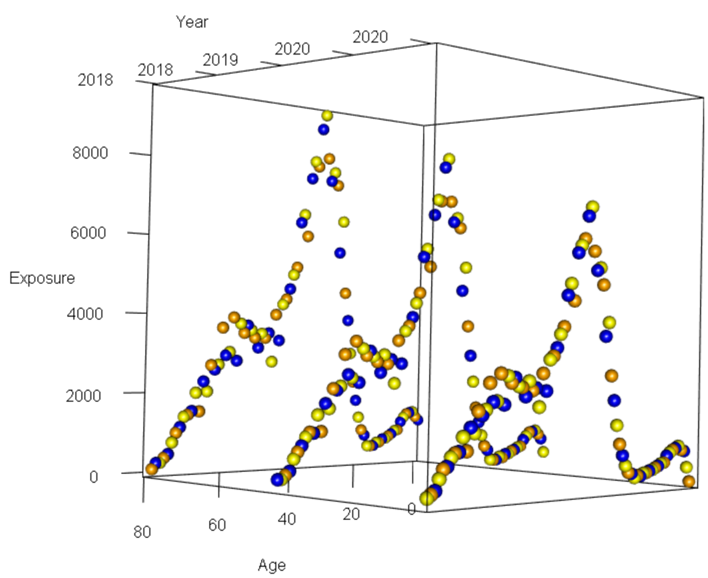



Figure 10: Observed Ghana total exposure from 2018 to 2020

It can be concluded that the exposure for the three data sets stay marginally stagnant at first from 0's to 10's, then going straightly up from 10's to 30's. Afterwards, it declines consistently, though experiencing a mild halt approximately around age 60. The maximum exposure is achieve in 2020 and age about 30, about 9000.

## 2.4 Estimation of Observed Mortality Rate

After the calculation of all these necessary variables we need to start modelling process, we can actually calculate the observed mortality rate by the formula:

$$\text{Observed Mortality Rate} = \frac{\text{Observed Death Count}}{\text{Observed Exposure}}$$

This data can be used afterwards to assess the goodness of fit by plotting the observed mortality rate and the modeled together to see the consistency.

Here we note that we have many 0s at the lower tail and the upper tail of the observed death count, i.e., at younger age between 0's to approximately 20's and the elder age group between 70's to 80's, leading to the same 0 derived in the observed mortality rate. No zero mortality rate can be applied to the reality. Thus this may affect the accuracy and the goodness of fit of the model. This issue will be addressed later.

We choose to plot the log mortality rate instead of the calculated real mortality rate because:

- To see clearly the pattern of the observed mortality rate since numerically the mortality rate is small.
- To analyse the possible approximate linear pattern since the Negative Binomial Model belongs to the exponential family.

Since $\log 0$ does not exist, we plot log(Observed Mortality Rate + 0.01) versus Ages and Years. This applies since it will not change the general pattern of the plot.

Below are 3-dimension graphs for the observed log mortality rate versus ages and years, calculated by the formula above:

**Observed Mortality Rate of female (2018-2020)**

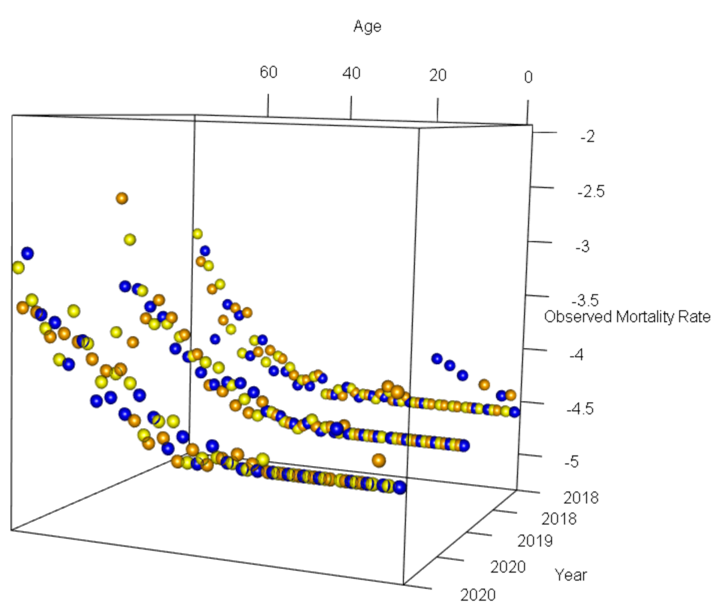



Figure 11: Observed Ghana female mortality rate from 2018 to 2020

**Observed Mortality Rate of male (2018-2020)**

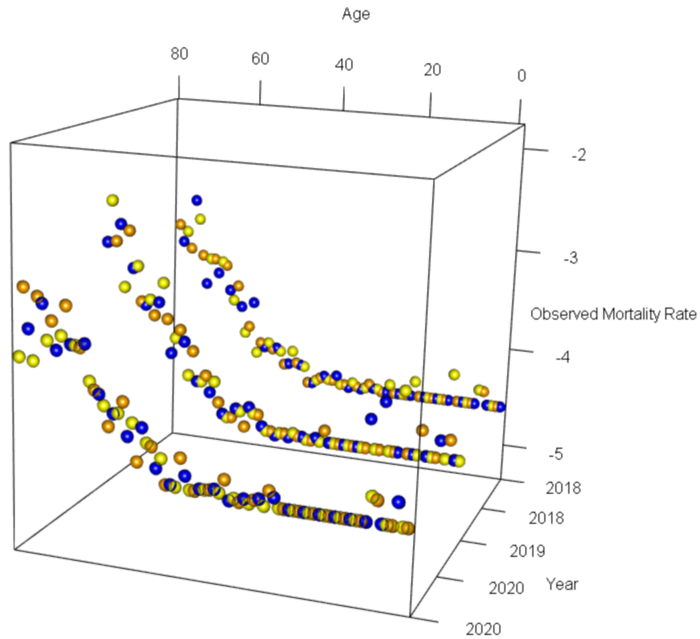



Figure 12: Observed Ghana male mortality rate from 2018 to 2020

**Observed Mortality Rate of total (2018-2020)**

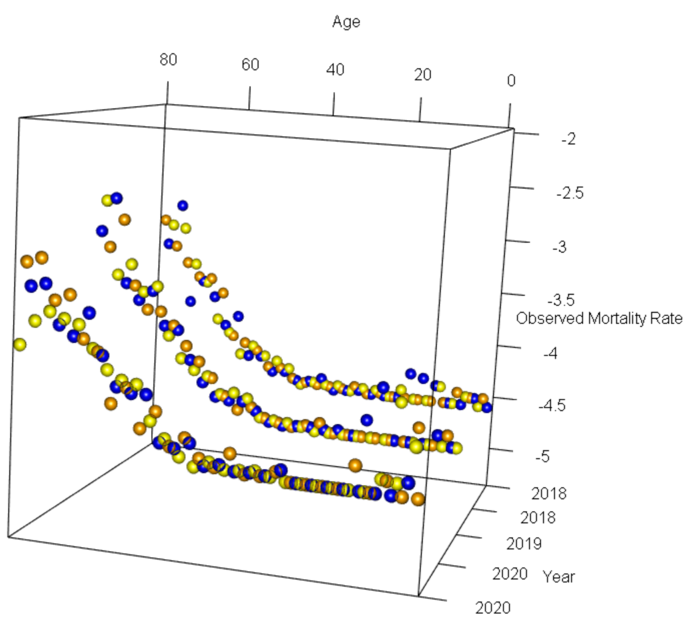



Figure 13: Observed Ghana total mortality rate from 2018 to 2020

The observed log mortality rate stay marginally stagnant with almost no fluctuation at the beginning since there are many 0's in the data set of the observed death count. With the age increasing, the log mortality rate starts to follow an approximately linear pattern, meaning that the real mortality rate starts to follow an approximately exponential pattern. This pattern continues with no discrepancy till the end of the age group we specified.

## 2.5 Insufficient Data and Solutions

After the data was shown to us, the problem of insufficient data occurred. Since the original data set was so small, only 2000 deaths or so. There are many age periods like age 0-16 and above 76 are very lack of sufficient figures. Considering the data was from an insurance company, the children and elders may not be accepted to be clients, and right and properly not to exist in the dataset.

Clearly from the graphs illustrated in section 2.2 and 2.3, we can see that there are some cases where the death count and the exposure are both zero at age 75-80, i.e., the upper tails of the raw data set, reasulting in that the observed mortality rate still cannot be calculated even if we add 0.01 to the mortality rate since we are dividing zero if the exposure is equal to 0. These points are missing in the observed mortality rate plot above. Adding these missing points into consideration as 0 or infinitesimal, the observed mortality rate declines at the end of the age group, which is not consistent with the reality that the death rate increases with age at these local tails. It is proved during the modelling process which will be mentioned later. Considering the deficiencies of both death count and exposure may lead to vast deviation of the final model, we delete the data which the exposure is less than 100 (3 standard deviations below the mean of exposure) at the upper tail to ensure the accuracy.

# 3 Modeling Methodology

## 3.1 Mathematical Rationale of Negative Binomial Regression model

After processing the raw data and calculating all the observed values needed, we can step into the modeling part. In this thesis we concentrate on the Negative Binomial Regression model. Described in the subsections below are some necessary concepts for this model.

### 3.1.1 PMF of Response Distribution

The traditional meaning and derivation of Negative Binomial Distribution is to count m successes among total n trials of a repeated Bernoulli experiment. With this definition the **PMF of Negative Binomial Distribution** can be written as:

$$f(n) = \binom{n-1}{m-1} p^m (1-p)^{n-m}, \qquad n = m, m+1, m+2, ...... \tag{1}$$

where $p$ is the probability of success. We can also write this in another way by substituting $n = m + y$ in (1), where $y$ is the total amount of failures.

$$f(y) = \binom{m+y-1}{m-1} p^m (1-p)^y, \qquad y = 0, 1, 2, ...... \tag{2}$$

Expand the combination in (2):

$$\begin{aligned} f(y) &= \frac{(m+y-1)!}{(m-1)![m+y-1-(m-1)]!} p^m (1-p)^y \\ &= \frac{(m+y-1)!}{(m-1)!y!} p^m (1-p)^y \end{aligned}$$

Note that for positive integer numbers $k$, the Gamma function $\Gamma(k) = (k-1)!$. Therefore, the PMF of negative binomial regression can be restated as:

$$f(y) = \frac{\Gamma(m+y)!}{\Gamma(m)y!} p^m (1-p)^y, \qquad y = 0, 1, 2, ...... \tag{3}$$

Now, we do some parametrization for the convenience of expressing the mean and variance. We substitute:

$$\mu = \frac{m(1-p)}{p}, \qquad \kappa = \frac{1}{m}$$

Substitute into (3) we reach the final expression for PMF:

$$y \sim NB(\mu, \kappa), \quad f(y) = \frac{\Gamma(y + \frac{1}{\kappa})}{y!\Gamma(\frac{1}{\kappa})} \left(\frac{1}{1+\kappa\mu}\right)^{\frac{1}{\kappa}} \left(\frac{\kappa\mu}{1+\kappa\mu}\right)^y, \qquad y = 0, 1, 2, ...... \tag{4}$$

### 3.1.2 Mean and Variance, Overdispersion

The mean and variance of negative binomial distribution can be derived from the Probability Mass Function illustrated above. As a published result [4],

$$\mathbb{E}[y] = \mu, \qquad \mathbb{VAR}[y] = \mu + \kappa\mu^2$$

It is clear that, the two parameters in the negative binomial distribution, i.e., $\mu$ and $\kappa$, represents **the mean of the distribution** and the **scale of quadratic dispersion of variance from the mean**, respectively.

Below are some examples of histograms of negative binomial distribution. The parameter $\mu$ controls the mean of the distribution strictly independent of $\kappa$, and when $\kappa$ is big, the histogram is strongly right-skewed and possessing a greater variance. In fact, when $\kappa \to 0$, $NB(\mu, \kappa) \to P(\mu)$, the distribution converges to Poisson Distribution with mean $\mu$.

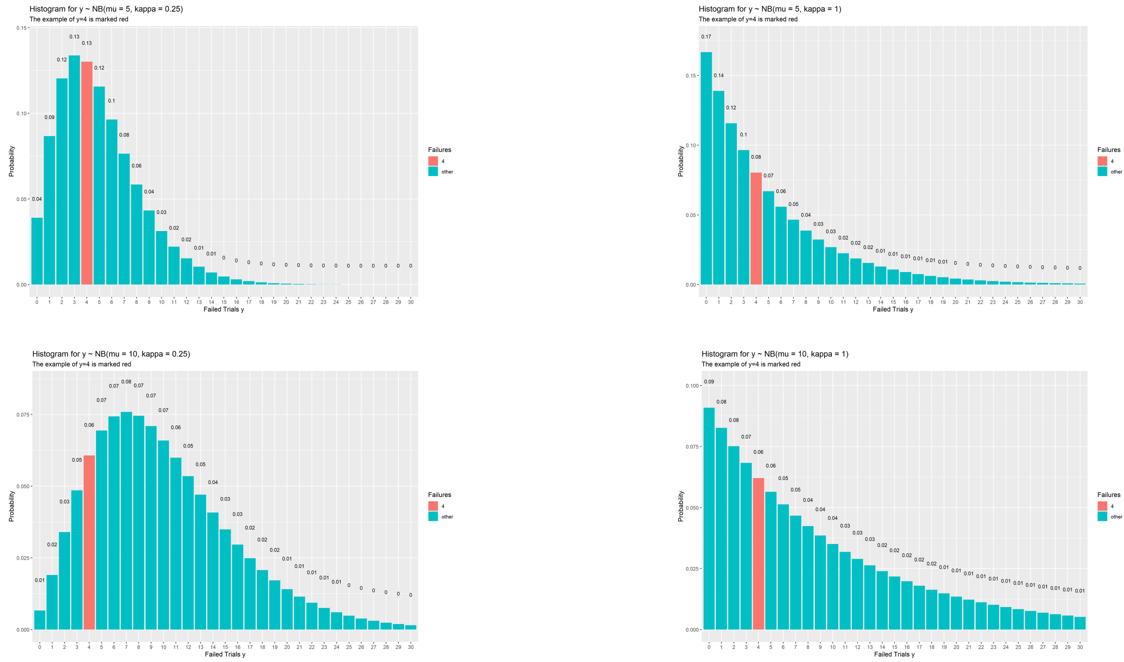



Figure 14: Negative Binomial Distribution PMF Histograms for NB(5,.25), NB(5,1), NB(10,.25), NB(10,1), respectively

This fascinating convergence property leads us to a significant topic of Negative Binomial Model: **Overdispersion**. We know that the mean and variance of Poisson Distribution is equal, and this is called **equidispersion**. This limits the Poisson Regression to a narrow feasible region since the raw data must have the same mean and the variance.

However, there is a quadratic term in the expression of variance of Negative Binomial Distribution, which brings the so called overdispersion, leading to a more flexible environment in modelling dispersed data. Therefore, **an important and necessary prerequisite of Negative Binomial Regression Model is the overdispersion of data**. We need to check this before starting the modeling process. If the dataset is not overdispersed, we might need to consider Poisson Regression Model instead.

### 3.1.3 Basic Concept of Negative Binomial Model

Negative Binomial Regression Model is a member of Generalized Linear Model (GLM). The response distribution belongs to the **exponential family**, where,

$$f(y) = c(y, \phi) \exp\left(\frac{y\theta - a(\theta)}{\phi}\right)$$

$$\theta : \text{Canonical Parameter} \qquad \phi : \text{Dispersion Parameter}$$

**Note:** Here the dispersion parameter $\phi$ is not same as the overdispersion parameter $\kappa$ in the negative binomial distribution. For Negative Binomial Regression Model, the dispersion parameter is fixed.

Specifically, For $y \sim NB(\mu, \kappa)$,

$$\theta = \ln \frac{\kappa\mu}{1+\kappa\mu}, \quad a(\theta) = -\frac{1}{\kappa}\ln\left(1 - \kappa e^{\theta}\right), \quad \phi = 1$$

$c(y, \theta)$ is generally not important in the estimation of the parameter during modelling process. The canonical parameter $\theta$ is commonly estimated when doing the negative binomial regression. This functional process is applied to many statistical analysis software such as R and SAS. We will see this later.

For our Negative Binomial Model, we choose the link function as natural log, i.e., $g(x) = \ln x$. Therefore, the structure of our negative binomial regression model is

$$\ln(\mathbb{E}[\mathbf{Y}]) = \mathbf{X^T}\boldsymbol{\beta}, \quad \text{where} \quad Y \sim NB(\mu, \kappa) \tag{5}$$

$\mathbf{Y}$ is the dependent variable (i.e., in our case, death count and exposure), and

$$\mathbf{X} = \begin{pmatrix} 1 & x_{11} & \cdots & x_{1p} \\ 1 & x_{21} & \cdots & x_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & x_{n1} & \cdots & x_{np} \end{pmatrix} = (\mathbf{1}, \mathbf{x_1}, \mathbf{x_2}, \cdots, \mathbf{x_p})$$

is the matrix of independent variables including the intercept(i.e., in our case, sexes, ages, years, etc.). $\boldsymbol{\beta}$ are the coefficients to be estimated [15].

### 3.1.4 Estimating Parameters: Maximum Likelihood Estimation

For the estimation of those coefficients mentioned above, we choose the **Maximum Likelihood Estimation (MLE)**.

Suppose that for each observation, we have a probability function $f(y_i; \theta, \phi)$. If our observations are independent, then the joint probability density function (pdf) is the multiple of each single probability function, that is,

$$F(y; \theta, \phi) = \prod_{i=1}^{n} f(y_i; \theta, \phi)$$

$F$ is called the likelihood function. For Negative Binomial Regression Model, from (4) we have the likelihood function

$$F(y; \mu, \kappa) = \prod_{i=1}^{n} \frac{\Gamma(y_i + \frac{1}{\kappa_i})}{y_i!\Gamma(\frac{1}{\kappa_i})} \left(\frac{1}{1 + \kappa_i \mu_i}\right)^{\frac{1}{\kappa_i}} \left(\frac{\kappa_i \mu_i}{1 + \kappa_i \mu_i}\right)^{y_i}$$

Substituting the inverse link function $\mu_i = \exp\left(\boldsymbol{X_i^T}\boldsymbol{\beta}\right)$,

$$F(y; \beta, \kappa) = \prod_{i=1}^{n} \frac{\Gamma(y_i + \frac{1}{\kappa_i})}{y_i!\Gamma(\frac{1}{\kappa_i})} \left(\frac{1}{1 + \kappa_i \exp\left(\boldsymbol{X_i^T}\boldsymbol{\beta}\right)}\right)^{\frac{1}{\kappa_i}} \left(\frac{\kappa_i \exp\left(\boldsymbol{X_i^T}\boldsymbol{\beta}\right)}{1 + \kappa_i \exp\left(\boldsymbol{X_i^T}\boldsymbol{\beta}\right)}\right)^{y_i}$$

For the precision of the model, we want the observed dependent variable $y$, have the optimal "likelihood" to appear. Thus, all the partial derivatives of $F(y; \beta, \kappa)$ are trivialized to find the optimal. For the convenience of calculation, we take the log of this function to transform the multiplication to the accumulation:

$$\ell(y; \beta, \kappa) = \ln \sum_{i=1}^{n} \frac{\Gamma(y_i + \frac{1}{\kappa_i})}{y_i!\Gamma(\frac{1}{\kappa_i})} \left(\frac{1}{1 + \kappa_i \exp\left(\boldsymbol{X_i^T}\boldsymbol{\beta}\right)}\right)^{\frac{1}{\kappa_i}} \left(\frac{\kappa_i \exp\left(\boldsymbol{X_i^T}\boldsymbol{\beta}\right)}{1 + \kappa_i \exp\left(\boldsymbol{X_i^T}\boldsymbol{\beta}\right)}\right)^{y_i} \tag{6}$$

This is called the **Log-Likelihood Function** of Negative Binomial Regression Model. The necessary condition for the optimization of log-likelihood function is:

$$\frac{\partial \ell}{\partial \boldsymbol{\beta}} = 0 \quad \textit{and} \quad \frac{\partial \ell}{\partial \kappa} = 0$$

The parameters of Negative Binomial Model are estimated in this way in many statistical software such as R.

### 3.1.5 Offset

There is an important characteristic need to be pointed out is that the Negative Binomial Regression Model is for the modeling of **count data**. That is, the independent and dependent variables in the model need to be count data and belong to the positive integer domain. This characteristic appears because the negative binomial distribution is discrete.

In our case, the goal is to model the death rate in each year and for each age groups. The explanatory variables (e.g., years, ages, count of reason of death) are all count data. However, the response variable, which is the death rate, is a continuous data and cannot be implemented into this modeling process.

This problem is solved by the introduction of the concept called the **Offset**.

In view of that the number of death is count data and the death rate:

$$q_x = \frac{\text{Number of death}}{\text{Exposure}}$$

We can model the number of death instead of the death rate by some transformation based on the model of death rate. As illustrated in (5), the model of death rate can be written as:

$$\ln q_x = \ln \frac{d_x}{n} = \mathbf{X}^{\mathbf{T}}\boldsymbol{\beta}$$

where $d_x$ is the number of death and $n$ is the exposure. Transfer the $\ln n$ the the RHS, we have:

$$\ln (q_x)_i = \ln (d_x)_i = \ln n_i + \left(\mathbf{X}^{\mathbf{T}}\boldsymbol{\beta}\right)_i \tag{7}$$

$\ln n_i$ in Equation (7) is called the offset. For this kind of offset model, the offset term generates a different intercept for every independent observation.

As stated by [4], offset terms are generally used to correct the different group sizes and different time periods of independent observations. In our case, exposure is one kind of group size for the observed number of people within the insurance policy. The offset term of the exposure efficiently correct the differences of number of observed people within different years and age groups.

## 3.2 Construction of Model

Since negative binomial regression is used for over-dispersion data (3.1.2), it is reasonable to test the over-dispersion of the data before modelling. Therefore, we run a Poisson Regression Model to check whether the data is over-dispersion or not.

```
>c<-deviance(fit) / df.residual(fit)
>c
[1] 7.164726
```

Table 2: Ratio of residual deviation to residual degrees of freedom (Female death count Model as example)

Over-dispersion is the case where the residual deviation is large relative to the degrees of freedom. In Table 2, c denotes the ratio of residual deviation to residual degrees of freedom. It is clear that the value of c is much greater than 1. Therefore, the model is over-dispersion and meets the negative binomial regression premise.

### 3.2.1 Offset and Non-offset Models

After confirming that the data was over-dispersion, we started to build the negative binomial regression model. As mentioned in section 3.1.5, there are two methods to build the model:

**Method 1**: Offset Model (take exposure as an offset term):
dx ∼ polynomial(Age) + polynomial(Year) + offset(log(Exposure))

**Method 2**: Non-offset Model (take exposure as a variable and model the exposure separately):
dx ∼ polynomial(Age) + polynomial(Year) + log(Exposure)

Exposure ∼ polynomial(Age) + polynomial(Year)

Here polynomial(x) means the polynomial that generated by the variable x, i.e.,

$$\text{polynomial}(x) = a_1x + a_2x^2 + a_3x^3 + .... + a_nx^n$$

The goal of our modelling process is to ascertain the power $n$ that makes models have the best goodness of fit. For convenience, Below we denote:

$$poly(x, n) = a_1x + a_2x^2 + a_3x^3 + .... + a_nx^n$$

as the polynomial of variable x with the highest power of n.

(Moreover, we also tried to add some interactions and other variables such as Age×Year, cause of death, smoking, etc. But they did not only make a marginal difference to the final model but also make the model more complex, so we decided not to include them in the model for efficiency.)

### 3.2.2 Likelihood Ratio Test

To assesses the goodness of fit of two competing models, we use the likelihood ratio test which is based on the ratio of their likelihoods.

The rationale of the likelihood ratio test is to compare the likelihood of two models by their ratio to see whether one of the model is significantly better than the other. The null and the alternative hypothesis of the Likelihood Ratio Test is [7]:

1. $H_0$: Both the full and nested models fit the data equally well. In this case the nested model is simpler and the nested model should be chosen to avoid overfitting.
2. $H_1$: The full model significantly outperforms the nested model in terms of data fit. In this case the full model should be chosen to ensure the performance of the model.

As stated before, the ratio of the likelihood is used as the criterion for the assessment of two models. Since we use log likelihood for the estimation of parameters, naturally, we can use the difference between the two log likelihood values as the test statistics (Since the ratio becomes substraction when taking log function). If we denote the two log likelihood as $\ell_1$ and $\ell_2$, then the test statistics:

$$\chi = 2(\ell_1 - \ell_2)$$

where the test statistics is constructed to make it fitted in the $\chi^2_q$ distribution (q is the number of restrictions on coefficients). Thus the p-value of the test can be found in the table of chi-sqaure distribution.

In R, the better model can be selected by observing the number of significant digits. Here we take females as an example and choose Method 2. Two cases are listed here.

**Case 1**:Insignificant Case — choose the simplest model

```
Likelihood ratio test

Model 1: dx ~ poly(Year, 1) + poly(age, 4) + log(ex)
Model 2: dx ~ poly(Year, 2) + poly(age, 4) + log(ex)
  #Df  LogLik Df  Chisq Pr(>Chisq)
1   8 -386.31
2   9 -385.62  1 1.3759     0.2408
```

Figure 15: Test in R output (Male death count Model as example)

(There are no significant digits. It means that these two models are similar, so we choose the simplest one. Therefore, model 1 is chosen in this example.)

**Case 2**: Significant Case — choose the most complete model

```
Likelihood ratio test

Model 1: ex ~ poly(Year, 1) + poly(age, 9)
Model 2: ex ~ poly(Year, 1) + poly(age, 10)
  #Df  LogLik Df  Chisq Pr(>Chisq)
1  12 -1616.1
2  13 -1607.9  1 16.401  5.126e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 16: Test in R output (Male Exposure Model as example)

(There are 3 significant digits, which means these two models are strongly different. Hence, we choose the most complete model. Obviously, model 2 is chosen in this example.)

Through the above methods, the following table shows the final models of offset and non-offset:

| | Method 1 | Method 2 | |
|---|---|---|---|
| | dx model | dx model | Exposure model |
| Female | poly(Age,3)+poly(Year,2)+offset(log(exposure)) | poly(Age,3)+poly(Year,2) | poly(Age,10)+poly(Year,1) |
| Male | poly(Age,4)+poly(Year,1)+offset(log(exposure)) | poly(Age,4)+poly(Year,1) | poly(Age,10)+poly(Year,1) |
| Total | poly(Age,3)+poly(Year,2)+offset(log(exposure)) | poly(Age,4)+poly(Year,2) | poly(Age,10)+poly(Year,1) |

Table 3: Models of offset and non-offset

#### 3.2.3 AIC & BIC Criteria

To measure which is better, the offset model or the non-offset model, we apply AIC and BIC as the measurement of the model statistics. Firstly, we introduce the AIC, which is called the Akaike information criterion.

For a specific model of some data, suppose that there are $k$ estimated parameters and let $L_{max}$ be the maximum likelihood function of the model. Then the AIC value is calculated in the following way:

$$AIC = 2k - 2\ln L_{max}$$

It's a measure of the goodness of fit of a statistical model. The Akaike information criterion is based on the concept of entropy, the smaller the AIC, the better the model. Thus, the model with the smallest AIC is usually chosen.

| | | | AIC | BIC |
|---|---|---|---|---|
| Female | Method 1 | poly(Age,3)+poly(Yeay,2)+offset(log(exposure)) | 707.07 | 726.26 |
| | Method 2 | poly(Age,3)+poly(Year,2)+log(exposure) | 697.49 | 725.13 |
| Male | Method 1 | poly(Age,4)+poly(Year,1)+offset(log(exposure)) | 793.61 | 817.98 |
| | Method 2 | poly(Age,4)+poly(Year,1)+log(exposure) | 788.61 | 816.46 |
| Total | Method 1 | poly(Age,3)+poly(Year,2)+offset(log(exposure)) | 956.93 | 981.29 |
| | Method 2 | poly(Age,4)+poly(Year,2)+log(exposure) | 944.95 | 976.28 |

Table 4: AIC and BIC of Table 3

The AIC value for Method 2 is slightly smaller than the one for Method 1 for all models. It shows that Method 2 is a better fit than Method 1. It indicates that the non-offset model is a better fit than the offset model.

On the other hand, there another criterion for the assessment of the model, called BIC (Bayesian information criterion):

$$BIC = k\ln n - 2\ln L_{max}, \text{where n is the sample size}$$

whose value for Method 1 is marginally higher when compared to Method 2. Thus, with lower AIC and BIC values, the non-offset model is the better approach for the mortality rate data. The final models are:

| | dx model | Exposure model |
|---|---|---|
| Female | poly(Age,3)+poly(Year,2)+log(exposure) | poly(Age,10)+poly(Year,1) |
| Male | poly(Age,4)+poly(Year,1)+log(exposure) | poly(Age,10)+poly(Year,1) |
| Total | poly(Age,4)+poly(Year,2)+log(exposure) | poly(Age,10)+poly(Year,1) |

Table 5: Final Models

#### 3.2.4 Modeling of Death Count

Using the package "glm" in **R** we can easily generate the fitted death count and the exposure, with those best model chosen above. In this section we display the output and the results of the death count model.

**Fitted Negative Binomial Regression Model for death count**

| | | | | |
|---|---|---|---|---|
| Call: | | | | |
| glm.nb(formula = dx ∼poly(Age, 3) + poly(Year, 2) + log(Exposure), | | | | |
| data = FemaleMortality, link = log, init.theta = 4713.063641) | | | | |
| Deviance Residuals: | | | | |
| Min | 1Q | Median | 3Q | Max |
| -2.0762 | -0.7109 | -0.3990 | 0.4385 | 3.0618 |
| Coefficients: | | | | |
| | Estimate | Std. Error | z value | Pr(>—z—) |
| (Intercept) | -4.5189 | 0.8071 | -5.599 | 2.15e-08 *** |
| poly(Age, 3)1 | 21.9890 | 1.4779 | 14.879 | <2e-16 *** |
| poly(Age, 3)2 | 6.5128 | 1.4568 | 4.471 | 7.80e-06 *** |
| poly(Age, 3)3 | -6.4808 | 0.9049 | -7.162 | 7.94e-13 *** |
| poly(Year, 2)1 | 3.4737 | 0.5619 | 6.182 | 6.33e-10 *** |
| poly(Year, 2)2 | -1.3593 | 0.5107 | -2.662 | 0.00777 ** |
| log(Exposure) | 0.6985 | 0.1162 | 6.009 | 1.87e-09 *** |
| — | | | | |
| Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 | | | | |
| Null deviance: 1410.88 on 233 degrees of freedom | | | | |
| Residual deviance: 200.52 on 227 degrees of freedom | | | | |
| AIC: 697.49 | | | | |
| Number of Fisher Scoring iterations: 1 | | | | |
| 2 x log-likelihood: -681.488 | | | | |

Table 6: Fitted Negative Binomial Regression with GLM of Female Model

| Call: | | | | |
|---|---|---|---|---|
| glm.nb(formula = dx ~poly(Age, 4) + poly(Year, 1) + log(Exposure), data = MaleMortality, link = log, init.theta = 6506.885421) | | | | |
| Deviance Residuals: | | | | |
| Min | 1Q | Median | 3Q | Max |
| -2.3714 | -0.7757 | -0.4566 | 0.4095 | 3.3004 |
| Coefficients: | | | | |
| | Estimate | Std. Error | z value | Pr(>—z—) |
| (Intercept) | -3.9755 | 0.9136 | -4.352 | 1.35e-05 *** |
| poly(Age, 4)1 | 23.4101 | 1.4561 | 16.077 | <2e-16 *** |
| poly(Age, 4)2 | 7.4497 | 1.9740 | 3.774 | 0.000161 *** |
| poly(Age, 4)3 | -5.0755 | 1.1974 | -4.239 | 2.25e-05 *** |
| poly(Age, 4)4 | -2.4805 | 0.9009 | -2.753 | 0.005898 ** |
| poly(Year, 1)1 | 0.9886 | 0.4893 | 2.020 | 0.043350 * |
| log(Exposure) | 0.6491 | 0.1287 | 5.045 | 4.55e-07 *** |
| — | | | | |
| Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 | | | | |
| Null deviance: 1795.51 on 239 degrees of freedom | | | | |
| Residual deviance: 239.04 on 233 degrees of freedom | | | | |
| AIC: 788.61 | | | | |
| Number of Fisher Scoring iterations: 1 | | | | |
| 2 x log-likelihood: -772.614 | | | | |

Table 7: Fitted Negative Binomial Regression with GLM of Male Model

| Call: | | | | |
|---|---|---|---|---|
| glm.nb(formula = dx ~poly(Age, 4) + poly(Year, 2) + log(Exposure), data = TotalMortality, link = log, init.theta = 90.37599788) | | | | |
| Deviance Residuals: | | | | |
| Min | 1Q | Median | 3Q | Max |
| -2.1813 | -0.8591 | -0.3615 | 0.4719 | 3.6182 |
| Coefficients: | | | | |
| | Estimate | Std. Error | z value | Pr(>—z—) |
| (Intercept) | -3.42574 | 0.74552 | -4.595 | 4.33e-06 *** |
| poly(Age, 3)1 | 22.82746 | 1.07034 | 21.327 | <2e-16 *** |
| poly(Age, 3)2 | 5.97018 | 1.43535 | 4.159 | 3.19e-05 *** |
| poly(Age, 3)3 | -5.74883 | 0.86613 | -6.637 | 3.19e-11 *** |
| poly(Age, 3)4 | -1.87039 | 0.74356 | -2.515 | 0.0119 * |
| poly(Year, 2)1 | 1.96411 | 0.40404 | 4.861 | 1.17e-06 *** |
| poly(Year, 2)2 | -0.82650 | 0.37678 | -2.194 | 0.0283 * |
| log(Exposure) | 0.60175 | 0.09672 | 6.222 | 4.92e-10 *** |
| — | | | | |
| Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 | | | | |
| Null deviance: 2726.1 on 239 degrees of freedom | | | | |
| Residual deviance: 243.2 on 232 degrees of freedom | | | | |
| AIC: 944.95 | | | | |
| Number of Fisher Scoring iterations: 1 | | | | |
| 2 x log-likelihood: -926.95 | | | | |

Table 8: Fitted Negative Binomial Regression with GLM of Male Model

Displayed above are regression coefficients against standard errors and p-values. All of the coefficients are statistically significant. These coefficients cannot be substitute directly into:

$$\text{Death Count} = \text{poly(Age, 3)} + \text{poly(Year,2)}$$

Since R uses the simulated polynomials which is orthogonal, meaning that the data used in the variables are different from the original data.

Below are figures showing the comparison of the fitted model and the observed data.
(All of these figures, the black line shows the observed data, and the red line shows the fit values.)

Female: dx $\sim$ poly(Age,3)+poly(Year,2) + log(exposure)

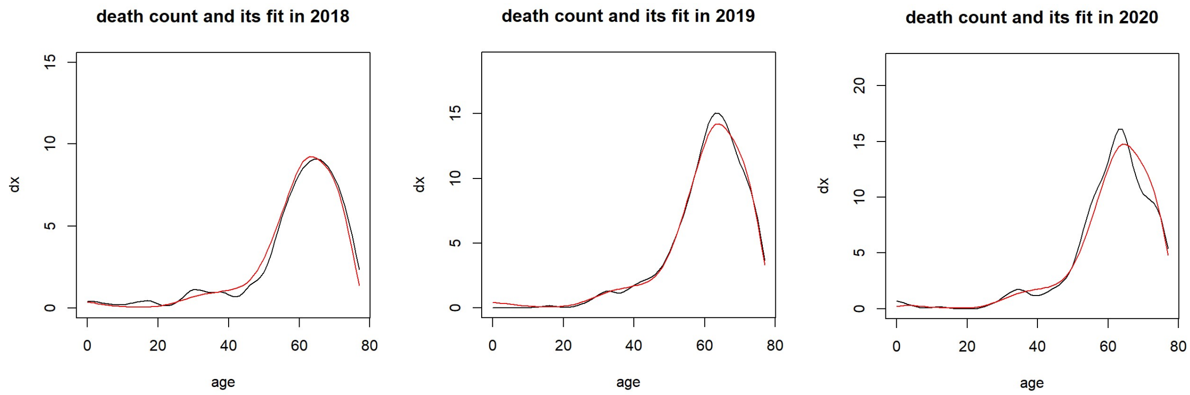



Figure 17: Female deaths in Ghana from 2018 to 2020 and the model fit values.

Male: dx $\sim$ poly(Age,4)+poly(Year,1) + log(exposure)

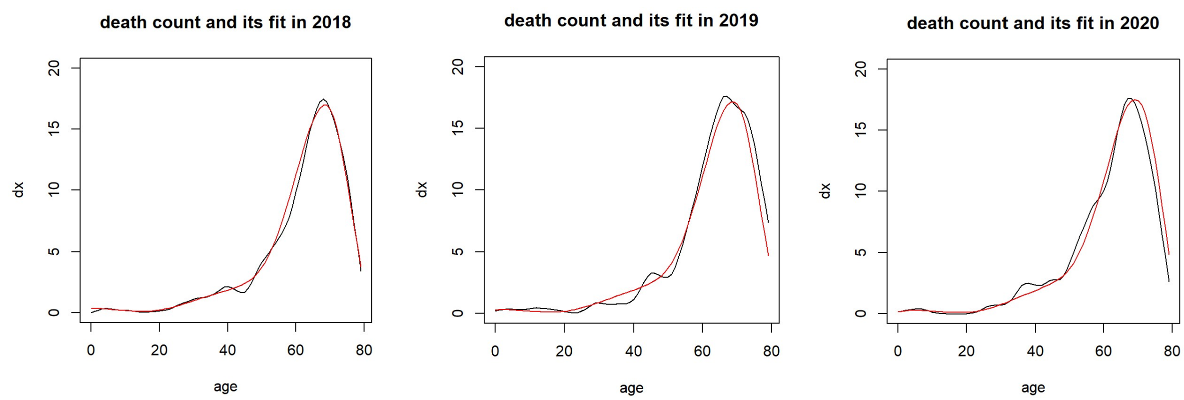



Figure 18: Male deaths in Ghana from 2018 to 2020 and the model fit values.

Total: dx $\sim$ poly(Age,4)+poly(Year,2) + log(exposure)

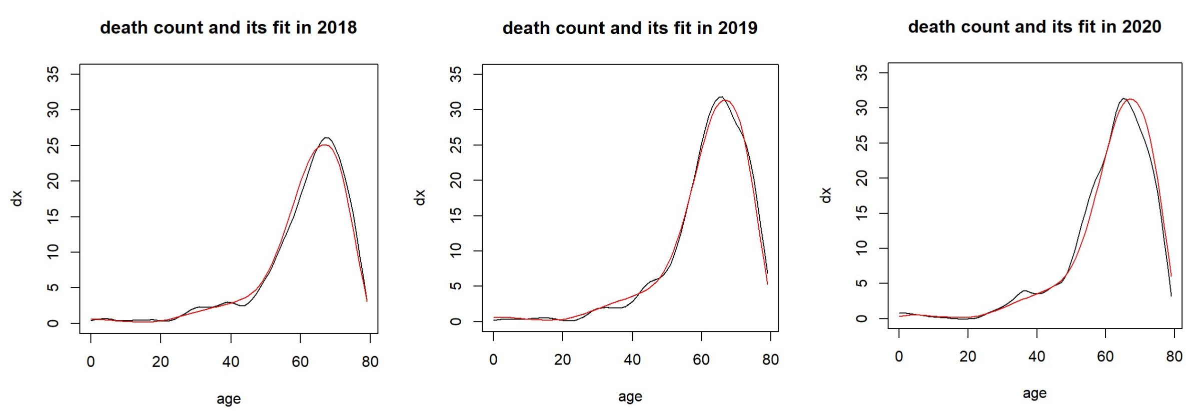



Figure 19: Total deaths in Ghana from 2018 to 2020 and the model fit values.

All the fitted red lines follow the observed values well. Although the exuberant overlap of fitted and observed lines may due to some overfitting issues, the likelihood ratio test already ensures that these models are not overfitted and the excellent fit is reasonable.

### 3.2.5 Modeling of Exposure

Similarly, we can construct all the fitted exposure models:

**Fitted Negative Binomial Regression Model for death count**

| | | | | |
|---|---|---|---|---|
| Call: | | | | |
| glm.nb(formula = dx ∼poly(Age, 10) + poly(Year, 1) + log(Exposure), | | | | |
| data = FemaleMortality, link = log, init.theta = 21.51466624) | | | | |
| Deviance Residuals: | | | | |
| Min | 1Q | Median | 3Q | Max |
| -2.1813 | -0.8591 | -0.3615 | 0.4719 | 3.6182 |
| Coefficients: | | | | |
| | Estimate | Std. Error | z value | Pr(>—z—) |
| (Intercept) | 6.74582 | 0.01436 | 469.617 | <2e-16 *** |
| poly(Age, 10)1 | 3.45966 | 0.22196 | 15.587 | <2e-16 *** |
| poly(Age, 10)2 | -9.76409 | 0.22136 | -44.110 | <2e-16 *** |
| poly(Age, 10)3 | -3.99631 | 0.22238 | -17.970 | <2e-16 *** |
| poly(Age, 10)4 | 2.28768 | 0.22303 | 10.257 | <2e-16 *** |
| poly(Age, 10)5 | -4.28564 | 0.22235 | -19.275 | <2e-16 *** |
| poly(Age, 10)6 | -2.83808 | 0.22214 | -12.776 | <2e-16 *** |
| poly(Age, 10)7 | 4.62734 | 0.22228 | 20.818 | <2e-16 *** |
| poly(Age, 10)8 | -1.90433 | 0.22195 | -8.580 | <2e-16 *** |
| poly(Age, 10)9 | -2.26861 | 0.22167 | -10.234 | <2e-16 *** |
| poly(Age, 10)10 | 0.45409 | 0.22158 | 2.049 | 0.0404 * |
| poly(Year, 1)1 | -2.29198 | 0.21961 | -10.437 | <2e-16 *** |
| — | | | | |
| Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1 | | | | |
| Null deviance: 3635.07 on 233 degrees of freedom | | | | |
| Residual deviance: 248.09 on 222 degrees of freedom | | | | |
| AIC: 3142.1 | | | | |
| Number of Fisher Scoring iterations: 1 | | | | |
| 2 x log-likelihood: -3116.101 | | | | |

Table 9: Fitted Negative Binomial Regression with GLM of Female Exposure Model

| | | | | |
|---|---|---|---|---|
| Call: | | | | |
| glm.nb(formula = dx ∼poly(Age, 10) + poly(Year, 1) + log(Exposure), data = MaleMortality, link = log, init.theta = 23.7371402) | | | | |
| Deviance Residuals: | | | | |
| Min | 1Q | Median | 3Q | Max |
| -7.6084 | -0.5519 | 0.0225 | 0.5164 | 2.5260 |
| Coefficients: | | | | |
| | Estimate | Std. Error | z value | Pr(>—z—) |
| (Intercept) | 6.83198 | 0.01352 | 505.430 | <2e-16 *** |
| poly(Age, 10)1 | 2.17189 | 0.21182 | 10.254 | <2e-16 *** |
| poly(Age, 10)2 | -12.05922 | 0.21092 | -57.174 | <2e-16 *** |
| poly(Age, 10)3 | -3.64765 | 0.21178 | -17.224 | <2e-16 *** |
| poly(Age, 10)4 | 4.46947 | 0.21221 | 21.062 | <2e-16 *** |
| poly(Age, 10)5 | -3.61470 | 0.21146 | -17.094 | <2e-16 *** |
| poly(Age, 10)6 | -3.60740 | 0.21127 | -17.074 | <2e-16 *** |
| poly(Age, 10)7 | 4.09473 | 0.21146 | 19.364 | <2e-16 *** |
| poly(Age, 10)8 | -1.09219 | 0.21127 | -5.170 | 2.35e-07 *** |
| poly(Age, 10)9 | -1.07036 | 0.21107 | -5.071 | 3.96e-07 *** |
| poly(Age, 10)10 | 0.87536 | 0.21107 | 4.147 | 3.36e-05 *** |
| poly(Year, 1)1 | -2.53276 | 0.20929 | -12.102 | <2e-16 *** |
| — | | | | |
| Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 | | | | |
| Null deviance: 5106.08 on 239 degrees of freedom | | | | |
| Residual deviance: 254.55 on 228 degrees of freedom | | | | |
| AIC: 3241.2 | | | | |
| Number of Fisher Scoring iterations: 1 | | | | |
| 2 x log-likelihood: -3215.224 | | | | |

Table 10: Fitted Negative Binomial Regression with GLM of Male Exposure Model

| | | | | |
|---|---|---|---|---|
| Call: | | | | |
| glm.nb(formula = dx ∼poly(Age, 10) + poly(Year, 1) + log(Exposure), data = TotalMortality, link = log, init.theta = 21.43046644) | | | | |
| Deviance Residuals: | | | | |
| Min | 1Q | Median | 3Q | Max |
| -7.6190 | -0.5267 | 0.0221 | 0.4596 | 2.5195 |
| Coefficients: | | | | |
| | Estimate | Std. Error | z value | Pr(>—z—) |
| (Intercept) | 7.45784 | 0.01409 | 529.443 | <2e-16 *** |
| poly(Age, 10)1 | 1.90754 | 0.21970 | 8.682 | <2e-16 *** |
| poly(Age, 10)2 | -11.96058 | 0.21951 | -54.488 | <2e-16 *** |
| poly(Age, 10)3 | -4.36712 | 0.22001 | -19.850 | <2e-16 *** |
| poly(Age, 10)4 | 3.01546 | 0.22028 | 13.689 | <2e-16 *** |
| poly(Age, 10)5 | -4.23537 | 0.21989 | -19.261 | <2e-16 *** |
| poly(Age, 10)6 | -3.12804 | 0.21974 | -14.235 | <2e-16 *** |
| poly(Age, 10)7 | 4.31242 | 0.21980 | 19.620 | <2e-16 *** |
| poly(Age, 10)8 | -1.67986 | 0.21966 | -7.648 | 2.05e-14 *** |
| poly(Age, 10)9 | -1.43650 | 0.21952 | -6.544 | 5.99e-11 *** |
| poly(Age, 10)10 | 0.95201 | 0.21947 | 4.338 | 1.44e-05 *** |
| poly(Year, 1)1 | -2.36720 | 0.21818 | -10.850 | <2e-16 *** |
| — | | | | |
| Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 | | | | |
| Null deviance: 4394.65 on 239 degrees of freedom | | | | |
| Residual deviance: 249.66 on 228 degrees of freedom | | | | |
| AIC: 3556 | | | | |
| Number of Fisher Scoring iterations: 1 | | | | |
| 2 x log-likelihood: -3529.994 | | | | |

Table 11: Fitted Negative Binomial Regression with GLM of Total Exposure Model

Below are figures showing the comparison of the fitted model and the observed data.

(All of these figures, the black line shows the observed data, and the red line shows the fit values.)

Female: ex $\sim$ poly(Age,10)+poly(Year,1)

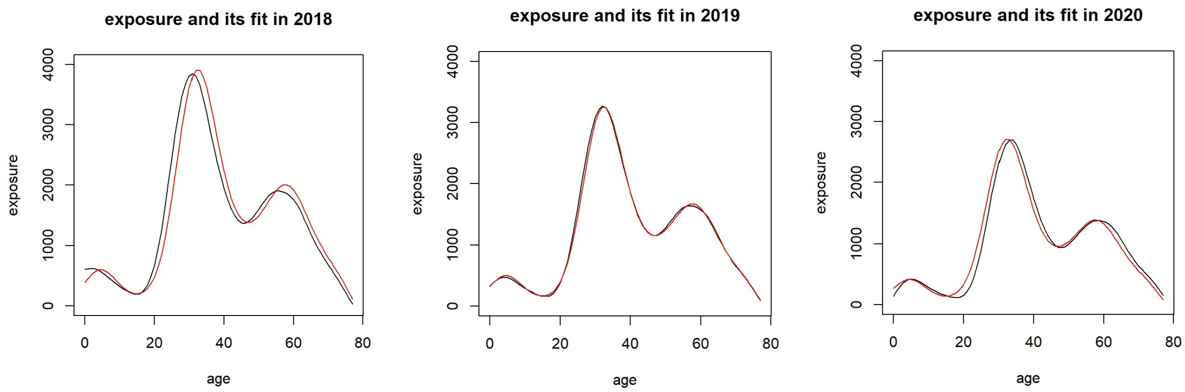



Figure 20: Female exposure in Ghana from 2018 to 2020 and the model fit values.

Male: ex $\sim$ poly(Age,10)+poly(Year,1)

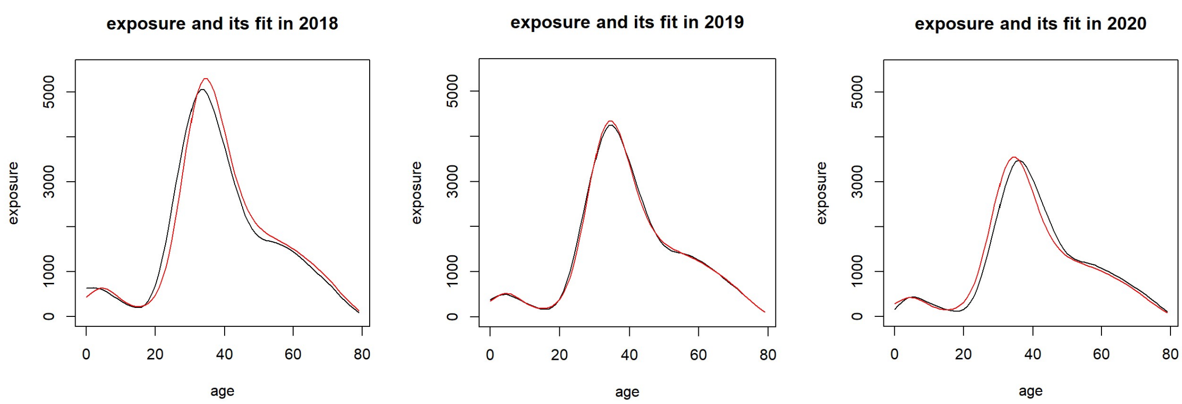



Figure 21: Male exposure in Ghana from 2018 to 2020 and the model fit values.

Total: ex $\sim$ poly(Age,10)+poly(Year,1)

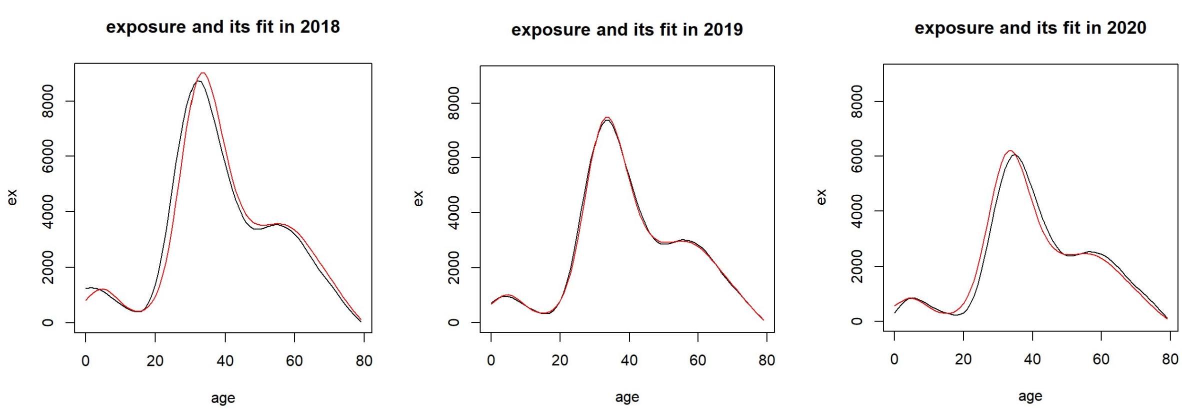



Figure 22: Total exposure in Ghana from 2018 to 2020 and the model fit values.

### 3.3 Fitted Mortality Rate

After modelling those variables, i.e., death count and exposure, separately, we can derive the fitted mortality rate by dividing the death count by the exposure. The complete 3D-plot will be shown at the process of modelling assessment. Displayed below are the example plots of log mortality rate versus the age for female and year from 2018 to 2020. The other plots follow the same pattern with the female plot. The blue points and the corresponding smoothed spline represent the observed mortality rate and the black ones represent the fitted mortality rate.

Similarly as the 3D log observed mortality rate, we add 0.001 to the mortality rate to deal with the zeros in the observed data. We can conclude from the plot that the fitted models fit well to the observed data. Most segments of the fitted spline approximately coincide with the observed one. If we analyse the pattern, the mortality rate declines mildly at the start, from age 0 to around 5, and the gradient becomes much less steep. At around age 25, the log mortality rate increases consistently and linearly, meaning that the mortality rate increases exponentially and at around age 78, the gradient becomes extremely steep.

In this chapter we do not consider the forecasting process. This is moved to the section 3.3, after analysing some problems of the model in order to simplify and format the forecasted data better.

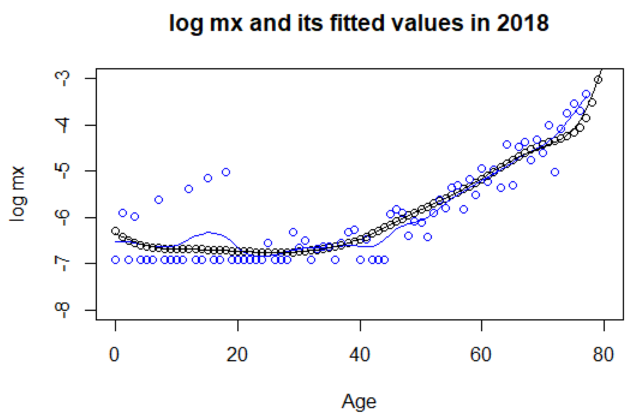



Figure 23: Fitted mortality rate for female in 2018

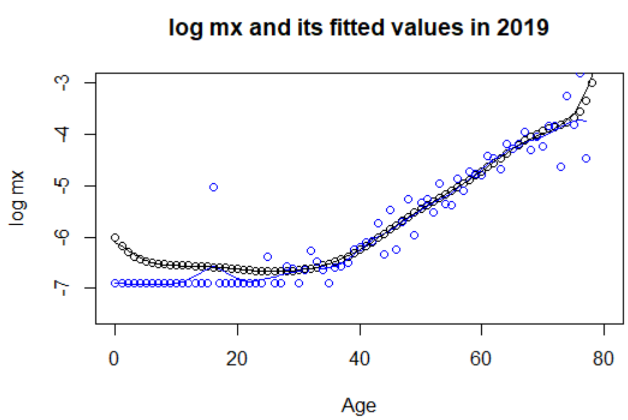



Figure 24: Fitted mortality rate for female in 2019

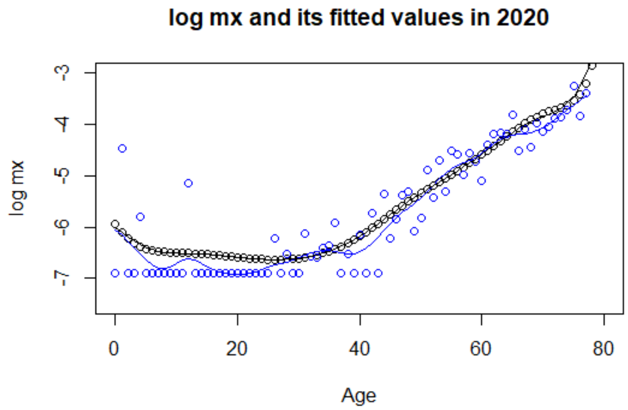



Figure 25: Fitted mortality rate for female in 2020

# 4 Model Assessment

## 4.1 Residual Analysis

Residuals, where $\epsilon_i = y_i - \hat{y}_i$, are commonly used for analysing the goodness of fit for general linear models. Models fit well when the residuals are normally distributed. However, for generalized linear models, the assumptions are not the same as general linear models, which means that the original definition of residuals are not suitable for the analysis of our negative binomial model. Below are some generalized residual forms that used in the Negative Binomial Regression Model assessment.

### 4.1.1 Deviance Residual

Deviance Residual is derived based on the comparison of fitted model and saturated model. The **saturated model** is defined as the perfect fitted model that making every prediction equal to the observed value. From (6) we can see that the log-likelihood function for exponential family:

$$\ell(y;\theta,\phi) = \ln \sum_{i=1}^{n} c(y_i,\phi) \exp\left(\frac{y_i\theta_i - a(\theta_i)}{\phi}\right) = \sum_{i=1}^{n}\left[\ln c(y_i,\phi) + \frac{y_i\theta_i - a(\theta_i)}{\phi}\right]$$

Therefore, to make every estimator saturated:

$$\frac{\partial l}{\partial \check{\theta}_i} = \frac{y_i - \dot{a}(\check{\theta}_i)}{\phi} = \frac{y_i - \mu_i}{\phi} = 0$$

where $\dot{a}(\check{\theta}_i) = \mu_i$, the expectation for each observation. Thus, the maximum likelihood estimator for the saturated model is $\check{\theta}_i$ defined as above. The saturated log-likelihood is:

$$\check{\ell}(y;\theta,\phi) = \sum_{i=1}^{n}\left[\ln c(y_i,\phi) + \frac{y_i\check{\theta}_i - a(\check{\theta}_i)}{\phi}\right]$$

If we denote the log-likelihood of our fitted model as $\hat{l}$, the deviance can be calculated as:

$$\Delta \equiv 2\left(\check{l} - \hat{l}\right) \tag{8}$$

As a direct intuition, if the model provides a good fit then the log-likelihood of the model should be close to the saturated one, resulting that the absolute value of deviance should relatively be small. For exponential family, the deviance:

$$\Delta = 2\sum_{i=1}^{n}\left[\frac{y_i(\check{\theta}_i - \hat{\theta}_i) - a(\check{\theta}_i) + a(\hat{\theta}_i)}{\phi}\right]$$

Specifically, as provided by [4], for Negative Binomial Model:

$$\Delta = 2\sum_{i=1}^{n}\left[y_i \ln\left(\frac{y_i}{\hat{\mu}_i}\right) - \left(y_i + \frac{1}{\kappa}\right)\ln\left(\frac{y_i + \frac{1}{\kappa}}{\hat{\mu}_i + \frac{1}{\kappa}}\right)\right] \tag{9}$$

This is called the **Residual Deviance** and is shown at the output of modelling procedure in R. What is illustrated simultaneously with this data is the **Null Deviance** $\Delta_N$, calculated by the same formula with (8), substituting the saturated log-likelihood with the log-likelihood of the model with only intercept term.

```
(Dispersion parameter for Negative Binomial(21.5147) family taken to be 1)

    Null deviance: 3635.07  on 233  degrees of freedom
Residual deviance:  248.09  on 222  degrees of freedom
AIC: 3142.1

Number of Fisher Scoring iterations: 1


              Theta:  21.51
          Std. Err.:  2.15

 2 x log-likelihood:  -3116.101
```

Figure 26: Null Deviance & Residual Deviance in R output (Female Exposure Model as example)

[14] stated that we can compare the value of null deviance and residual deviance to analysis the goodness of fit by the test statistics:

$$\mathbf{X}^2 = \Delta_N - \Delta, \qquad \text{where} \quad \mathbf{X}^2 \sim \chi^2_p$$

where $p = r - n$ (r is the df of residual deviance and n is the df of null deviance) is the difference of degree of freedom between null and residual deviance, indicating the number of explanatory variables. If the p-value for this test statistics is significantly small, the model provides a good fit. R codes are shown in the Appendix A and the results are concluded in the Table below:

| Model | Null & df | Residual & df | test stat & df | p-value |
|---|---|---|---|---|
| Female dx | 1410.88 (233 df) | 200.52 (227 df) | 1210.36 (6 df) | 0.000000 |
| Female Exposure | 3635.07 (233 df) | 248.09 (222 df) | 3386.98 (11 df) | 0.000000 |
| Male dx | 1795.51 (239 df) | 239.04 (233 df) | 1556.47 (6 df) | 0.000000 |
| Male Exposure | 5106.08 (239 df) | 254.55 (228 df) | 4851.53 (11 df) | 0.000000 |
| Total dx | 2726.1 (239 df) | 243.2 (232 df) | 2482.9 (7 df) | 0.000000 |
| Total Exposure | 4394.65 (239 df) | 249.66 (228 df) | 4144.99 (11 df) | 0.000000 |

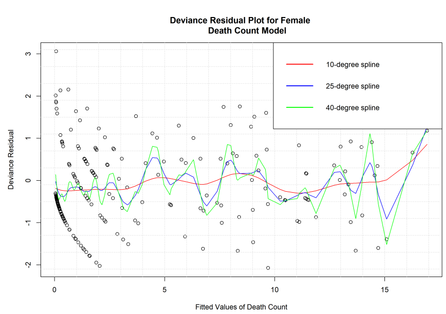
Table 12: $\chi^2$-test for Null and Residual Deviance

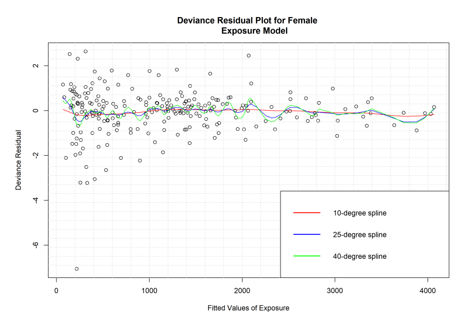
All the p-values illustrated are strongly significant, meaning that all the models give decent goodness of fit.

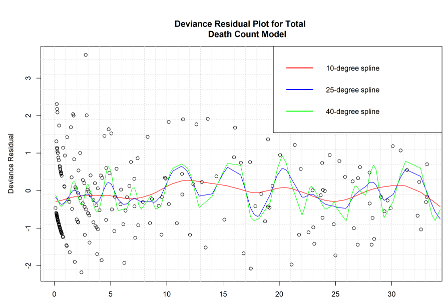
Barring the Residual Deviance Analysis, we can also analysis the deviance individually. For each observation, we have the deviance:

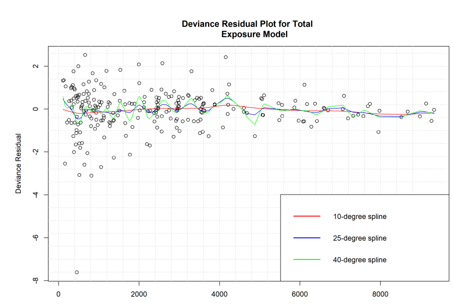
$$\delta_i^2 = 2\left[y_i \ln\left(\frac{y_i}{\hat{\mu}_i}\right) - \left(y_i + \frac{1}{\kappa}\right)\ln\left(\frac{y_i + \frac{1}{\kappa}}{\hat{\mu}_i + \frac{1}{\kappa}}\right)\right]$$

the square root of which, i.e., $\delta_i$, is called the **Deviance Residuals**. The sign is given by the sign of $y_i - \hat{\mu}_i$. The distribution of deviance residuals is skewed for GLM [6]. Thus, we need other criterion for analysing this residual.
As mentioned above, $\delta_i \sim \chi^2_{r-n}$. Remember that: $\mathbb{E}[X] = r - n$ for $X \sim \chi^2_{r-n}$. Therefore, for large $r$, we expect that every single value of residual deviance, contributes approximately $\frac{r-n}{n} \approx 1$ to the deviance residual. Thus one criterion for this residual is that $\delta_i$ is not much greater than 1 or less than -1 [4], otherwise the observation contributes too much to the model, which due to a lack of fit. The residual also cannot show any manifest pattern. These two requisites can be shown by the Fitted Value VS Residual plot shown below.



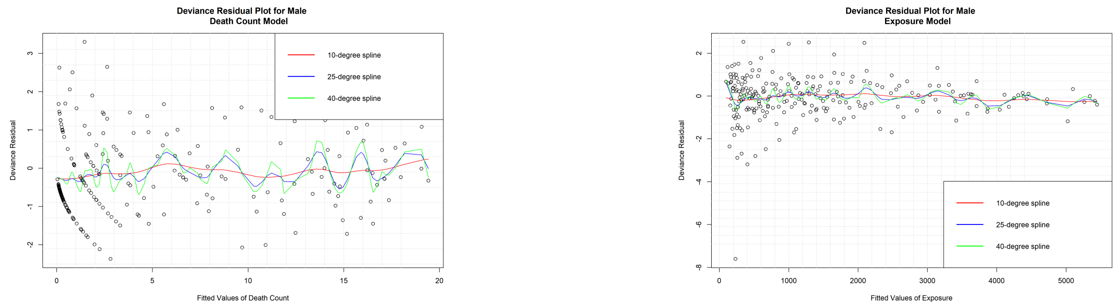



Figure 3: Plot and splines of fitted values VS deviance residuals (Row1: Female Data Row2: Male Data Row3: Total Data, dx plot on the left and Exposure model on the right)

There are three splines shown in the figure. We choose the 25-degree (blue) one to analysis since the 40-degree (green) one may due to some overfitting.

As shown in the figure, for death count deviance residuals, the death count residual figure shows some inverse function pattern at the lower tail intuitively. This may due to lack of data for age 0-10. However, the splines shows that there are no clear pattern for the residuals. No residuals are much greater than 3, meaning that the deviance residual behaves well generally.

For Exposure deviance residuals, The splines also indicate that there are no clear pattern. However, apparently there is one single observation that contributes too much to the modelling process. This one observation, nevertheless, makes small difference on the basis of over 200 observations.

In conclusion, the residual deviance and the deviance residual behaves well generally, with some minor discrepancies with the criterion for deviance residuals of exposure.

### 4.1.2 Anscombe Residual

As illustrated above, we cannot analysis residual deviance through normality test. There are two substitutions for this residuals, which simulate residuals in standardized spaces in order to make them approximately normally distributed. In this section we will analyze the so called Anscombe Residuals.

The Anscombe Residual is calculated as:

$$A(y_i) = \frac{h(y_i) - h(\hat{y}_i)}{\dot{h}(\hat{y}_i)\sqrt{V(\hat{y}_i)}}$$

where $\dot{h}(y) = V(y)^{-\frac{1}{3}}$ so that $h(y)$ is approximately normally distributed. $V(\mu)$ is the variance function of the response distribution. [4] mentioned that the approximate normality of Anscombe residual can be checked through the quantile-quantile plot (QQ-plot). Below are examples of QQ-plots of Female dx and Exposure model. The remaining QQ-plot follows the similar pattern and are not illustrated for avoiding repetition.

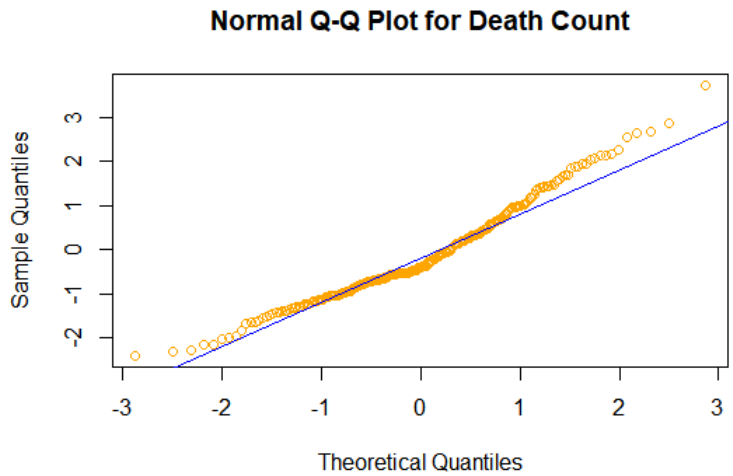



Figure 27: Q-Q Plot for Female Death Count Model

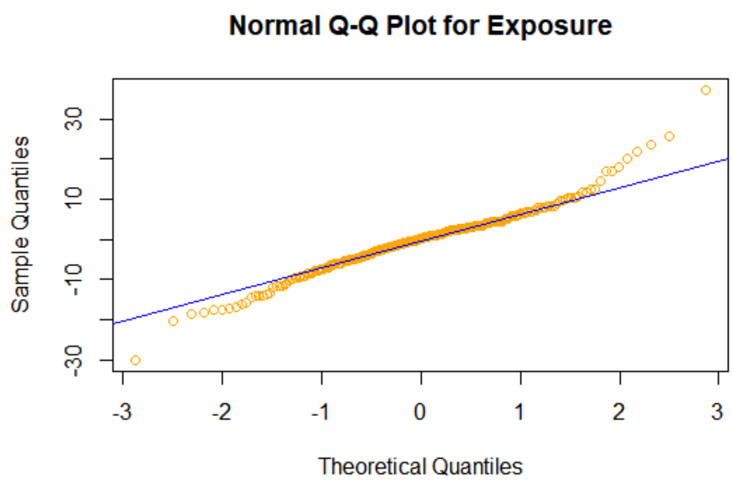



Figure 28: Q-Q Plot for Female Exposure Model

The Quantile-Quantile residual plots both approximately follow the straight line, with some minor deviation at both tails, which indicates that our model fits well, but the negative binomial model does not completely capture the historical trend of death count and exposure.

However, this graphical consilience does not make the Anscombe Residual successfully pass the formal Anderson-Darling Normality Test. As we can see in Table 13, the p-values are significantly small, illustrating the strong non-normality of both residuals, which is discrepant with the intuitive graphical analysis.

| Anderson-Darling Test for Anscombe Residuals | | |
|---|---|---|
| Model | Test Statistics | p-value |
| Female dx | 2.8977 | 2.644e-07 |
| Female Exposure | 1.9973 | 4.229e-05 |
| Male dx | 4.0666 | 3.816e-10 |
| Male Exposure | 1.8546 | 9.484e-05 |
| Total dx | 2.7932 | 4.764e-07 |
| Total Exposure | 1.827 | 0.0001109 |

Table 13: Anderson-Darling Test for Anscombe Residuals (ansresdx: Residual for Death Count model, ansresex: Residual for Exposure model)

This discrepancy can be shown by the histogram of Anscombe Residual. As shown in Figure below, the Anscombe Residuals are apparently right-skewed marginally, leading to the non-normality result of Anderson-Darling Test.

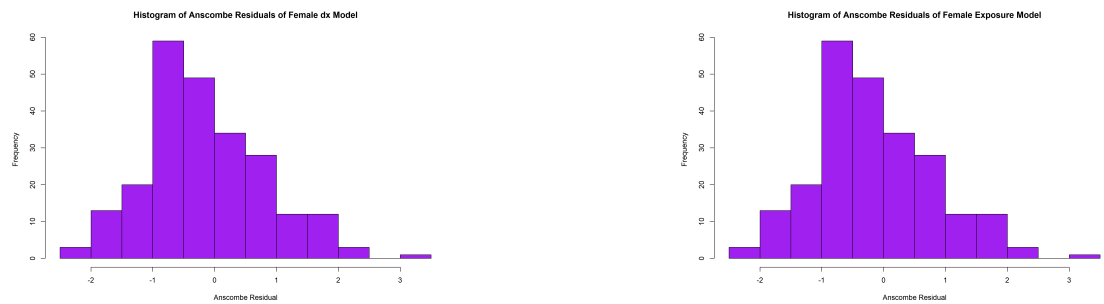



Figure 29: Histogram for the Anscombe Residuals (Female Data Examples)

### 4.1.3 Simulated Residual: DHARMa Package

The bad behaviour, i.e., the marginal non-normality of Anscombe Residual is explained by [11], that Anscombe Residual and Deviance residual are numerically similar, which leads to the similar distribution of Anscombe Residual and Deviance Residual. Even the best-fitted regression model for count data has non-normal Deviance Residual [9]. This problem leads us to find another substitution for Deviance and Anscombe Residual to process the residual normality test.

Recently [8] provides well-behaved standardized residuals for hierarchical (multi-level/mixed) regression models, where the Negative Binomial Regression Model falls into this category. Hartig provides a powerful R package called the DHARMa package, which can generate analytical graphs for this kind of simulated residual. In this section, we will focus on these R packages and the generated figures for the final diagnostics of residual.

Now we focus on the Death Count Model. The R command in DHARMa Package `simulateResiduals()` provides a graphical visualization of the information of this residual, including the Q-Q Plot, the fitted values VS residuals plot, its quantile splines, etc. Below are sequentially the DHARMa residual plots for female, male and Total data.

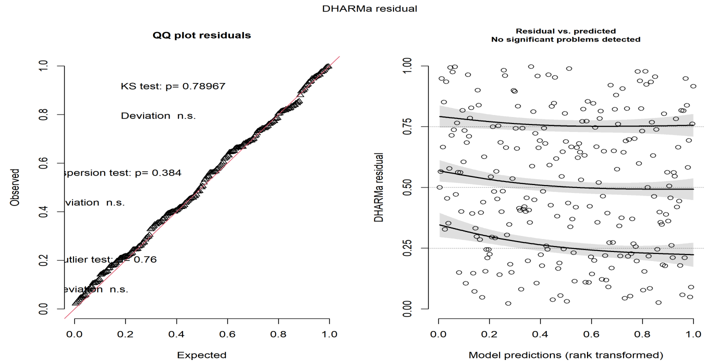



Figure 30: DHARMa Residual Plot for Female dx Model

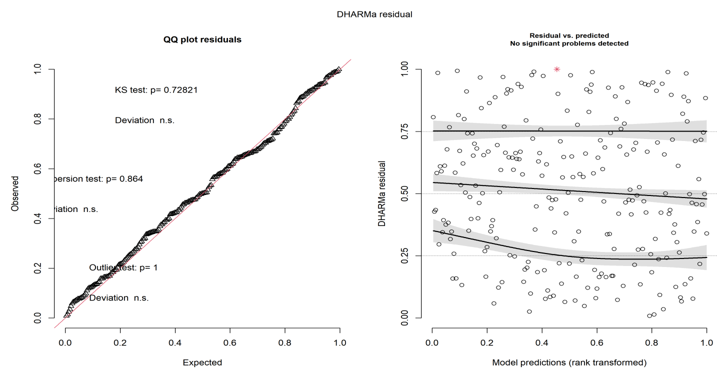



Figure 31: DHARMa Residual Plot for Male dx Model

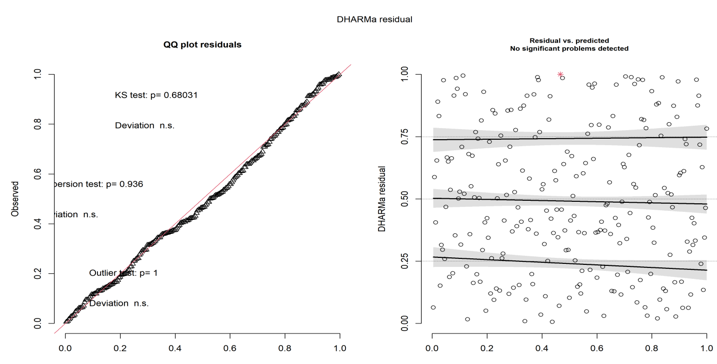



Figure 32: DHARMa Residual Plot for Total dx Model

Now the residuals suit much better to the normal pattern compared with the Anscombe Residual Plots, which can be seen through the figures at left. From the right figures, the DHARMa residuals are randomly distributed throughout the space and the three smoothed quantile lines show no manifest pattern and they all go straight approximately.

However, for the Exposure models, there are some inconsistencies detected by the DHARMa residuals. Shown below are the corresponding three DHARMa residual plots for three exposure models.

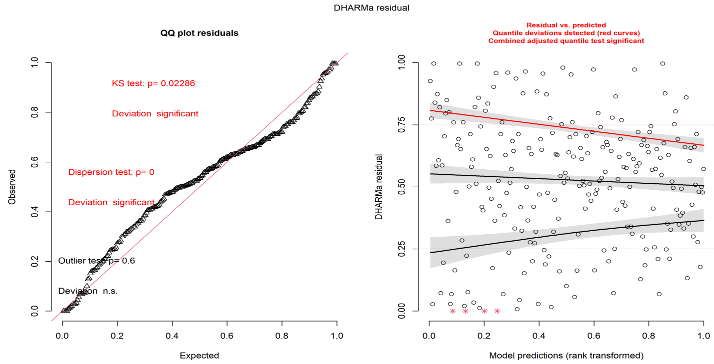



Figure 33: DHARMa Residual Plot for Female Exposure Model

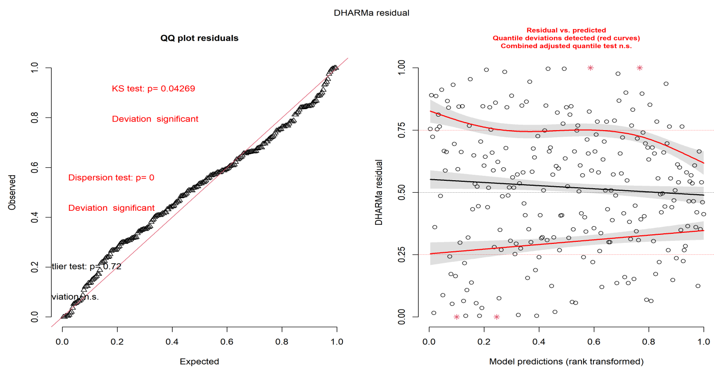



Figure 34: DHARMa Residual Plot for Male Exposure Model

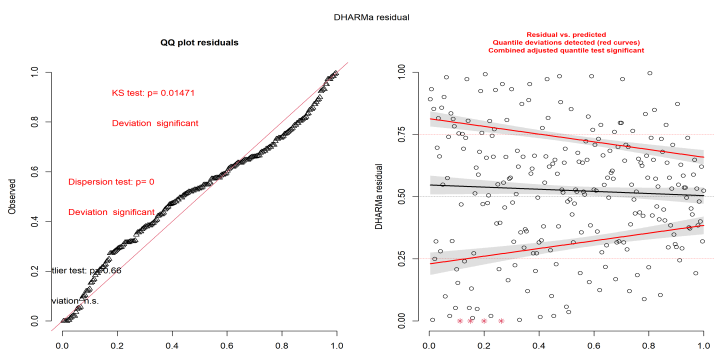



Figure 35: DHARMa Residual Plot for Total Exposure Model

From the left Q-Q Plots, the DHARMa residuals accumulate more around 0.4-0.6 than the lower and upper tails, indicating some underdispersion of the residuals, which illustrates that the Negative Binomial Regression Model may not capture the historical trace of Exposure decently. From the left figures, i.e., the residual plots, the 3 quantile lines converge with the increase of exposure, meaning that some heteroskedasticity appears in the residual pattern. Both indicate that some assumptions of the negative binomial model may be violated for the three Exposure Models.

Furthermore, DHARMa Package provides a rigorous way to go through the residual non-parametric dispersion test by the R command `testDispersion()`. Below are three graphs generated by this R dispersion test command, for the models belonging to three datasets.

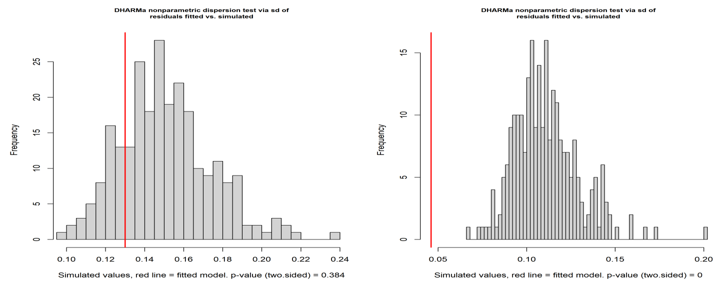



Figure 36: DHARMa Dispersion Test for Female dx (left) and Exposure (right) Models

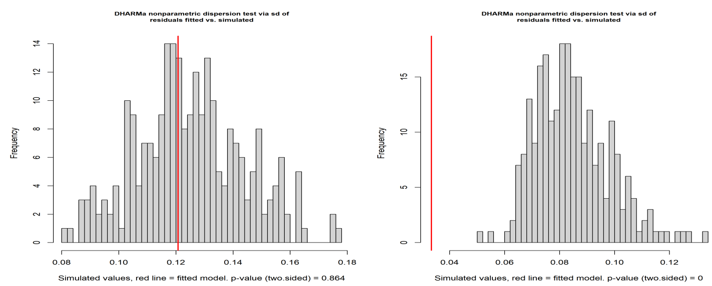



Figure 37: DHARMa Dispersion Test for Male dx (left) and Exposure (right) Models

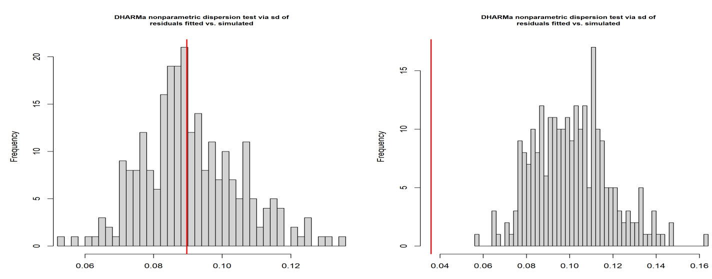



Figure 38: DHARMa Dispersion Test for Total dx (left) and Exposure (right) Models

Indeed, the DHARMa Residuals for the exposure models face the problem of underdispersion for the fitted variance line falls below the histogram of residuals, meaning that the variance is significantly small than the mean of the residual. Barring from that, the dx models pass through the dispersion test successfully and the simulated variance lines falls into the histograms.

Two ways for avoiding this problem of the exposure model were considered by us:

- Increase or decrease the power of the polynomial used in the exposure model to cater for the decent DHARMa residual pattern.
- Use the offset models, thus avoiding the models for exposures.

However, after trying the first methods, the pattern of the DHARMa residuals for exposure models is still discontented. Moreover, increasing or decreasing the power of our chosen model may be due to overfitting or underfitting, respectively, which escalates the inaccuracy of models.

Indeed, as long as the model gives a good fit, some minor heteroskedasticity in the residual pattern does not influence significantly to the inaccuracy or prediction of our model. Thus, in view of the non-offset models performing better on the value of AIC and BIC, it is preferred to choose the non-offset ones. Thus the second method: using the offset model, is also not in consideration.

### 4.2 Upper Tail Assessment

As mentioned in section 2.4, the raw data set is due to a significant lack of data at the lower tail and the upper tail. Since the mortality rate of the lower tail is small, the lack of data, which leads to the 0s in the mortality rate, does not affect much to the final result much. However, we have many 0 data or a small database around the upper tail, whilst the mortality rate around this age group is much greater than 0, this affects that the mortality rate begins to decrease at the lower tail drastically, which is not discrepant with the reality. Below is the example graph for the fitted mortality rate of females versus the age in 2018 (including the age group from 81 to 100 forecasted by the fitted model).

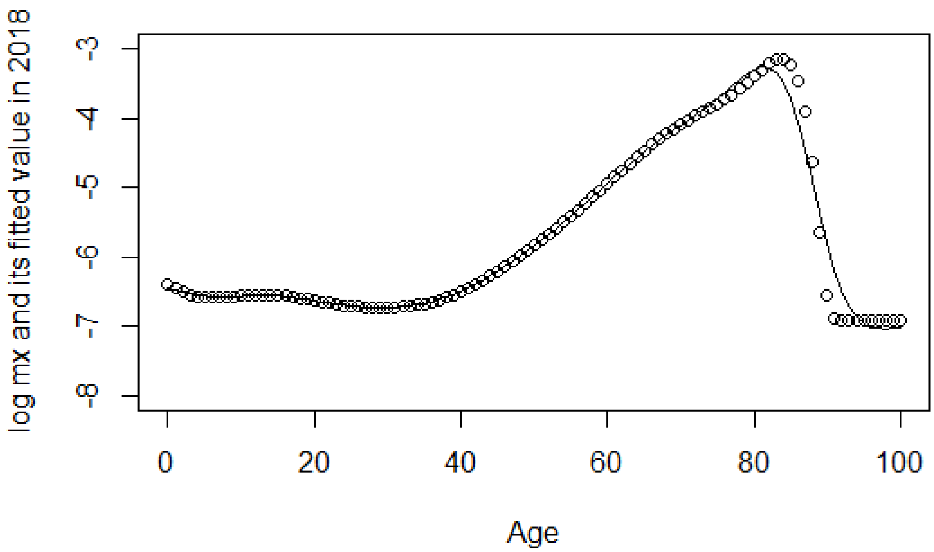



Figure 39: The drastic decline at the upper tail of age variable

As mentioned before, the fitted mortality rate is also added by 0.001 to avoid the zeros that made the value log(mortality rate) invalid. The plunging pattern forecasts that people who are alive to about 82 years old have a very small possibility to die afterwards. This is absolutely inconsistent with reality. This may be due to two reasons:

- Lack of data between the age group 70 to 80, leading to the decline of the further forecast of the age group mortality rate values.
- The innate character of the Negative Binomial Model. Since we use the model of age polynomial for 4, the curve should turn the direction (i.e., the gradient should turn from positive to negative (or vice versa) four times. If we analyse the pattern, before age 80, the curve changes the direction for 3 times, at around age 4, age 18 and age 38, respectively. The final change then happens in the forecasting area.

This problem cannot be effectively solved since we are not provided more data for the 80s to 100s. Therefore, the construction of the mortality table is constrained to halt at age 80. Due to this intractable problem, We only do the forecast in the year (from 2021 to 2025), but not in age.

### 4.3 Forcasting and assessment

Now we do the forecasting process formally, ranging from the year 2021 to 2025, and age 0 to 80. This process was done in R by the command "predict.glm". The complete R program is displayed in the Appendix below. The generated variables are all calculated by the model we constructed above. Suppose that for our model:

$$N = f(a) + g(b) + \log(c)$$

$$c = F(a) + G(b)$$

where a represents the age variable, and b represents the year variable. N is the death count and c is the exposure. Therefore, the first equation represents our death count model and the second equation is the exposure model. Then, the "predict.glm" function generate the forecasted mortality rate $N_{forecast}$ at the age i and year j by the formula:

$$N_{forecast} = \frac{N}{c} = \frac{f(a) + g(b) + \log(c)}{F(a) + G(b)} = \frac{f(a) + g(b) + \log(F(a) + G(b))}{F(a) + G(b)}$$

Below are the 3D plots for the fitted and forecasted mortality rate versus age and year for female, male, and combined sex data.

Fitted and Forecasted $m_x$ for females from 2018 to 2025

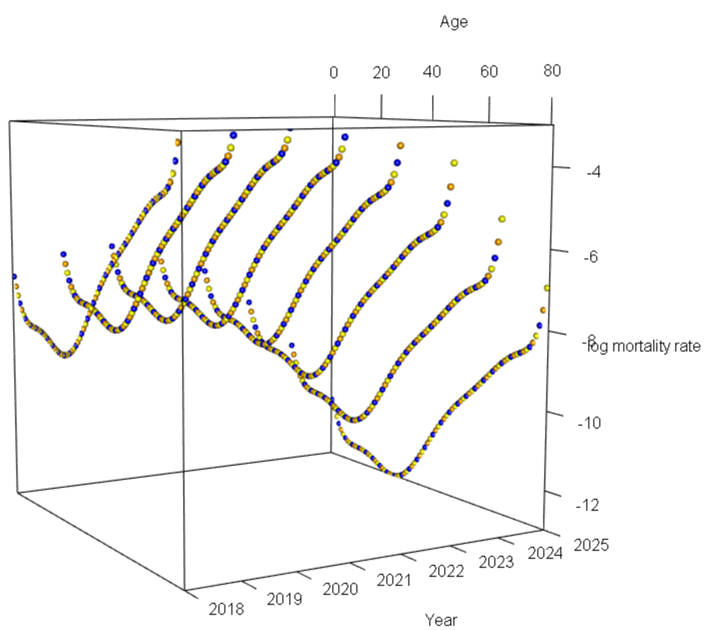



Figure 40: Fitted and forecasted mortality rate for female data

Fitted and Forecasted $m_x$ for males from 2018 to 2025

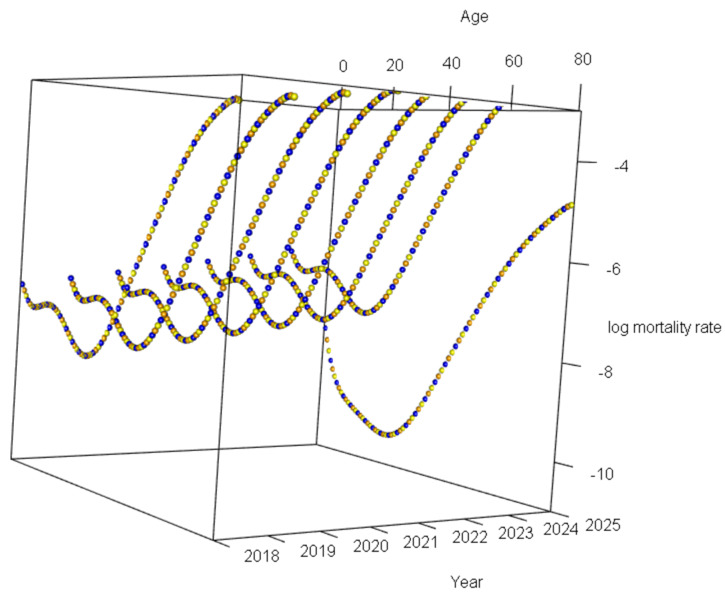



Figure 41: Fitted and forecasted mortality rate for male data

Fitted and Forecasted $m_x$ for combined sex data from 2018 to 2025

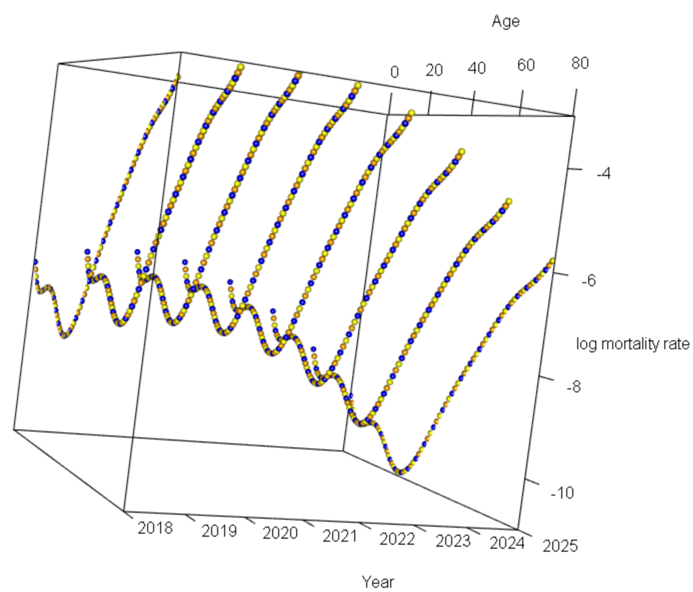



Figure 42: Fitted and forecasted mortality rate for combined sex data

Barring the male mortality rate plot, which increases steadily from 2018 to 2025 in almost all age intervals and an abrupt plummet in 2025, the other mortality rates experience a mild increase from 2018 to 2020, and a mild decrease from 2021 to 2022. Then, the mortality rate experiences a plunge similar to a quadratic pattern. This pattern leads to the that the prediction of the mortality rate after 2023 is significantly not consistent with reality, even leading to the result that only less than 1000 people died in 100000 people after 80 years of life (derived when constructing the mortality table, by the variable $l_x$). This may be due to some reasons:

- We only have 3 years observed data set, but our prediction has a time span of 5 years. The lack of data in the time span leads to the coefficient for the year is extremely large and the model is very sensitive to the small change in the year.
- The innate character discussed before, said that the mortality rate has only one gradient change during the time span from 2018 to 2025, meaning that the mortality rate will continuously decrease.

Therefore, due to this problem, we construct a reasonable prediction of the mortality table only spanning from 2021 to 2022, with the original fitted data from 2018 to 2020.

# 5 Construction of Mortality Table

After the data processing and the modelling process, we are ready to construct the final mortality table, which is the ultimate goal of our project. In this section, we are going to define all the parameters displayed in the mortality table and illustrate our final result.

## 5.1 Definition of Parameters

Except for the Age, Year and mortality rate, there is also many other important information stored in many extra variables proffered by the mortality table. Below is the table concluding all the variables and the definitions contained in the mortality table. These formulae are provided by [13] who provide the formulae of the mortality table in HMD (Human Mortality Database).

| Parameter | Formula | Definition |
|---|---|---|
| $m_x$ | $m_x = \frac{d_x}{E_x}$ | The life table death rates |
| $q_x$ | $q_x = \frac{m_x}{1+(1-a_x)m_x}$ | The probability of death |
| $d_x$ | $d_x = l_x q_x$ | The distribution of deaths by age in the life-table population |
| $L_x$ | $L_x = l_x - (1-a_x)d_x$ | The person-years lived by the life-table population in the age interval $[x, x+1)]$ |
| $a_x$ | $a_x = \frac{1}{2}$ for all single-year ages except age 0 | The estimated average age at death of those dying in the $x$th year of life |
| $p_x$ | $p_x = 1 - q_x$ | The probability of surviving from age $x$ to $x+1$ |
| $l_x$ | $l_x = l_0 \prod_{i=0}^{x-1} p_i$ | The number of survivors (out of 100,000) at ages $x > 0$ |
| $T_x$ | $T_x = \sum_{i=x}^{109} +_{\infty}L_x \ ({}_{\infty}L_x = l_{110}a_{110})$ | The person-years remaining for individuals of age $x$ for $x = 0, 1, .., 109$.. For the open age category,${}_{\infty}T_x =_{\infty} L_x$ |
| $e_x$ | ${}_{\circ}e_x = \frac{T_x}{l_x}$ | Remaining life expectancy at age $x$ |

Table 14: Parameters in Mortality Table

Firstly, the two most confusing variables in the mortality table are the mortality rate $m_x$, and the death rate $d_x$. The specific distinction is described as below:

- $m_x$: Known as the central mortality. The average number of deaths each year at age x last birthday in the relevant year period, divided by the average population at that age over the same period.
- $q_x$: The probability that a person exact age x will die within one year.

Secondly, as mentioned in the formula table above, $a_x = \frac{1}{2}$ for all single-year ages except age 0. Since for age 0, the possible death period is much accumulated around the time that the child was just born, which is different from other age period, when the death is happened uniformly during the one-year period. Therefore, we have alternative formulae for the age 0. [13] provides a empirical formulae for the calculation of $m_0$, which is shown as the table below:

Table 15: Andreev-Kingkade formulas for computing $a_0$ given $m_0$

| | $m_0$ range | Formula: $a_0 = a + bm_0$ |
|---|---|---|
| Males | | |
| | $[0, 0.02300)$ | $0.14929 - 1.99545m_0$ |
| | $[0.0230, 0.08307)$ | $0.02832 + 3.26021m_0$ |
| | $[0.08307, \infty)$ | $0.29915$ |
| Females | | |
| | $[0, 0.01724)$ | $0.14903 - 2.05527m_0$ |
| | $[0.01724, 0.06891)$ | $0.04667 + 3.88089m_0$ |
| | $[0.06891, \infty)$ | $0.31411$ |

For a Combined-sex life table, we compute a0 as follows: $a_0^T = \frac{a_0^F D_0^F + a_0^M D_0^M}{D_0^F + D_0^M}$ where the superscripts $F$, $M$, and $T$ denote values for the female, male, and total populations, respectively, and where $D_0^i$ refers to all deaths at age zero (both lower and upper triangles) for population $i$.

## 5.2 Result Table

With those parameter provided above, we can calculate all these variables in R and construct the final mortality table. The complete R code is provided in the Appendix.

## Table 16: Combined Sex Life Table in 2018

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|
| 2018 | 0 | 0.000671727 | 0.000671342 | 67.13421607 | 99942.77448 | 0.1475953 | 0.999328658 | 100000 | 7696624.613 | 76.96624613 |
| 2018 | 1 | 0.000575164 | 0.000574999 | 57.46128789 | 99904.13514 | 0.5 | 0.999425001 | 99932.86578 | 7596681.838 | 76.01785237 |
| 2018 | 2 | 0.000498049 | 0.000497925 | 49.73048443 | 99850.53925 | 0.5 | 0.999502075 | 99875.4045 | 7496777.703 | 75.06130004 |
| 2018 | 3 | 0.000442591 | 0.000442493 | 44.17213031 | 99803.58795 | 0.5 | 0.999557507 | 99825.67401 | 7396927.164 | 74.09844449 |
| 2018 | 4 | 0.000406283 | 0.000406201 | 40.53132159 | 99761.23622 | 0.5 | 0.999593799 | 99781.50188 | 7297123.576 | 73.13102568 |
| 2018 | 5 | 0.000385549 | 0.000385475 | 38.4476314 | 99721.74674 | 0.5 | 0.999614525 | 99740.97056 | 7197362.34 | 72.16054044 |
| 2018 | 6 | 0.00037703 | 0.000376959 | 37.58371994 | 99683.73107 | 0.5 | 0.999623041 | 99702.52293 | 7097640.593 | 71.18817443 |
| 2018 | 7 | 0.000377818 | 0.000377746 | 37.64804675 | 99646.11519 | 0.5 | 0.999622254 | 99664.93921 | 6997956.862 | 70.21483099 |
| 2018 | 8 | 0.000385319 | 0.000385245 | 38.38090565 | 99608.10071 | 0.5 | 0.999614755 | 99627.29116 | 6898310.747 | 69.24117545 |
| 2018 | 9 | 0.000397061 | 0.000396982 | 39.53499678 | 99569.14276 | 0.5 | 0.999603018 | 99588.91026 | 6798702.646 | 68.26766784 |
| 2018 | 10 | 0.000410572 | 0.000410488 | 40.86381821 | 99528.94335 | 0.5 | 0.999589512 | 99549.37526 | 6699133.503 | 67.29458107 |
| 2018 | 11 | 0.0004234 | 0.00042331 | 42.12293944 | 99487.44997 | 0.5 | 0.99957669 | 99508.51144 | 6599604.56 | 66.3220107 |
| 2018 | 12 | 0.000433246 | 0.000433153 | 43.08412898 | 99444.84644 | 0.5 | 0.999566847 | 99466.3885 | 6500117.11 | 65.34988561 |
| 2018 | 13 | 0.000438202 | 0.000438106 | 43.55797371 | 99401.52539 | 0.5 | 0.999561894 | 99423.30437 | 6400672.264 | 64.37798768 |
| 2018 | 14 | 0.000436979 | 0.000436884 | 43.41739914 | 99358.0377 | 0.5 | 0.999563116 | 99379.7464 | 6301270.738 | 63.40598529 |
| 2018 | 15 | 0.000429076 | 0.000428984 | 42.61373316 | 99315.02213 | 0.5 | 0.999571016 | 99336.329 | 6201912.701 | 62.43347991 |
| 2018 | 16 | 0.000414809 | 0.000414723 | 41.17936288 | 99273.12559 | 0.5 | 0.999585277 | 99293.71527 | 6102597.678 | 61.4600598 |
| 2018 | 17 | 0.000395189 | 0.000395111 | 39.21575768 | 99232.92802 | 0.5 | 0.999604889 | 99252.5359 | 6003324.553 | 60.48535182 |
| 2018 | 18 | 0.000371698 | 0.000371629 | 36.8705485 | 99194.88487 | 0.5 | 0.999628371 | 99213.32015 | 5904091.625 | 59.50906205 |
| 2018 | 19 | 0.000346012 | 0.000345952 | 34.31033693 | 99159.29443 | 0.5 | 0.999654048 | 99176.4496 | 5804896.74 | 58.53099968 |
| 2018 | 20 | 0.000319754 | 0.000319703 | 31.69602703 | 99126.29125 | 0.5 | 0.999680297 | 99142.13926 | 5705737.446 | 57.5510826 |
| 2018 | 21 | 0.000294314 | 0.000294271 | 29.16529486 | 99095.86059 | 0.5 | 0.999705729 | 99110.44323 | 5606611.154 | 56.56932783 |
| 2018 | 22 | 0.000270762 | 0.000270725 | 26.82376468 | 99067.86606 | 0.5 | 0.999729275 | 99081.27794 | 5507515.294 | 55.58583224 |
| 2018 | 23 | 0.000249832 | 0.000249801 | 24.74390042 | 99042.08222 | 0.5 | 0.999750199 | 99054.45417 | 5408447.428 | 54.60074938 |
| 2018 | 24 | 0.00023197 | 0.000231943 | 22.96923655 | 99018.22566 | 0.5 | 0.999768057 | 99029.71027 | 5309405.345 | 53.61426718 |
| 2018 | 25 | 0.000217396 | 0.000217373 | 21.52134597 | 98995.98036 | 0.5 | 0.999782627 | 99006.74104 | 5210387.12 | 52.62658952 |
| 2018 | 26 | 0.000206188 | 0.000206167 | 20.40745858 | 98975.01596 | 0.5 | 0.999793833 | 98985.21969 | 5111391.139 | 51.63792287 |
| 2018 | 27 | 0.000198347 | 0.000198327 | 19.62742526 | 98954.99852 | 0.5 | 0.999801673 | 98964.81223 | 5012416.123 | 50.64846798 |
| 2018 | 28 | 0.000193858 | 0.000193839 | 19.17943669 | 98935.59509 | 0.5 | 0.999806161 | 98945.18481 | 4913461.125 | 49.65841576 |
| 2018 | 29 | 0.000192732 | 0.000192714 | 19.06440471 | 98916.47317 | 0.5 | 0.999807286 | 98926.00537 | 4814525.53 | 48.66794643 |
| 2018 | 30 | 0.000195043 | 0.000195024 | 19.28918306 | 98897.29637 | 0.5 | 0.999804976 | 98906.94097 | 4715609.057 | 47.67723085 |
| 2018 | 31 | 0.000200944 | 0.000200924 | 19.86889592 | 98877.71733 | 0.5 | 0.999799076 | 98887.65178 | 4616711.76 | 46.68643331 |
| 2018 | 32 | 0.000210694 | 0.000210671 | 20.82862401 | 98857.36857 | 0.5 | 0.999789329 | 98867.78289 | 4517834.043 | 45.69571514 |
| 2018 | 33 | 0.000224662 | 0.000224636 | 22.20462176 | 98835.85195 | 0.5 | 0.999775364 | 98846.95426 | 4418976.674 | 44.70523859 |
| 2018 | 34 | 0.000243341 | 0.000243311 | 24.04514377 | 98812.72707 | 0.5 | 0.999756689 | 98824.74964 | 4320140.822 | 43.71517093 |
| 2018 | 35 | 0.00026735 | 0.000267315 | 26.41086613 | 98787.49906 | 0.5 | 0.999732685 | 98800.7045 | 4221328.095 | 42.72568821 |
| 2018 | 36 | 0.000297438 | 0.000297393 | 29.37481293 | 98759.60622 | 0.5 | 0.999702607 | 98774.29363 | 4122540.596 | 41.73697877 |
| 2018 | 37 | 0.00033447 | 0.000334414 | 33.02165501 | 98728.40799 | 0.5 | 0.999665586 | 98744.91882 | 4023780.99 | 40.74924602 |
| 2018 | 38 | 0.000379421 | 0.000379349 | 37.44624837 | 98693.17404 | 0.5 | 0.999620651 | 98711.89716 | 3925052.582 | 39.76271042 |
| 2018 | 39 | 0.00043335 | 0.000433256 | 42.75133743 | 98653.07525 | 0.5 | 0.999566744 | 98674.45091 | 3826359.408 | 38.77761034 |
| 2018 | 40 | 0.000497372 | 0.000497249 | 49.04446832 | 98607.17734 | 0.5 | 0.999502751 | 98631.69958 | 3727706.333 | 37.79420155 |
| 2018 | 41 | 0.000572621 | 0.000572457 | 56.43433481 | 98554.43794 | 0.5 | 0.999427543 | 98582.65511 | 3629099.155 | 36.81275526 |
| 2018 | 42 | 0.000660215 | 0.000659997 | 65.02698845 | 98493.70728 | 0.5 | 0.999340003 | 98526.22077 | 3530544.718 | 35.83355466 |
| 2018 | 43 | 0.000761224 | 0.000760935 | 74.92254066 | 98423.73252 | 0.5 | 0.999239065 | 98461.19379 | 3432051.01 | 34.85689009 |
| 2018 | 44 | 0.000876656 | 0.000876272 | 86.21311092 | 98343.16469 | 0.5 | 0.999123728 | 98386.27125 | 3333627.278 | 33.88305335 |
| 2018 | 45 | 0.001007452 | 0.001006945 | 98.98277399 | 98250.56675 | 0.5 | 0.998993055 | 98300.05813 | 3235284.113 | 32.91233163 |
| 2018 | 46 | 0.001154524 | 0.001153858 | 113.3100984 | 98144.42031 | 0.5 | 0.998846142 | 98201.07536 | 3137033.546 | 31.94500197 |
| 2018 | 47 | 0.001318807 | 0.001317938 | 129.2735495 | 98023.12849 | 0.5 | 0.998682062 | 98087.76526 | 3038889.126 | 30.98132696 |
| 2018 | 48 | 0.001501349 | 0.001500223 | 146.9596049 | 97885.01191 | 0.5 | 0.998499777 | 97958.49171 | 2940865.998 | 30.02155246 |
| 2018 | 49 | 0.001703427 | 0.001701977 | 166.4729731 | 97728.29562 | 0.5 | 0.998298023 | 97811.53211 | 2842980.986 | 29.06590792 |
| 2018 | 50 | 0.001926661 | 0.001924807 | 187.9479106 | 97551.08518 | 0.5 | 0.998075193 | 97645.05913 | 2745252.69 | 28.11460932 |
| 2018 | 51 | 0.002173153 | 0.002170794 | 211.5593553 | 97351.33155 | 0.5 | 0.997829206 | 97457.11122 | 2647701.605 | 27.16786463 |
| 2018 | 52 | 0.002445592 | 0.002442605 | 237.5324527 | 97126.78564 | 0.5 | 0.997557395 | 97245.55187 | 2550350.273 | 26.22588102 |
| 2018 | 53 | 0.002747346 | 0.002743577 | 266.1490143 | 96874.94491 | 0.5 | 0.997256423 | 97008.01942 | 2453223.488 | 25.28887305 |
| 2018 | 54 | 0.003082516 | 0.003077772 | 297.7494415 | 96592.99568 | 0.5 | 0.996922228 | 96741.8704 | 2356348.543 | 24.35707035 |
| 2018 | 55 | 0.003455924 | 0.003449963 | 332.7286167 | 96277.75665 | 0.5 | 0.996550037 | 96444.12096 | 2259755.547 | 23.43072366 |
| 2018 | 56 | 0.003873044 | 0.003865558 | 371.5241676 | 95925.63026 | 0.5 | 0.996134442 | 96111.39234 | 2163477.79 | 22.51010767 |
| 2018 | 57 | 0.004339833 | 0.004330436 | 414.5954079 | 95532.57047 | 0.5 | 0.995669564 | 95739.86818 | 2067552.16 | 21.59551919 |
| 2018 | 58 | 0.004862461 | 0.004850668 | 462.3912821 | 95094.07713 | 0.5 | 0.995149332 | 95325.27277 | 1972019.59 | 20.68726931 |
| 2018 | 59 | 0.005446909 | 0.005432115 | 515.306054 | 94605.22846 | 0.5 | 0.994567885 | 94862.88149 | 1876925.513 | 19.78566836 |
| 2018 | 60 | 0.006098426 | 0.006079887 | 573.622593 | 94060.76414 | 0.5 | 0.993920113 | 94347.57543 | 1782320.284 | 18.89100251 |
| 2018 | 61 | 0.006820863 | 0.00679768 | 637.445281 | 93455.2302 | 0.5 | 0.99320232 | 93773.95284 | 1688259.52 | 18.00350171 |
| 2018 | 62 | 0.007615905 | 0.007587014 | 706.627972 | 92783.19357 | 0.5 | 0.992412986 | 93136.50756 | 1594804.29 | 17.12329925 |
| 2018 | 63 | 0.008482301 | 0.008446478 | 780.706956 | 92039.52611 | 0.5 | 0.991553522 | 92429.87959 | 1502021.096 | 16.25038465 |
| 2018 | 64 | 0.009415217 | 0.009371102 | 858.8537445 | 91219.74576 | 0.5 | 0.990628898 | 91649.17263 | 1409981.57 | 15.38455318 |
| 2018 | 65 | 0.010405915 | 0.010352053 | 939.866229 | 90320.38577 | 0.5 | 0.989647947 | 90790.31889 | 1318761.824 | 14.52535733 |
| 2018 | 66 | 0.01144196 | 0.011376873 | 1022.217227 | 89339.34404 | 0.5 | 0.988623127 | 89850.45266 | 1228441.439 | 13.67206733 |
| 2018 | 67 | 0.012508186 | 0.012430445 | 1104.174502 | 88276.14818 | 0.5 | 0.987569555 | 88828.23543 | 1139102.094 | 12.8236488 |
| 2018 | 68 | 0.01358851 | 0.01349681 | 1183.994942 | 87132.06346 | 0.5 | 0.98650319 | 87724.06093 | 1050825.946 | 11.97876541 |
| 2018 | 69 | 0.014668599 | 0.014561798 | 1260.178976 | 85909.9765 | 0.5 | 0.985438202 | 86540.06598 | 963693.8828 | 11.13581174 |
| 2018 | 70 | 0.015739161 | 0.015616268 | 1331.753548 | 84614.01023 | 0.5 | 0.984383732 | 85279.88701 | 877783.9063 | 10.29297689 |
| 2018 | 71 | 0.016799498 | 0.016659562 | 1398.539159 | 83248.86388 | 0.5 | 0.983340438 | 83948.13346 | 793169.8961 | 9.448332719 |
| 2018 | 72 | 0.017860834 | 0.017702741 | 1461.354117 | 81818.91724 | 0.5 | 0.982297259 | 82549.5943 | 709921.0322 | 8.599933631 |
| 2018 | 73 | 0.018948986 | 0.018771139 | 1522.118607 | 80327.18088 | 0.5 | 0.981228861 | 81088.24018 | 628102.115 | 7.745908822 |
| 2018 | 74 | 0.020106045 | 0.019905931 | 1583.837696 | 78774.20273 | 0.5 | 0.980094069 | 79566.12158 | 547774.9341 | 6.884524761 |
| 2018 | 75 | 0.021390839 | 0.021164476 | 1650.454178 | 77157.05679 | 0.5 | 0.978835524 | 77982.28388 | 469000.7314 | 6.014195892 |
| 2018 | 76 | 0.022877785 | 0.022619048 | 1726.553324 | 75468.55304 | 0.5 | 0.977380952 | 76331.8297 | 391843.6746 | 5.133424367 |
| 2018 | 77 | 0.024653081 | 0.024352894 | 1816.854388 | 73696.84919 | 0.5 | 0.975647106 | 74605.27638 | 316375.1215 | 4.240653435 |
| 2018 | 78 | 0.026805459 | 0.026450944 | 1925.322464 | 71825.76076 | 0.5 | 0.973549056 | 72788.42199 | 242678.2723 | 3.33402299 |
| 2018 | 79 | 0.029405552 | 0.028979473 | 2053.57531 | 69836.31187 | 0.5 | 0.971020527 | 70863.09953 | 170852.5116 | 2.411022277 |
| 2018 | 80 | 0.032463019 | 0.031944511 | 2198.086608 | 67710.48091 | 0.5 | 0.968055489 | 68809.52422 | 101016.1997 | 1.468055489 |

Table 17: Combined Sex Life Table in 2019

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|
| 2019 | 0 | 0.000946563 | 0.000945799 | 94.57989863 | 99919.29779 | 0.1467298 | 0.999054201 | 100000 | 7535405.708 | 75.35405708 |
| 2019 | 1 | 0.000810492 | 0.000810164 | 80.93976289 | 99864.95022 | 0.5 | 0.999189836 | 99905.4201 | 7435486.409 | 74.42525543 |
| 2019 | 2 | 0.000701826 | 0.000701579 | 70.03480233 | 99789.46294 | 0.5 | 0.999298421 | 99824.48034 | 7335621.459 | 73.48519556 |
| 2019 | 3 | 0.000623676 | 0.000623482 | 62.19507381 | 99723.348 | 0.5 | 0.999376518 | 99754.44554 | 7235831.996 | 72.53643642 |
| 2019 | 4 | 0.000572514 | 0.00057235 | 57.05884645 | 99663.72104 | 0.5 | 0.99942765 | 99692.25046 | 7136108.648 | 71.58137784 |
| 2019 | 5 | 0.000543296 | 0.000543149 | 54.11671931 | 99608.13326 | 0.5 | 0.999456851 | 99635.19162 | 7036444.927 | 70.62208456 |
| 2019 | 6 | 0.000531291 | 0.00053115 | 52.89247409 | 99554.62866 | 0.5 | 0.99946885 | 99581.0749 | 6936836.794 | 69.66019197 |
| 2019 | 7 | 0.000532401 | 0.00053226 | 52.97482162 | 99501.69501 | 0.5 | 0.99946774 | 99528.18242 | 6837282.165 | 68.69694592 |
| 2019 | 8 | 0.000542972 | 0.000542825 | 53.99760171 | 99448.2088 | 0.5 | 0.999457175 | 99475.2076 | 6737780.47 | 67.73326372 |
| 2019 | 9 | 0.000559518 | 0.000559361 | 55.61237596 | 99393.40381 | 0.5 | 0.999440639 | 99421.21 | 6638332.262 | 66.76977942 |
| 2019 | 10 | 0.000578557 | 0.00057839 | 57.4720822 | 99336.86158 | 0.5 | 0.99942161 | 99365.59762 | 6538938.858 | 65.80686892 |
| 2019 | 11 | 0.000596633 | 0.000596455 | 59.23284107 | 99278.50912 | 0.5 | 0.999403545 | 99308.12554 | 6439601.996 | 64.84466363 |
| 2019 | 12 | 0.000610509 | 0.000610323 | 60.57383954 | 99218.60578 | 0.5 | 0.999389677 | 99248.8927 | 6340323.487 | 63.88306524 |
| 2019 | 13 | 0.000617492 | 0.000617302 | 61.22912168 | 99157.7043 | 0.5 | 0.999382698 | 99188.31886 | 6241104.881 | 62.92177298 |
| 2019 | 14 | 0.000615769 | 0.000615579 | 61.02059095 | 99096.57944 | 0.5 | 0.999384421 | 99127.08974 | 6141947.177 | 61.96032985 |
| 2019 | 15 | 0.000604633 | 0.00060445 | 59.88047567 | 99036.12891 | 0.5 | 0.99939555 | 99066.06915 | 6042850.598 | 60.99818686 |
| 2019 | 16 | 0.000584527 | 0.000584357 | 57.8549212 | 98977.26121 | 0.5 | 0.999415643 | 99006.18867 | 5943814.469 | 60.0347771 |
| 2019 | 17 | 0.00055688 | 0.000556725 | 55.08702619 | 98920.79024 | 0.5 | 0.999443275 | 98948.33375 | 5844837.207 | 59.06958698 |
| 2019 | 18 | 0.000523778 | 0.000523641 | 51.78454691 | 98867.35445 | 0.5 | 0.999476359 | 98893.24672 | 5745916.417 | 58.10221231 |
| 2019 | 19 | 0.000487583 | 0.000487464 | 48.18166446 | 98817.37135 | 0.5 | 0.999512536 | 98841.46218 | 5647049.063 | 57.13239099 |
| 2019 | 20 | 0.000450581 | 0.00045048 | 44.50435315 | 98771.02834 | 0.5 | 0.99954952 | 98793.28051 | 5548231.691 | 56.16001071 |
| 2019 | 21 | 0.000414732 | 0.000414646 | 40.94581106 | 98728.30325 | 0.5 | 0.999585354 | 98748.77616 | 5449460.663 | 55.1850957 |
| 2019 | 22 | 0.000381543 | 0.000381471 | 37.65413122 | 98689.00328 | 0.5 | 0.999618529 | 98707.83035 | 5350732.36 | 54.20778008 |
| 2019 | 23 | 0.000352051 | 0.000351989 | 34.73080164 | 98652.81082 | 0.5 | 0.999648011 | 98670.17622 | 5252043.356 | 53.22827584 |
| 2019 | 24 | 0.00032688 | 0.000326827 | 32.23668697 | 98619.32707 | 0.5 | 0.999673173 | 98635.44542 | 5153390.546 | 52.24684214 |
| 2019 | 25 | 0.000306344 | 0.000306297 | 30.2018361 | 98588.10781 | 0.5 | 0.999693703 | 98603.20873 | 5054771.219 | 51.26375991 |
| 2019 | 26 | 0.00029055 | 0.000290507 | 28.63618815 | 98558.6888 | 0.5 | 0.999709493 | 98573.00689 | 4956183.111 | 50.27931344 |
| 2019 | 27 | 0.0002795 | 0.000279461 | 27.53934929 | 98530.60103 | 0.5 | 0.999720539 | 98544.37071 | 4857624.422 | 49.29377891 |
| 2019 | 28 | 0.000273175 | 0.000273137 | 26.90861493 | 98503.37705 | 0.5 | 0.999726863 | 98516.83136 | 4759093.821 | 48.3074187 |
| 2019 | 29 | 0.000271589 | 0.000271552 | 26.74511062 | 98476.55019 | 0.5 | 0.999728448 | 98489.92274 | 4660590.444 | 47.32048025 |
| 2019 | 30 | 0.000274844 | 0.000274806 | 27.05830153 | 98449.64848 | 0.5 | 0.999725194 | 98463.17763 | 4562113.894 | 46.33319789 |
| 2019 | 31 | 0.00028316 | 0.00028312 | 27.86924803 | 98422.1847 | 0.5 | 0.99971688 | 98436.11933 | 4463664.245 | 45.3457966 |
| 2019 | 32 | 0.000296899 | 0.000296855 | 29.21295733 | 98393.6436 | 0.5 | 0.999703145 | 98408.25008 | 4365242.061 | 44.35849694 |
| 2019 | 33 | 0.000316582 | 0.000316532 | 31.1400743 | 98363.46709 | 0.5 | 0.999683468 | 98379.03712 | 4266848.417 | 43.37152041 |
| 2019 | 34 | 0.000342903 | 0.000342844 | 33.71801997 | 98331.03804 | 0.5 | 0.999657156 | 98347.89705 | 4168484.95 | 42.3850949 |
| 2019 | 35 | 0.000376736 | 0.000376665 | 37.03155571 | 98295.66325 | 0.5 | 0.999623335 | 98314.17903 | 4070153.912 | 41.39945989 |
| 2019 | 36 | 0.000419134 | 0.000419046 | 41.18264583 | 98256.55615 | 0.5 | 0.999580954 | 98277.14747 | 3971858.249 | 40.41487111 |
| 2019 | 37 | 0.000471318 | 0.000471207 | 46.28942972 | 98212.82011 | 0.5 | 0.999528793 | 98235.96483 | 3873601.692 | 39.43160429 |
| 2019 | 38 | 0.000534661 | 0.000534518 | 52.48411564 | 98163.43334 | 0.5 | 0.999465482 | 98189.6754 | 3775388.872 | 38.44995777 |
| 2019 | 39 | 0.000610655 | 0.000610469 | 59.90968928 | 98107.23644 | 0.5 | 0.999389531 | 98137.19128 | 3677225.439 | 37.47025354 |
| 2019 | 40 | 0.000700872 | 0.000700626 | 68.71549902 | 98042.92384 | 0.5 | 0.999299374 | 98077.28159 | 3579118.203 | 36.49283651 |
| 2019 | 41 | 0.000806908 | 0.000806583 | 79.05202958 | 97969.04008 | 0.5 | 0.999193417 | 98008.56609 | 3481075.279 | 35.51807171 |
| 2019 | 42 | 0.000930341 | 0.000929908 | 91.0654691 | 97883.98133 | 0.5 | 0.999070092 | 97929.51406 | 3383106.239 | 34.54633949 |
| 2019 | 43 | 0.001072679 | 0.001072104 | 104.8929508 | 97786.00212 | 0.5 | 0.998927896 | 97838.4486 | 3285222.257 | 33.57802893 |
| 2019 | 44 | 0.001235339 | 0.001234576 | 120.659526 | 97673.22588 | 0.5 | 0.998765424 | 97733.55564 | 3187436.255 | 32.61353006 |
| 2019 | 45 | 0.001419651 | 0.001418644 | 138.4779219 | 97543.65716 | 0.5 | 0.998581356 | 97612.89612 | 3089763.029 | 31.65322567 |
| 2019 | 46 | 0.001626897 | 0.001625574 | 158.4519062 | 97395.19224 | 0.5 | 0.998374426 | 97474.4182 | 2992219.372 | 30.69748379 |
| 2019 | 47 | 0.001858395 | 0.00185667 | 180.683628 | 97225.62448 | 0.5 | 0.99814333 | 97315.96629 | 2894824.18 | 29.74665196 |
| 2019 | 48 | 0.002115625 | 0.00211339 | 205.2846958 | 97032.64031 | 0.5 | 0.99788661 | 97135.28266 | 2797598.555 | 28.80105435 |
| 2019 | 49 | 0.002400382 | 0.002397505 | 232.390108 | 96813.80291 | 0.5 | 0.997602495 | 96929.99797 | 2700565.915 | 27.86099218 |
| 2019 | 50 | 0.002714953 | 0.002711273 | 262.1735832 | 96566.52107 | 0.5 | 0.997288727 | 96697.60786 | 2603752.112 | 26.92674793 |
| 2019 | 51 | 0.003062297 | 0.003057615 | 294.8624471 | 96288.00305 | 0.5 | 0.996942385 | 96435.43428 | 2507185.591 | 25.99859284 |
| 2019 | 52 | 0.003446203 | 0.003440275 | 330.7500322 | 95975.19681 | 0.5 | 0.996559725 | 96140.57183 | 2410897.588 | 25.07679684 |
| 2019 | 53 | 0.00387142 | 0.003863941 | 370.2034972 | 95624.72005 | 0.5 | 0.996136059 | 95809.8218 | 2314922.391 | 24.16163967 |
| 2019 | 54 | 0.004343724 | 0.004334311 | 413.6649799 | 95232.78581 | 0.5 | 0.995665689 | 95439.6183 | 2219297.671 | 23.25342149 |
| 2019 | 55 | 0.004869912 | 0.004858083 | 461.6439747 | 94795.13133 | 0.5 | 0.995141917 | 95025.95332 | 2124064.885 | 22.35247121 |
| 2019 | 56 | 0.005457696 | 0.005442843 | 514.6987349 | 94306.95998 | 0.5 | 0.994557157 | 94564.30934 | 2029269.754 | 21.45915058 |
| 2019 | 57 | 0.006115472 | 0.006096829 | 573.4044262 | 93762.9084 | 0.5 | 0.993903171 | 94049.61061 | 1934962.794 | 20.57385226 |
| 2019 | 58 | 0.006851933 | 0.006828539 | 638.3058996 | 93157.05323 | 0.5 | 0.993171461 | 93476.20618 | 1841199.886 | 19.69698986 |
| 2019 | 59 | 0.007675507 | 0.007646163 | 709.8536783 | 92482.97344 | 0.5 | 0.992353837 | 92837.90028 | 1748042.832 | 18.82897854 |
| 2019 | 60 | 0.008593591 | 0.008556824 | 788.3235098 | 91733.88485 | 0.5 | 0.991443176 | 92128.0466 | 1655559.859 | 17.97020473 |
| 2019 | 61 | 0.009611612 | 0.009565642 | 873.7230645 | 90902.86156 | 0.5 | 0.990434358 | 91339.7231 | 1563825.974 | 17.1209844 |
| 2019 | 62 | 0.010731945 | 0.010674665 | 965.6942852 | 89983.15289 | 0.5 | 0.989325335 | 90466.00003 | 1472923.113 | 16.28151031 |
| 2019 | 63 | 0.011952827 | 0.011881816 | 1063.426167 | 88968.59266 | 0.5 | 0.988118184 | 89500.30575 | 1382939.96 | 15.45179034 |
| 2019 | 64 | 0.013267445 | 0.013180013 | 1165.599193 | 87854.07998 | 0.5 | 0.986819987 | 88436.87958 | 1293971.367 | 14.631581 |
| 2019 | 65 | 0.014663485 | 0.014556759 | 1270.386986 | 86636.08689 | 0.5 | 0.985443241 | 87271.28039 | 1206117.287 | 13.82032304 |
| 2019 | 66 | 0.016123428 | 0.015994485 | 1375.540005 | 85313.1234 | 0.5 | 0.984005515 | 86000.8934 | 1119481.2 | 13.01708803 |
| 2019 | 67 | 0.017625899 | 0.01747192 | 1478.567422 | 83886.06968 | 0.5 | 0.98252808 | 84625.3534 | 1034168.077 | 12.22054662 |
| 2019 | 68 | 0.019148237 | 0.018966648 | 1577.01583 | 82358.27806 | 0.5 | 0.981033352 | 83146.78597 | 950282.0071 | 11.42896861 |
| 2019 | 69 | 0.020670243 | 0.020458799 | 1668.819496 | 80735.3604 | 0.5 | 0.979541201 | 81569.77014 | 867923.729 | 10.64026204 |
| 2019 | 70 | 0.022178825 | 0.021935572 | 1752.673072 | 79024.61411 | 0.5 | 0.978064428 | 79900.95065 | 787188.3686 | 9.852052601 |
| 2019 | 71 | 0.023672998 | 0.02339607 | 1828.362611 | 77234.09627 | 0.5 | 0.97660393 | 78148.27758 | 708163.7545 | 9.061796069 |
| 2019 | 72 | 0.025168578 | 0.024855786 | 1896.991475 | 75371.41923 | 0.5 | 0.975144214 | 76319.91496 | 630929.6582 | 8.266907249 |
| 2019 | 73 | 0.026701946 | 0.026350146 | 1961.054907 | 73442.39604 | 0.5 | 0.973649854 | 74422.92349 | 555558.239 | 7.464880617 |
| 2019 | 74 | 0.028332416 | 0.027936659 | 2024.342528 | 71449.69732 | 0.5 | 0.972063341 | 72461.86858 | 482115.843 | 6.653373042 |
| 2019 | 75 | 0.030142881 | 0.02969533 | 2091.665582 | 69391.69326 | 0.5 | 0.97030467 | 70437.52605 | 410666.1457 | 5.83021819 |
| 2019 | 76 | 0.03223821 | 0.031726802 | 2168.395604 | 67261.66267 | 0.5 | 0.968273198 | 68345.86047 | 341274.4524 | 4.993344879 |
| 2019 | 77 | 0.034739867 | 0.03414674 | 2259.744697 | 65047.59252 | 0.5 | 0.96585326 | 66177.46487 | 274012.7897 | 4.140575501 |
| 2019 | 78 | 0.037772888 | 0.037072716 | 2369.603498 | 62732.91842 | 0.5 | 0.962927284 | 63917.72017 | 208965.1972 | 3.269284271 |
| 2019 | 79 | 0.041436807 | 0.040595729 | 2498.590639 | 60298.82135 | 0.5 | 0.959404271 | 61548.11667 | 146232.2788 | 2.375901761 |
| 2019 | 80 | 0.045745234 | 0.044722317 | 2640.831627 | 57729.11022 | 0.5 | 0.955277683 | 59049.52603 | 85933.45742 | 1.455277683 |

Table 18: Combined Sex Life Table in 2020

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | 0 | 0.001063668 | 0.001062703 | 106.2702812 | 99909.28198 | 0.1463463 | 0.998937297 | 100000 | 7470402.495 | 74.70402495 |
| 2020 | 1 | 0.000910763 | 0.000910348 | 90.93809686 | 99848.26067 | 0.5 | 0.999089652 | 99893.72972 | 7370493.211 | 73.78334188 |
| 2020 | 2 | 0.000788653 | 0.000788342 | 78.67870633 | 99763.45227 | 0.5 | 0.999211658 | 99802.79162 | 7270644.951 | 72.85011604 |
| 2020 | 3 | 0.000700835 | 0.000700589 | 69.8656462 | 99689.18009 | 0.5 | 0.999299411 | 99724.11292 | 7170881.498 | 71.90719766 |
| 2020 | 4 | 0.000643343 | 0.000643136 | 64.09122081 | 99622.20166 | 0.5 | 0.999356864 | 99654.24727 | 7071192.318 | 70.95725985 |
| 2020 | 5 | 0.000610511 | 0.000610324 | 60.78228761 | 99559.7649 | 0.5 | 0.999389676 | 99590.15605 | 6971570.117 | 70.0026026 |
| 2020 | 6 | 0.00059702 | 0.000596842 | 59.40330303 | 99499.67211 | 0.5 | 0.999403158 | 99529.37376 | 6872010.352 | 69.04504763 |
| 2020 | 7 | 0.000598268 | 0.000598089 | 59.49187262 | 99440.22452 | 0.5 | 0.999401911 | 99469.97046 | 6772510.68 | 68.08598262 |
| 2020 | 8 | 0.000610146 | 0.00060996 | 60.63644315 | 99380.16036 | 0.5 | 0.99939004 | 99410.47859 | 6673070.455 | 67.12642923 |
| 2020 | 9 | 0.000628739 | 0.000628541 | 62.44549026 | 99318.6194 | 0.5 | 0.999371459 | 99349.84214 | 6573690.295 | 66.16709351 |
| 2020 | 10 | 0.000650134 | 0.000649923 | 64.52915643 | 99255.13207 | 0.5 | 0.999350077 | 99287.39665 | 6474371.675 | 65.20839395 |
| 2020 | 11 | 0.000670446 | 0.000670221 | 66.5012868 | 99189.61685 | 0.5 | 0.999329779 | 99222.8675 | 6375116.543 | 64.25047677 |
| 2020 | 12 | 0.000686039 | 0.000685803 | 68.0017609 | 99122.36533 | 0.5 | 0.999314197 | 99156.36621 | 6275926.927 | 63.29323236 |
| 2020 | 13 | 0.000693886 | 0.000693645 | 68.73217642 | 99053.99836 | 0.5 | 0.999306355 | 99088.36445 | 6176804.561 | 62.33632572 |
| 2020 | 14 | 0.000691949 | 0.00069171 | 68.49286687 | 98985.38584 | 0.5 | 0.99930829 | 99019.63227 | 6077750.563 | 61.37924797 |
| 2020 | 15 | 0.000679435 | 0.000679205 | 67.20806493 | 98917.53537 | 0.5 | 0.999320795 | 98951.1394 | 5978765.177 | 60.4213879 |
| 2020 | 16 | 0.000656843 | 0.000656627 | 64.92986643 | 98851.46641 | 0.5 | 0.999343373 | 98883.93134 | 5879847.642 | 59.46211444 |
| 2020 | 17 | 0.000625775 | 0.000625579 | 61.81912695 | 98788.09191 | 0.5 | 0.999374421 | 98819.00147 | 5780996.175 | 58.500856 |
| 2020 | 18 | 0.000588578 | 0.000588405 | 58.10917211 | 98728.12776 | 0.5 | 0.999411595 | 98757.18235 | 5682208.083 | 57.53716285 |
| 2020 | 19 | 0.000547905 | 0.000547755 | 54.06287483 | 98672.04174 | 0.5 | 0.999452245 | 98699.07317 | 5583479.956 | 56.57074353 |
| 2020 | 20 | 0.000506325 | 0.000506197 | 49.93380101 | 98620.0434 | 0.5 | 0.999493803 | 98645.0103 | 5484807.914 | 55.60147338 |
| 2020 | 21 | 0.000466041 | 0.000465933 | 45.93866439 | 98572.10717 | 0.5 | 0.999534067 | 98595.0765 | 5386187.87 | 54.6293797 |
| 2020 | 22 | 0.000428746 | 0.000428654 | 42.24352263 | 98528.01607 | 0.5 | 0.999571346 | 98549.13783 | 5287615.763 | 53.6546121 |
| 2020 | 23 | 0.000395605 | 0.000395527 | 38.96212129 | 98487.41325 | 0.5 | 0.999604473 | 98506.89431 | 5189087.747 | 52.67740683 |
| 2020 | 24 | 0.00036732 | 0.000367253 | 36.16262511 | 98449.85088 | 0.5 | 0.999632747 | 98467.93219 | 5090600.334 | 51.69805256 |
| 2020 | 25 | 0.000344243 | 0.000344184 | 33.87863329 | 98414.83025 | 0.5 | 0.999655816 | 98431.76956 | 4992150.483 | 50.7168621 |
| 2020 | 26 | 0.000326495 | 0.000326442 | 32.12119599 | 98381.83033 | 0.5 | 0.999673558 | 98397.89093 | 4893735.653 | 49.73415189 |
| 2020 | 27 | 0.000314079 | 0.00031403 | 30.88978321 | 98350.32484 | 0.5 | 0.99968597 | 98365.76974 | 4795353.822 | 48.75022922 |
| 2020 | 28 | 0.000306971 | 0.000306923 | 30.18128194 | 98319.78931 | 0.5 | 0.999693077 | 98334.87995 | 4697003.498 | 47.76538599 |
| 2020 | 29 | 0.000305188 | 0.000305142 | 29.99688113 | 98289.70023 | 0.5 | 0.999694858 | 98304.69867 | 4598683.708 | 46.7798973 |
| 2020 | 30 | 0.000308847 | 0.000308799 | 30.34712518 | 98259.52823 | 0.5 | 0.999691201 | 98274.70179 | 4500394.008 | 45.79402355 |
| 2020 | 31 | 0.000318192 | 0.000318141 | 31.25555998 | 98228.72688 | 0.5 | 0.999681859 | 98244.35466 | 4402134.48 | 44.80801462 |
| 2020 | 32 | 0.00033363 | 0.000333574 | 32.76136399 | 98196.71842 | 0.5 | 0.999666426 | 98213.0991 | 4303905.753 | 43.8221153 |
| 2020 | 33 | 0.000355748 | 0.000355685 | 34.92123662 | 98162.87712 | 0.5 | 0.999644315 | 98180.33774 | 4205709.035 | 42.83657127 |
| 2020 | 34 | 0.000385326 | 0.000385251 | 37.81066511 | 98126.51117 | 0.5 | 0.999614749 | 98145.4165 | 4107546.157 | 41.85163509 |
| 2020 | 35 | 0.000423345 | 0.000423255 | 41.5245446 | 98086.84357 | 0.5 | 0.999576745 | 98107.60584 | 4009419.646 | 40.86757201 |
| 2020 | 36 | 0.000470987 | 0.000470876 | 46.17700757 | 98042.99279 | 0.5 | 0.999529124 | 98066.08129 | 3911332.803 | 39.88466502 |
| 2020 | 37 | 0.000529627 | 0.000529487 | 51.90025003 | 97993.95416 | 0.5 | 0.999470513 | 98019.90429 | 3813289.81 | 38.90321907 |
| 2020 | 38 | 0.000600807 | 0.000600626 | 58.84214275 | 97938.58296 | 0.5 | 0.999399374 | 97968.00404 | 3715295.856 | 37.92356384 |
| 2020 | 39 | 0.000686203 | 0.000685968 | 67.16250648 | 97875.58064 | 0.5 | 0.999314032 | 97909.16189 | 3617357.273 | 36.94605492 |
| 2020 | 40 | 0.000787581 | 0.000787271 | 77.02812051 | 97803.48533 | 0.5 | 0.999212729 | 97841.99939 | 3519481.692 | 35.97107289 |
| 2020 | 41 | 0.000906736 | 0.000906325 | 88.60681324 | 97720.66786 | 0.5 | 0.999093675 | 97764.97127 | 3421678.207 | 34.99902023 |
| 2020 | 42 | 0.001045439 | 0.001044893 | 102.0613138 | 97625.3338 | 0.5 | 0.998955107 | 97676.36445 | 3323957.539 | 34.03031591 |
| 2020 | 43 | 0.001205386 | 0.00120466 | 117.543853 | 97515.53121 | 0.5 | 0.99879534 | 97574.30314 | 3226332.205 | 33.06538813 |
| 2020 | 44 | 0.00138817 | 0.001387207 | 135.1926982 | 97389.16294 | 0.5 | 0.998612793 | 97456.75929 | 3128816.674 | 32.10466567 |
| 2020 | 45 | 0.001595284 | 0.001594013 | 155.1318031 | 97244.00069 | 0.5 | 0.998405987 | 97321.56659 | 3031427.511 | 31.14856878 |
| 2020 | 46 | 0.00182817 | 0.0018265 | 177.4744895 | 97077.69754 | 0.5 | 0.9981735 | 97166.43479 | 2934183.51 | 30.19750099 |
| 2020 | 47 | 0.002088308 | 0.00208613 | 202.3315694 | 96887.79451 | 0.5 | 0.99791387 | 96988.9603 | 2837105.813 | 29.25184273 |
| 2020 | 48 | 0.002377362 | 0.002374539 | 229.8236277 | 96671.71691 | 0.5 | 0.997625461 | 96786.62873 | 2740218.018 | 28.31194819 |
| 2020 | 49 | 0.002697347 | 0.002693714 | 260.0964577 | 96426.75687 | 0.5 | 0.997306286 | 96556.8051 | 2643546.301 | 27.37814594 |
| 2020 | 50 | 0.003050836 | 0.003046189 | 293.3380029 | 96150.03964 | 0.5 | 0.996953811 | 96296.70864 | 2547119.544 | 26.45074354 |
| 2020 | 51 | 0.003441152 | 0.003435241 | 329.7947148 | 95838.47328 | 0.5 | 0.996564759 | 96003.37064 | 2450969.505 | 25.53003596 |
| 2020 | 52 | 0.003872553 | 0.003865069 | 369.7850153 | 95488.68342 | 0.5 | 0.996134931 | 95673.57592 | 2355131.032 | 24.61631656 |
| 2020 | 53 | 0.004350377 | 0.004340934 | 413.7074952 | 95096.93716 | 0.5 | 0.995659066 | 95303.79091 | 2259642.348 | 23.70988947 |
| 2020 | 54 | 0.004881112 | 0.004869229 | 462.041501 | 94659.06266 | 0.5 | 0.995130771 | 94890.08341 | 2164545.411 | 22.81108134 |
| 2020 | 55 | 0.005472398 | 0.005457465 | 515.3377406 | 94170.37304 | 0.5 | 0.994542535 | 94428.04191 | 2069886.348 | 21.92025066 |
| 2020 | 56 | 0.0061329 | 0.006114151 | 574.196467 | 93625.60594 | 0.5 | 0.993885849 | 93912.70417 | 1975715.975 | 21.03779241 |
| 2020 | 57 | 0.006872053 | 0.006848521 | 639.2307431 | 93018.89233 | 0.5 | 0.993151479 | 93338.5077 | 1882090.369 | 20.16413606 |
| 2020 | 58 | 0.007699626 | 0.007670098 | 711.0125059 | 92343.77071 | 0.5 | 0.992329902 | 92699.27696 | 1789071.477 | 19.29973497 |
| 2020 | 59 | 0.008625089 | 0.008588052 | 790.0000335 | 91593.26444 | 0.5 | 0.991411948 | 91988.26446 | 1696727.706 | 18.44504531 |
| 2020 | 60 | 0.009656755 | 0.009610353 | 876.447474 | 90760.04068 | 0.5 | 0.990389647 | 91198.26442 | 1605134.442 | 17.6004933 |
| 2020 | 61 | 0.010800721 | 0.010742707 | 970.3008091 | 89836.66654 | 0.5 | 0.989257293 | 90321.81695 | 1514374.401 | 16.76642978 |
| 2020 | 62 | 0.012059658 | 0.011987376 | 1071.090193 | 88815.97104 | 0.5 | 0.988012624 | 89351.51614 | 1424537.735 | 15.94307289 |
| 2020 | 63 | 0.013431581 | 0.013341979 | 1177.83561 | 87691.50814 | 0.5 | 0.986658021 | 88280.42595 | 1335721.764 | 15.13044086 |
| 2020 | 64 | 0.014908839 | 0.014798524 | 1288.989817 | 86458.09543 | 0.5 | 0.985201476 | 87102.59034 | 1248030.255 | 14.32827945 |
| 2020 | 65 | 0.016477591 | 0.016342945 | 1402.446965 | 85112.37704 | 0.5 | 0.983657055 | 85813.60052 | 1161572.16 | 13.53599142 |
| 2020 | 66 | 0.018118152 | 0.017955492 | 1515.643791 | 83653.33166 | 0.5 | 0.982044508 | 84411.15356 | 1076459.783 | 12.75257756 |
| 2020 | 67 | 0.019806503 | 0.019612278 | 1625.76976 | 82082.62488 | 0.5 | 0.980387722 | 82895.50976 | 992806.4513 | 11.97660107 |
| 2020 | 68 | 0.021517178 | 0.021288148 | 1730.082224 | 80404.69889 | 0.5 | 0.978711852 | 81269.74 | 910723.8264 | 11.20618605 |
| 2020 | 69 | 0.02322748 | 0.022960819 | 1826.295691 | 78626.50993 | 0.5 | 0.977039181 | 79539.65778 | 830319.1275 | 10.43905834 |
| 2020 | 70 | 0.024922698 | 0.02461595 | 1912.988217 | 76756.86798 | 0.5 | 0.97538405 | 77713.36209 | 751692.6176 | 9.672630258 |
| 2020 | 71 | 0.026601724 | 0.026252542 | 1989.952534 | 74805.3976 | 0.5 | 0.973747458 | 75800.37387 | 674935.7496 | 8.904121644 |
| 2020 | 72 | 0.028282331 | 0.027887963 | 2058.422299 | 72781.21019 | 0.5 | 0.972112037 | 73810.42134 | 600130.352 | 8.130699448 |
| 2020 | 73 | 0.030005401 | 0.029561893 | 2121.124904 | 70691.43659 | 0.5 | 0.970438107 | 71751.99904 | 527349.1418 | 7.349609055 |
| 2020 | 74 | 0.031837586 | 0.031338711 | 2182.141847 | 68539.80321 | 0.5 | 0.968661289 | 69630.87413 | 456657.7052 | 6.55826472 |
| 2020 | 75 | 0.033872035 | 0.033307931 | 2246.577715 | 66325.44343 | 0.5 | 0.966692069 | 67448.73229 | 388117.902 | 5.754265334 |
| 2020 | 76 | 0.036226589 | 0.03558208 | 2320.028272 | 64042.14044 | 0.5 | 0.96441792 | 65202.15457 | 321792.4586 | 4.935304067 |
| 2020 | 77 | 0.03903774 | 0.038290356 | 2407.778974 | 61678.23681 | 0.5 | 0.961709644 | 62882.1263 | 257750.3182 | 4.098944062 |
| 2020 | 78 | 0.042445994 | 0.041563884 | 2513.548753 | 59217.57295 | 0.5 | 0.958436116 | 60474.34733 | 196072.0814 | 3.242235593 |
| 2020 | 79 | 0.046563198 | 0.045503797 | 2637.436428 | 56642.08036 | 0.5 | 0.954496203 | 57960.79857 | 136854.5084 | 2.361156364 |
| 2020 | 80 | 0.051404645 | 0.050116534 | 2772.615166 | 53937.05456 | 0.5 | 0.949883466 | 55323.36214 | 80212.42805 | 1.449883466 |

## Table 19: Combined Sex Life Table in 2021

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 0 | 0.000953152 | 0.000952377 | 95.23772456 | 99918.73593 | 0.1467239 | 0.999047623 | 100000 | 7531691.956 | 75.31691956 |
| 2021 | 1 | 0.000816134 | 0.000815801 | 81.50241065 | 99864.01107 | 0.5 | 0.999184199 | 99904.76228 | 7431773.22 | 74.38857819 |
| 2021 | 2 | 0.000706711 | 0.000706461 | 70.52127372 | 99787.99923 | 0.5 | 0.999293539 | 99823.25986 | 7331909.209 | 73.44890578 |
| 2021 | 3 | 0.000628018 | 0.00062782 | 62.62680044 | 99721.42519 | 0.5 | 0.99937218 | 99752.73859 | 7232121.209 | 72.5004778 |
| 2021 | 4 | 0.000576499 | 0.000576333 | 57.45468079 | 99661.38445 | 0.5 | 0.999423667 | 99690.11179 | 7132399.784 | 71.54570956 |
| 2021 | 5 | 0.000547078 | 0.000546928 | 54.49193161 | 99605.41114 | 0.5 | 0.999453072 | 99632.65711 | 7032738.4 | 70.58667914 |
| 2021 | 6 | 0.000534989 | 0.000534846 | 53.25899902 | 99551.53568 | 0.5 | 0.999465154 | 99578.16518 | 6933132.989 | 69.62503252 |
| 2021 | 7 | 0.000536107 | 0.000535964 | 53.34171971 | 99498.23532 | 0.5 | 0.999464036 | 99524.90618 | 6833581.453 | 68.66202356 |
| 2021 | 8 | 0.000546752 | 0.000546602 | 54.37137997 | 99444.37877 | 0.5 | 0.999453398 | 99471.56446 | 6734083.218 | 67.69857551 |
| 2021 | 9 | 0.000563413 | 0.000563254 | 55.99711703 | 99389.19452 | 0.5 | 0.999436746 | 99417.19308 | 6634638.839 | 66.73532649 |
| 2021 | 10 | 0.000582585 | 0.000582415 | 57.86945998 | 99332.26123 | 0.5 | 0.999417585 | 99361.19596 | 6535249.644 | 65.77265482 |
| 2021 | 11 | 0.000600786 | 0.000600606 | 59.64214927 | 99273.50543 | 0.5 | 0.999399394 | 99303.3265 | 6435917.383 | 64.81069275 |
| 2021 | 12 | 0.000614759 | 0.00061457 | 60.992158 | 99213.18827 | 0.5 | 0.99938543 | 99243.68435 | 6336643.878 | 63.84934133 |
| 2021 | 13 | 0.000621791 | 0.000621597 | 61.65170198 | 99151.86634 | 0.5 | 0.999378403 | 99182.6922 | 6237430.689 | 62.88829786 |
| 2021 | 14 | 0.000620055 | 0.000619863 | 61.44146831 | 99090.31976 | 0.5 | 0.999380137 | 99121.04049 | 6138278.823 | 61.92710238 |
| 2021 | 15 | 0.000608841 | 0.000608656 | 60.29323322 | 99029.45241 | 0.5 | 0.999391344 | 99059.59902 | 6039188.503 | 60.96520239 |
| 2021 | 16 | 0.000588596 | 0.000588423 | 58.25347545 | 98970.17905 | 0.5 | 0.999411577 | 98999.30579 | 5940159.051 | 60.00202732 |
| 2021 | 17 | 0.000560757 | 0.000560599 | 55.46629246 | 98913.31917 | 0.5 | 0.999439401 | 98941.05232 | 5841188.872 | 59.0370603 |
| 2021 | 18 | 0.000527424 | 0.000527285 | 52.14087996 | 98859.51558 | 0.5 | 0.999472715 | 98885.58602 | 5742275.553 | 58.06989455 |
| 2021 | 19 | 0.000490977 | 0.000490856 | 48.51303506 | 98809.18863 | 0.5 | 0.999509144 | 98833.44514 | 5643416.037 | 57.1002663 |
| 2021 | 20 | 0.000453717 | 0.000453615 | 44.81028663 | 98762.52697 | 0.5 | 0.999546385 | 98784.93211 | 5544606.848 | 56.12806255 |
| 2021 | 21 | 0.000417619 | 0.000417532 | 41.22715811 | 98719.50824 | 0.5 | 0.999582468 | 98740.12182 | 5445844.321 | 55.1533077 |
| 2021 | 22 | 0.000384199 | 0.000384125 | 37.9127554 | 98679.93829 | 0.5 | 0.999615875 | 98698.89466 | 5347124.813 | 54.17613674 |
| 2021 | 23 | 0.000354501 | 0.000354439 | 34.96925789 | 98643.49728 | 0.5 | 0.999645561 | 98660.98191 | 5248444.875 | 53.19676303 |
| 2021 | 24 | 0.000329155 | 0.000329101 | 32.45794232 | 98609.78368 | 0.5 | 0.999670899 | 98626.01265 | 5149801.378 | 52.21544742 |
| 2021 | 25 | 0.000308476 | 0.000308428 | 30.4090583 | 98578.35018 | 0.5 | 0.999691572 | 98593.55471 | 5051191.594 | 51.23247264 |
| 2021 | 26 | 0.000292572 | 0.000292529 | 28.83260816 | 98548.72935 | 0.5 | 0.999707471 | 98563.14565 | 4952613.244 | 50.2481248 |
| 2021 | 27 | 0.000281446 | 0.000281406 | 27.7281909 | 98520.44895 | 0.5 | 0.999718594 | 98534.31304 | 4854064.514 | 49.26268185 |
| 2021 | 28 | 0.000275076 | 0.000275038 | 27.09307938 | 98493.03831 | 0.5 | 0.999724962 | 98506.58485 | 4755544.065 | 48.27640784 |
| 2021 | 29 | 0.000273479 | 0.000273442 | 26.92840315 | 98466.02757 | 0.5 | 0.999726558 | 98479.49177 | 4657051.027 | 47.2895518 |
| 2021 | 30 | 0.000276757 | 0.000276719 | 27.24368865 | 98438.94152 | 0.5 | 0.999723281 | 98452.56337 | 4558585 | 46.30234951 |
| 2021 | 31 | 0.000285131 | 0.000285091 | 28.06013676 | 98411.28961 | 0.5 | 0.999714909 | 98425.31968 | 4460146.058 | 45.3150274 |
| 2021 | 32 | 0.000298966 | 0.000298921 | 29.41299034 | 98382.55305 | 0.5 | 0.999701079 | 98397.25954 | 4361734.768 | 44.32780739 |
| 2021 | 33 | 0.000318785 | 0.000318735 | 31.35323613 | 98352.16993 | 0.5 | 0.999681265 | 98367.84655 | 4263352.215 | 43.34091235 |
| 2021 | 34 | 0.00034529 | 0.00034523 | 33.94875057 | 98319.51894 | 0.5 | 0.99965477 | 98336.49332 | 4165000.045 | 42.35457158 |
| 2021 | 35 | 0.000379359 | 0.000379287 | 37.28486727 | 98283.90213 | 0.5 | 0.999620713 | 98302.54457 | 4066680.526 | 41.36902605 |
| 2021 | 36 | 0.000422051 | 0.000421962 | 41.46423776 | 98244.52758 | 0.5 | 0.999578038 | 98265.2597 | 3968396.624 | 40.38453301 |
| 2021 | 37 | 0.000474598 | 0.000474486 | 46.60579554 | 98200.49256 | 0.5 | 0.999525514 | 98223.79546 | 3870152.097 | 39.40136989 |
| 2021 | 38 | 0.000538382 | 0.000538237 | 52.84263413 | 98150.76835 | 0.5 | 0.999461763 | 98177.18967 | 3771951.604 | 38.4198368 |
| 2021 | 39 | 0.000614906 | 0.000614717 | 60.31869135 | 98094.18769 | 0.5 | 0.999385283 | 98124.34703 | 3673800.836 | 37.44025766 |
| 2021 | 40 | 0.00070575 | 0.000705501 | 69.18430237 | 98029.43619 | 0.5 | 0.999294499 | 98064.02834 | 3575706.648 | 36.46297943 |
| 2021 | 41 | 0.000812525 | 0.000812195 | 79.59093503 | 97955.04857 | 0.5 | 0.999187805 | 97994.84404 | 3477677.212 | 35.48836927 |
| 2021 | 42 | 0.000936817 | 0.000936378 | 91.68571701 | 97869.41024 | 0.5 | 0.999063622 | 97915.2531 | 3379722.163 | 34.51680975 |
| 2021 | 43 | 0.001080145 | 0.001079562 | 105.6066417 | 97770.76406 | 0.5 | 0.998920438 | 97823.56739 | 3281852.753 | 33.54869221 |
| 2021 | 44 | 0.001243938 | 0.001243165 | 121.4795168 | 97657.22099 | 0.5 | 0.998756835 | 97717.96074 | 3184081.989 | 32.58440889 |
| 2021 | 45 | 0.001429533 | 0.001428512 | 139.4177166 | 97526.77237 | 0.5 | 0.998571488 | 97596.48123 | 3086424.768 | 31.62434474 |
| 2021 | 46 | 0.001638221 | 0.00163688 | 159.5255651 | 97377.30073 | 0.5 | 0.99836312 | 97457.06351 | 2988897.996 | 30.66886984 |
| 2021 | 47 | 0.001871331 | 0.001869582 | 181.9057211 | 97206.58508 | 0.5 | 0.998130418 | 97297.53795 | 2891520.695 | 29.71833364 |
| 2021 | 48 | 0.002130352 | 0.002128085 | 206.6703254 | 97012.29706 | 0.5 | 0.997871915 | 97115.63222 | 2794314.11 | 28.77306203 |
| 2021 | 49 | 0.002417091 | 0.002414173 | 233.9550168 | 96791.98439 | 0.5 | 0.997585827 | 96908.9619 | 2697301.813 | 27.83335782 |
| 2021 | 50 | 0.002733852 | 0.00273012 | 263.9343548 | 96543.0397 | 0.5 | 0.99726988 | 96675.00688 | 2600509.828 | 26.89950497 |
| 2021 | 51 | 0.003083613 | 0.003078866 | 296.8367911 | 96262.65413 | 0.5 | 0.996921134 | 96411.07253 | 2503966.789 | 25.9717761 |
| 2021 | 52 | 0.003470192 | 0.003464181 | 332.9571319 | 95947.75717 | 0.5 | 0.996535819 | 96114.23574 | 2407704.135 | 25.05044249 |
| 2021 | 53 | 0.003898369 | 0.003890785 | 372.664381 | 95594.94641 | 0.5 | 0.996109215 | 95781.2786 | 2311756.377 | 24.13578531 |
| 2021 | 54 | 0.004373961 | 0.004364416 | 416.4028655 | 95200.41279 | 0.5 | 0.995635584 | 95408.61422 | 2216161.431 | 23.22810628 |
| 2021 | 55 | 0.004903811 | 0.004891817 | 464.6845166 | 94759.8691 | 0.5 | 0.995108183 | 94992.21136 | 2120961.018 | 22.32773601 |
| 2021 | 56 | 0.005495687 | 0.005480627 | 518.0700963 | 94268.49179 | 0.5 | 0.994519373 | 94527.52684 | 2026201.149 | 21.4350382 |
| 2021 | 57 | 0.006158041 | 0.006139139 | 577.1370796 | 93720.88821 | 0.5 | 0.993860861 | 94009.45674 | 1931932.657 | 20.55040763 |
| 2021 | 58 | 0.006899629 | 0.006875908 | 642.432053 | 93111.10364 | 0.5 | 0.993124092 | 93432.31967 | 1838211.769 | 19.67426021 |
| 2021 | 59 | 0.007728935 | 0.007699182 | 714.4062244 | 92432.6845 | 0.5 | 0.992300818 | 92789.88761 | 1745100.666 | 18.80701346 |
| 2021 | 60 | 0.00865341 | 0.008616131 | 793.3344081 | 91678.81418 | 0.5 | 0.991383869 | 92075.48139 | 1652667.981 | 17.9490561 |
| 2021 | 61 | 0.009678518 | 0.009631907 | 879.2211124 | 90842.53642 | 0.5 | 0.990368093 | 91282.14698 | 1560989.167 | 17.10070609 |
| 2021 | 62 | 0.01080665 | 0.010748571 | 971.7023105 | 89917.07471 | 0.5 | 0.989251429 | 90402.92587 | 1470146.63 | 16.26215763 |
| 2021 | 63 | 0.012036029 | 0.011964029 | 1069.957796 | 88896.24466 | 0.5 | 0.988035971 | 89431.22356 | 1380229.556 | 15.43341912 |
| 2021 | 64 | 0.013359799 | 0.013271149 | 1172.6555 | 87774.93801 | 0.5 | 0.986728851 | 88361.26576 | 1291333.311 | 14.61424641 |
| 2021 | 65 | 0.014765556 | 0.014657345 | 1277.9535 | 86549.63351 | 0.5 | 0.985342655 | 87188.61026 | 1203558.373 | 13.80407796 |
| 2021 | 66 | 0.016235662 | 0.016104925 | 1383.584655 | 85218.86443 | 0.5 | 0.983895075 | 85910.65676 | 1117008.74 | 13.00198115 |
| 2021 | 67 | 0.017748592 | 0.017592471 | 1487.04005 | 83783.55208 | 0.5 | 0.982407529 | 84527.0721 | 1031789.875 | 12.20662031 |
| 2021 | 68 | 0.019281526 | 0.019097413 | 1585.849748 | 82247.10718 | 0.5 | 0.980902587 | 83040.03205 | 948006.323 | 11.41625671 |
| 2021 | 69 | 0.020814126 | 0.020599744 | 1677.935267 | 80615.21467 | 0.5 | 0.979400256 | 81454.18231 | 865759.2158 | 10.62878776 |
| 2021 | 70 | 0.02233321 | 0.022086577 | 1761.984262 | 78895.25491 | 0.5 | 0.977913423 | 79776.24704 | 785144.0012 | 9.841826738 |
| 2021 | 71 | 0.023837784 | 0.02355701 | 1837.782781 | 77095.37139 | 0.5 | 0.97644299 | 78014.26278 | 706248.7463 | 9.052815743 |
| 2021 | 72 | 0.025343775 | 0.02502664 | 1906.441327 | 75223.25933 | 0.5 | 0.97497336 | 76176.48 | 629153.3749 | 8.259155252 |
| 2021 | 73 | 0.026887816 | 0.026531134 | 1970.468337 | 73284.8045 | 0.5 | 0.973468866 | 74270.03867 | 553930.1155 | 7.458325396 |
| 2021 | 74 | 0.028529635 | 0.028128389 | 2033.670419 | 71282.73512 | 0.5 | 0.971871611 | 72299.57033 | 480645.311 | 6.647969121 |
| 2021 | 75 | 0.030352703 | 0.029898946 | 2100.87637 | 69215.46173 | 0.5 | 0.970101054 | 70265.89991 | 409362.5759 | 5.825906683 |
| 2021 | 76 | 0.032462617 | 0.031944122 | 2177.471846 | 67076.28762 | 0.5 | 0.968055878 | 68165.02354 | 340147.1142 | 4.990053498 |
| 2021 | 77 | 0.034981688 | 0.034380346 | 2268.674891 | 64853.21425 | 0.5 | 0.965619654 | 65987.5517 | 273070.8266 | 4.138217278 |
| 2021 | 78 | 0.038035822 | 0.03732596 | 2378.368232 | 62529.69269 | 0.5 | 0.96267404 | 63718.8768 | 208217.6123 | 3.267753965 |
| 2021 | 79 | 0.041725245 | 0.040872537 | 2507.142191 | 60086.93748 | 0.5 | 0.959127463 | 61340.50857 | 145687.9196 | 2.375068662 |
| 2021 | 80 | 0.046063662 | 0.045026616 | 2649.067422 | 57508.83267 | 0.5 | 0.954973384 | 58833.36638 | 85600.98215 | 1.454973384 |

## Table 20: Combined Sex Life Table in 2022

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|
| 2022 | 0 | 0.000681111 | 0.000680715 | 68.07152917 | 99941.93833 | 0.1470492 | 0.999319285 | 100000 | 7690908.857 | 76.90908857 |
| 2022 | 1 | 0.000583199 | 0.000583029 | 58.2632571 | 99902.79684 | 0.5 | 0.999416971 | 99931.92847 | 7590966.919 | 75.96137726 |
| 2022 | 2 | 0.000505007 | 0.00050488 | 50.42417922 | 99848.45312 | 0.5 | 0.99949512 | 99873.66521 | 7491064.122 | 75.00539913 |
| 2022 | 3 | 0.000448774 | 0.000448673 | 44.78799685 | 99800.84704 | 0.5 | 0.999551327 | 99823.24103 | 7391215.669 | 74.04303439 |
| 2022 | 4 | 0.000411959 | 0.000411874 | 41.09618275 | 99757.90495 | 0.5 | 0.999588126 | 99778.45304 | 7291414.822 | 73.07604598 |
| 2022 | 5 | 0.000390935 | 0.000390859 | 38.98323778 | 99717.86524 | 0.5 | 0.999609141 | 99737.35685 | 7191656.917 | 72.10595051 |
| 2022 | 6 | 0.000382297 | 0.000382224 | 38.10708835 | 99679.32007 | 0.5 | 0.999617776 | 99698.37362 | 7091939.052 | 71.13394928 |
| 2022 | 7 | 0.000383096 | 0.000383022 | 38.17210966 | 99641.18047 | 0.5 | 0.999616978 | 99660.26653 | 6992259.732 | 70.16095757 |
| 2022 | 8 | 0.000390702 | 0.000390626 | 38.91496256 | 99602.63694 | 0.5 | 0.999609374 | 99622.09442 | 6892618.551 | 69.1876495 |
| 2022 | 9 | 0.000402608 | 0.000402527 | 40.0848934 | 99563.13701 | 0.5 | 0.999597473 | 99583.17946 | 6793015.914 | 68.21449116 |
| 2022 | 10 | 0.000416308 | 0.000416221 | 41.43196382 | 99522.37858 | 0.5 | 0.999583779 | 99543.09456 | 6693452.777 | 67.24175903 |
| 2022 | 11 | 0.000429315 | 0.000429222 | 42.70834231 | 99480.30843 | 0.5 | 0.999570778 | 99501.6626 | 6593930.399 | 66.26954994 |
| 2022 | 12 | 0.000439299 | 0.000439203 | 43.68262858 | 99437.11294 | 0.5 | 0.999560797 | 99458.95426 | 6494450.09 | 65.29779183 |
| 2022 | 13 | 0.000444324 | 0.000444225 | 44.16278685 | 99393.19024 | 0.5 | 0.999555775 | 99415.27163 | 6395012.977 | 64.32626369 |
| 2022 | 14 | 0.000443084 | 0.000442986 | 44.01999127 | 99349.09885 | 0.5 | 0.999557014 | 99371.10884 | 6295619.787 | 63.35462954 |
| 2022 | 15 | 0.000435071 | 0.000434976 | 43.2049098 | 99305.4864 | 0.5 | 0.999565024 | 99327.08885 | 6196270.688 | 62.38248558 |
| 2022 | 16 | 0.000420604 | 0.000420515 | 41.75039452 | 99263.00874 | 0.5 | 0.999579485 | 99283.88394 | 6096965.202 | 61.4094147 |
| 2022 | 17 | 0.00040071 | 0.00040063 | 39.75933517 | 99222.25388 | 0.5 | 0.99959937 | 99242.13355 | 5997702.193 | 60.43503882 |
| 2022 | 18 | 0.000376891 | 0.00037682 | 37.38141833 | 99183.6835 | 0.5 | 0.99962318 | 99202.37421 | 5898479.939 | 59.45906019 |
| 2022 | 19 | 0.000350846 | 0.000350785 | 34.78555867 | 99147.60001 | 0.5 | 0.999649215 | 99164.99279 | 5799296.256 | 58.48128551 |
| 2022 | 20 | 0.000324221 | 0.000324168 | 32.13488933 | 99114.13979 | 0.5 | 0.999675832 | 99130.20723 | 5700148.656 | 57.50163159 |
| 2022 | 21 | 0.000298426 | 0.000298381 | 29.56898988 | 99083.28785 | 0.5 | 0.999701619 | 99098.07234 | 5601034.516 | 56.52011572 |
| 2022 | 22 | 0.000274544 | 0.000274506 | 27.19494178 | 99054.90588 | 0.5 | 0.999725494 | 99068.50335 | 5501951.228 | 55.53683605 |
| 2022 | 23 | 0.000253322 | 0.00025329 | 25.08620592 | 99028.76531 | 0.5 | 0.99974671 | 99041.30841 | 5402896.322 | 54.55194816 |
| 2022 | 24 | 0.00023521 | 0.000235183 | 23.28691309 | 99004.57875 | 0.5 | 0.999764817 | 99016.22221 | 5303867.557 | 53.56564247 |
| 2022 | 25 | 0.000220433 | 0.000220409 | 21.81892894 | 98982.02583 | 0.5 | 0.999779591 | 98992.93529 | 5204862.978 | 52.57812553 |
| 2022 | 26 | 0.000209068 | 0.000209047 | 20.68957824 | 98960.77158 | 0.5 | 0.999790953 | 98971.11636 | 5105880.952 | 51.58960654 |
| 2022 | 27 | 0.000201118 | 0.000201098 | 19.89870524 | 98940.47743 | 0.5 | 0.999798902 | 98950.42679 | 5006920.181 | 50.60028889 |
| 2022 | 28 | 0.000196566 | 0.000196547 | 19.44447153 | 98920.80585 | 0.5 | 0.999803453 | 98930.52808 | 4907979.703 | 49.61036597 |
| 2022 | 29 | 0.000195425 | 0.000195406 | 19.32779778 | 98901.41971 | 0.5 | 0.999804594 | 98911.08361 | 4809058.898 | 48.62002035 |
| 2022 | 30 | 0.000197767 | 0.000197748 | 19.55562868 | 98881.978 | 0.5 | 0.999802252 | 98891.75581 | 4710157.478 | 47.62942511 |
| 2022 | 31 | 0.000203751 | 0.000203731 | 20.14329352 | 98862.12854 | 0.5 | 0.999796269 | 98872.20018 | 4611275.5 | 46.6387467 |
| 2022 | 32 | 0.000213637 | 0.000213614 | 21.11621514 | 98841.49878 | 0.5 | 0.999786386 | 98852.05689 | 4512413.371 | 45.64814849 |
| 2022 | 33 | 0.0002278 | 0.000227774 | 22.51114351 | 98819.6851 | 0.5 | 0.999772226 | 98830.94067 | 4413571.873 | 44.65779484 |
| 2022 | 34 | 0.00024674 | 0.00024671 | 24.37699316 | 98796.24103 | 0.5 | 0.99975329 | 98808.42953 | 4314752.187 | 43.66785514 |
| 2022 | 35 | 0.000271085 | 0.000271049 | 26.77526957 | 98770.6649 | 0.5 | 0.999728951 | 98784.05254 | 4215955.946 | 42.6785077 |
| 2022 | 36 | 0.000301593 | 0.000301547 | 29.77999389 | 98742.38727 | 0.5 | 0.999698453 | 98757.27727 | 4117185.282 | 41.68994322 |
| 2022 | 37 | 0.000339142 | 0.000339085 | 33.47699085 | 98710.75878 | 0.5 | 0.999660915 | 98727.49727 | 4018442.894 | 40.70236768 |
| 2022 | 38 | 0.000384721 | 0.000384647 | 37.96240567 | 98675.03908 | 0.5 | 0.999615353 | 98694.02028 | 3919732.135 | 39.71600432 |
| 2022 | 39 | 0.000439404 | 0.000439308 | 43.34037377 | 98634.38769 | 0.5 | 0.999560692 | 98656.05788 | 3821057.096 | 38.73109446 |
| 2022 | 40 | 0.000504321 | 0.000504193 | 49.71988942 | 98587.85756 | 0.5 | 0.999495807 | 98612.7175 | 3722422.709 | 37.74789706 |
| 2022 | 41 | 0.000580621 | 0.000580452 | 57.21109866 | 98534.39207 | 0.5 | 0.999419548 | 98562.99761 | 3623834.851 | 36.76668668 |
| 2022 | 42 | 0.000669438 | 0.000669214 | 65.92145417 | 98472.82579 | 0.5 | 0.999330786 | 98505.78652 | 3525300.459 | 35.78774998 |
| 2022 | 43 | 0.000771859 | 0.000771561 | 75.95236859 | 98401.88888 | 0.5 | 0.999228439 | 98439.86506 | 3426827.633 | 34.81138085 |
| 2022 | 44 | 0.000888903 | 0.000888508 | 87.39713054 | 98320.21413 | 0.5 | 0.999111492 | 98363.91269 | 3328425.744 | 33.83787462 |
| 2022 | 45 | 0.001021527 | 0.001021005 | 100.3408471 | 98226.34514 | 0.5 | 0.998978995 | 98276.51556 | 3230105.53 | 32.86752193 |
| 2022 | 46 | 0.001170653 | 0.001169968 | 114.8630121 | 98118.74321 | 0.5 | 0.998830032 | 98176.17472 | 3131879.185 | 31.90060312 |
| 2022 | 47 | 0.001337231 | 0.001336337 | 131.0429783 | 97995.79021 | 0.5 | 0.998663663 | 98061.3117 | 3033760.442 | 30.93738386 |
| 2022 | 48 | 0.001522324 | 0.001521166 | 148.9681769 | 97855.78464 | 0.5 | 0.998478834 | 97930.26873 | 2935764.652 | 29.9781129 |
| 2022 | 49 | 0.001727224 | 0.001725734 | 168.7444672 | 97696.92832 | 0.5 | 0.998274266 | 97781.30055 | 2837908.867 | 29.02302231 |
| 2022 | 50 | 0.001953577 | 0.001951671 | 190.5075962 | 97517.30228 | 0.5 | 0.998048329 | 97612.55608 | 2740211.939 | 28.07233054 |
| 2022 | 51 | 0.002203513 | 0.002201088 | 214.4344677 | 97314.83125 | 0.5 | 0.997798912 | 97422.04849 | 2642694.636 | 27.12624788 |
| 2022 | 52 | 0.002479757 | 0.002476686 | 240.7527757 | 97087.23763 | 0.5 | 0.997523314 | 97207.61402 | 2545379.805 | 26.18498387 |
| 2022 | 53 | 0.002785727 | 0.002781853 | 269.7475202 | 96831.98748 | 0.5 | 0.997218147 | 96966.86124 | 2448292.568 | 25.24875546 |
| 2022 | 54 | 0.003125579 | 0.003120702 | 301.7629189 | 96546.23226 | 0.5 | 0.996879298 | 96697.11372 | 2351460.58 | 24.31779491 |
| 2022 | 55 | 0.003504204 | 0.003498075 | 337.1981936 | 96226.75171 | 0.5 | 0.996501925 | 96395.3508 | 2254914.348 | 23.39235585 |
| 2022 | 56 | 0.003927151 | 0.003919455 | 376.4956183 | 95869.9048 | 0.5 | 0.996080545 | 96058.15261 | 2158687.596 | 22.47271614 |
| 2022 | 57 | 0.004400462 | 0.004390801 | 420.1191082 | 95471.59744 | 0.5 | 0.995609199 | 95681.65699 | 2062817.691 | 21.55917609 |
| 2022 | 58 | 0.004930391 | 0.004918267 | 468.5216626 | 95027.27705 | 0.5 | 0.995081733 | 95261.53788 | 1967346.094 | 20.65205053 |
| 2022 | 59 | 0.005523004 | 0.005507794 | 522.10039 | 94531.96602 | 0.5 | 0.994492206 | 94793.01622 | 1872318.817 | 19.75165357 |
| 2022 | 60 | 0.006183622 | 0.006164563 | 581.1389823 | 93980.34634 | 0.5 | 0.993835437 | 94270.91583 | 1777786.851 | 18.85827495 |
| 2022 | 61 | 0.006916152 | 0.006892318 | 645.739707 | 93366.90699 | 0.5 | 0.993107682 | 93689.77685 | 1683806.504 | 17.97214767 |
| 2022 | 62 | 0.007722301 | 0.007692599 | 715.7504479 | 92686.16192 | 0.5 | 0.992307401 | 93044.03714 | 1590439.597 | 17.09340702 |
| 2022 | 63 | 0.008600801 | 0.008563972 | 790.696902 | 91932.93824 | 0.5 | 0.991436028 | 92328.28669 | 1497753.436 | 16.22204299 |
| 2022 | 64 | 0.009546751 | 0.009501397 | 869.7349696 | 91102.72231 | 0.5 | 0.990498603 | 91537.58979 | 1405820.497 | 15.35784917 |
| 2022 | 65 | 0.010551288 | 0.010495915 | 951.6421349 | 90192.03375 | 0.5 | 0.989504085 | 90667.85482 | 1314717.775 | 14.50037367 |
| 2022 | 66 | 0.011601808 | 0.011534895 | 1034.867071 | 89198.77915 | 0.5 | 0.988465105 | 89716.21269 | 1224525.741 | 13.64887911 |
| 2022 | 67 | 0.012682929 | 0.012603007 | 1117.65166 | 88122.51978 | 0.5 | 0.987396993 | 88681.34561 | 1135326.962 | 12.80231997 |
| 2022 | 68 | 0.013778345 | 0.013684074 | 1198.228026 | 86964.57994 | 0.5 | 0.986315926 | 87563.69395 | 1047204.442 | 11.95934519 |
| 2022 | 69 | 0.014873523 | 0.014763729 | 1275.076311 | 85727.92777 | 0.5 | 0.985236271 | 86365.46593 | 960239.8624 | 11.11833129 |
| 2022 | 70 | 0.015959042 | 0.015832704 | 1347.210965 | 84416.78414 | 0.5 | 0.984167296 | 85090.38962 | 874511.9346 | 10.27744659 |
| 2022 | 71 | 0.017034192 | 0.016890335 | 1414.450372 | 83035.95347 | 0.5 | 0.983109665 | 83743.17865 | 790095.1505 | 9.434740396 |
| 2022 | 72 | 0.018110355 | 0.017947834 | 1477.622355 | 81589.9171 | 0.5 | 0.982052166 | 82328.72828 | 707059.197 | 8.588243883 |
| 2022 | 73 | 0.019213708 | 0.019030881 | 1538.667801 | 80081.77203 | 0.5 | 0.980969119 | 80851.10593 | 625469.2799 | 7.736063382 |
| 2022 | 74 | 0.020386932 | 0.020181216 | 1600.621425 | 78512.12741 | 0.5 | 0.979818784 | 79312.43813 | 545387.5079 | 6.876443604 |
| 2022 | 75 | 0.021689675 | 0.021456977 | 1667.46069 | 76878.08636 | 0.5 | 0.978543023 | 77711.8167 | 466875.3805 | 6.007778486 |
| 2022 | 76 | 0.023197394 | 0.022931419 | 1743.805003 | 75172.45351 | 0.5 | 0.977068581 | 76044.35601 | 389997.2941 | 5.128550159 |
| 2022 | 77 | 0.024997491 | 0.024688911 | 1834.39967 | 73383.35117 | 0.5 | 0.975311089 | 74300.55101 | 314824.8406 | 4.237180429 |
| 2022 | 78 | 0.027179938 | 0.026815516 | 1943.217253 | 71494.54271 | 0.5 | 0.973184484 | 72466.15134 | 241441.4894 | 3.331782977 |
| 2022 | 79 | 0.029816356 | 0.029378378 | 2071.849385 | 69487.00939 | 0.5 | 0.970621622 | 70522.93408 | 169946.9467 | 2.409811063 |
| 2022 | 80 | 0.032916536 | 0.032383559 | 2216.68971 | 67342.73984 | 0.5 | 0.967616441 | 68451.0847 | 100459.9373 | 1.467616441 |

Table 21: Male Life Table in 2018

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | Sex | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2018 | Male | 0 | 0.000692918 | 0.00069251 | 69.2509558 | 99940.99177 | 0.1479073 | 0.99930749 | 100000 | 7606231.514 | 76.06231514 |
| 2018 | Male | 1 | 0.000615938 | 0.000615748 | 61.5321898 | 99899.98295 | 0.5 | 0.999384252 | 99930.74904 | 7506290.522 | 75.11492302 |
| 2018 | Male | 2 | 0.000553216 | 0.000553063 | 55.23395549 | 99841.59988 | 0.5 | 0.999446937 | 99869.21685 | 7406390.539 | 74.16089534 |
| 2018 | Male | 3 | 0.000507455 | 0.000507327 | 50.63829344 | 99788.66375 | 0.5 | 0.999492673 | 99813.9829 | 7306548.939 | 73.20165699 |
| 2018 | Male | 4 | 0.000477524 | 0.00047741 | 47.62805067 | 99739.53058 | 0.5 | 0.99952259 | 99763.34461 | 7206760.275 | 72.2385592 |
| 2018 | Male | 5 | 0.000461019 | 0.000460912 | 45.96020465 | 99692.73645 | 0.5 | 0.999539088 | 99715.71655 | 7107020.745 | 71.27282429 |
| 2018 | Male | 6 | 0.000455313 | 0.000455209 | 45.37058862 | 99647.07106 | 0.5 | 0.999544791 | 99669.75635 | 7007328.008 | 70.3054594 |
| 2018 | Male | 7 | 0.000457856 | 0.000457751 | 45.60313854 | 99601.58419 | 0.5 | 0.999542249 | 99624.38576 | 6907680.937 | 69.33724996 |
| 2018 | Male | 8 | 0.000466168 | 0.000466059 | 46.40959735 | 99555.57782 | 0.5 | 0.999533941 | 99578.78262 | 6808079.353 | 68.36877469 |
| 2018 | Male | 9 | 0.00047778 | 0.000477666 | 47.54324171 | 99508.6014 | 0.5 | 0.999522334 | 99532.37303 | 6708523.775 | 67.4004203 |
| 2018 | Male | 10 | 0.000490222 | 0.000490102 | 48.7577413 | 99460.45091 | 0.5 | 0.999509898 | 99484.82978 | 6609015.174 | 66.43239163 |
| 2018 | Male | 11 | 0.000501103 | 0.000500978 | 49.81525981 | 99411.16441 | 0.5 | 0.999499022 | 99436.07204 | 6509554.723 | 65.46472109 |
| 2018 | Male | 12 | 0.000508279 | 0.00050815 | 50.50311637 | 99361.00522 | 0.5 | 0.99949185 | 99386.25678 | 6410143.559 | 64.49728329 |
| 2018 | Male | 13 | 0.000510064 | 0.000509934 | 50.65469645 | 99310.42632 | 0.5 | 0.999490066 | 99335.75367 | 6310782.553 | 63.52982003 |
| 2018 | Male | 14 | 0.000505422 | 0.000505295 | 50.16823169 | 99260.01485 | 0.5 | 0.999494705 | 99285.09897 | 6211472.127 | 62.56197749 |
| 2018 | Male | 15 | 0.000494074 | 0.000493952 | 49.01727024 | 99210.4221 | 0.5 | 0.999506048 | 99234.93074 | 6112212.112 | 61.59335293 |
| 2018 | Male | 16 | 0.000476483 | 0.00047637 | 47.24917092 | 99162.28888 | 0.5 | 0.99952363 | 99185.91347 | 6013001.69 | 60.62354502 |
| 2018 | Male | 17 | 0.000453728 | 0.000453625 | 44.97177501 | 99116.17841 | 0.5 | 0.999546375 | 99138.6643 | 5913839.401 | 59.6521997 |
| 2018 | Male | 18 | 0.000427282 | 0.000427191 | 42.33192899 | 99072.52656 | 0.5 | 0.999572809 | 99093.69252 | 5814723.223 | 58.6790448 |
| 2018 | Male | 19 | 0.000398776 | 0.000398696 | 39.49139332 | 99031.6149 | 0.5 | 0.999601304 | 99051.36059 | 5715650.696 | 57.70390898 |
| 2018 | Male | 20 | 0.000369776 | 0.000369708 | 36.60543646 | 98993.56648 | 0.5 | 0.999630292 | 99011.8692 | 5616619.081 | 56.72672505 |
| 2018 | Male | 21 | 0.000341635 | 0.000341576 | 33.8076118 | 98958.35996 | 0.5 | 0.999658424 | 98975.26376 | 5517625.515 | 55.74752019 |
| 2018 | Male | 22 | 0.000315407 | 0.000315357 | 31.20187558 | 98925.85521 | 0.5 | 0.999684643 | 98941.45615 | 5418667.155 | 54.76639788 |
| 2018 | Male | 23 | 0.000291835 | 0.000291792 | 28.8612552 | 98895.82365 | 0.5 | 0.999708208 | 98910.25428 | 5319741.3 | 53.78351657 |
| 2018 | Male | 24 | 0.000271384 | 0.000271347 | 26.83118872 | 98867.97743 | 0.5 | 0.999728653 | 98881.39302 | 5220845.476 | 52.79906883 |
| 2018 | Male | 25 | 0.000254299 | 0.000254267 | 25.13542788 | 98841.99412 | 0.5 | 0.999745733 | 98854.56183 | 5121977.499 | 51.81326389 |
| 2018 | Male | 26 | 0.000240673 | 0.000240644 | 23.78274493 | 98817.53503 | 0.5 | 0.999759356 | 98829.4264 | 5023135.504 | 50.82631446 |
| 2018 | Male | 27 | 0.000230512 | 0.000230486 | 22.7732712 | 98794.25702 | 0.5 | 0.999769514 | 98805.64366 | 4924317.969 | 49.83842812 |
| 2018 | Male | 28 | 0.000223787 | 0.000223762 | 22.10386945 | 98771.81845 | 0.5 | 0.999776238 | 98782.87039 | 4825523.712 | 48.84980254 |
| 2018 | Male | 29 | 0.00022048 | 0.000220456 | 21.77237348 | 98749.88033 | 0.5 | 0.999779544 | 98760.76652 | 4726751.894 | 47.86062381 |
| 2018 | Male | 30 | 0.000220614 | 0.00022059 | 21.78078957 | 98728.10375 | 0.5 | 0.99977941 | 98738.99415 | 4628002.014 | 46.87106704 |
| 2018 | Male | 31 | 0.000224279 | 0.000224253 | 22.13767237 | 98706.14452 | 0.5 | 0.999775747 | 98717.21336 | 4529273.91 | 45.88129826 |
| 2018 | Male | 32 | 0.000231648 | 0.000231622 | 22.85990964 | 98683.64573 | 0.5 | 0.999768378 | 98695.07568 | 4430567.765 | 44.89147746 |
| 2018 | Male | 33 | 0.000242997 | 0.000242967 | 23.97411824 | 98660.22871 | 0.5 | 0.999757033 | 98672.21577 | 4331884.12 | 43.90176187 |
| 2018 | Male | 34 | 0.000258708 | 0.000258675 | 25.51779808 | 98635.48276 | 0.5 | 0.999741325 | 98648.24166 | 4233223.891 | 42.91230964 |
| 2018 | Male | 35 | 0.000279288 | 0.000279249 | 27.54033236 | 98608.95369 | 0.5 | 0.999720751 | 98622.72386 | 4134588.408 | 41.92328346 |
| 2018 | Male | 36 | 0.000305375 | 0.000305328 | 30.10387053 | 98580.13159 | 0.5 | 0.999694672 | 98595.18352 | 4035979.454 | 40.93485412 |
| 2018 | Male | 37 | 0.000337743 | 0.000337686 | 33.28409189 | 98548.43761 | 0.5 | 0.999662314 | 98565.07965 | 3937399.323 | 39.94720378 |
| 2018 | Male | 38 | 0.000377318 | 0.000377247 | 37.17082703 | 98513.21015 | 0.5 | 0.999622753 | 98531.79556 | 3838850.885 | 38.96052907 |
| 2018 | Male | 39 | 0.000425175 | 0.000425084 | 41.86851354 | 98473.69048 | 0.5 | 0.999574916 | 98494.62474 | 3740337.675 | 37.97504366 |
| 2018 | Male | 40 | 0.000482546 | 0.000482429 | 47.49648357 | 98429.00798 | 0.5 | 0.999517571 | 98452.75622 | 3641863.985 | 36.99098049 |
| 2018 | Male | 41 | 0.000550825 | 0.000550673 | 54.18912372 | 98378.16518 | 0.5 | 0.999449327 | 98405.25974 | 3543434.977 | 36.0085933 |
| 2018 | Male | 42 | 0.00063157 | 0.000631371 | 62.0960065 | 98320.02261 | 0.5 | 0.999368629 | 98351.07061 | 3445056.811 | 35.0281577 |
| 2018 | Male | 43 | 0.000726512 | 0.000726248 | 71.38215807 | 98253.28353 | 0.5 | 0.999273752 | 98288.97461 | 3346736.789 | 34.04997155 |
| 2018 | Male | 44 | 0.00083756 | 0.000837209 | 82.22868362 | 98176.47811 | 0.5 | 0.999162791 | 98217.59245 | 3248483.505 | 33.07435485 |
| 2018 | Male | 45 | 0.000966826 | 0.000966359 | 94.83400164 | 98087.94677 | 0.5 | 0.999033641 | 98135.36377 | 3150307.027 | 32.10164926 |
| 2018 | Male | 46 | 0.001116651 | 0.001116027 | 109.4159226 | 97985.8218 | 0.5 | 0.998883973 | 98040.52976 | 3052219.08 | 31.13221734 |
| 2018 | Male | 47 | 0.001289642 | 0.001288811 | 126.2147328 | 97868.00648 | 0.5 | 0.998711189 | 97931.11384 | 2954233.259 | 30.16644193 |
| 2018 | Male | 48 | 0.001488735 | 0.001487628 | 145.4973021 | 97732.15046 | 0.5 | 0.998512372 | 97804.89911 | 2856365.252 | 29.20472572 |
| 2018 | Male | 49 | 0.001717253 | 0.00171578 | 167.5620277 | 97575.62079 | 0.5 | 0.99828422 | 97659.40181 | 2758633.102 | 28.24749129 |
| 2018 | Male | 50 | 0.001978985 | 0.001977029 | 192.7441626 | 97395.4677 | 0.5 | 0.998022971 | 97491.83978 | 2661057.481 | 27.2951817 |
| 2018 | Male | 51 | 0.002278264 | 0.002275671 | 221.4207695 | 97188.38523 | 0.5 | 0.997724329 | 97299.09562 | 2563662.013 | 26.34826148 |
| 2018 | Male | 52 | 0.002620036 | 0.002616608 | 254.0142039 | 96950.66775 | 0.5 | 0.997383392 | 97077.67485 | 2466473.628 | 25.4072178 |
| 2018 | Male | 53 | 0.003009911 | 0.003005388 | 290.9926794 | 96678.1643 | 0.5 | 0.996994612 | 96823.66064 | 2369522.96 | 24.4725612 |
| 2018 | Male | 54 | 0.003454178 | 0.003448223 | 332.8661271 | 96366.2349 | 0.5 | 0.996551777 | 96532.66796 | 2272844.796 | 23.54482523 |
| 2018 | Male | 55 | 0.003959758 | 0.003951934 | 380.1752739 | 96009.7142 | 0.5 | 0.996048066 | 96199.80184 | 2176478.561 | 22.62456387 |
| 2018 | Male | 56 | 0.004534086 | 0.00452383 | 433.471703 | 95602.89071 | 0.5 | 0.99547617 | 95819.62656 | 2080468.847 | 21.7123456 |
| 2018 | Male | 57 | 0.005184878 | 0.005171471 | 493.2867649 | 95139.51148 | 0.5 | 0.994828529 | 95386.15486 | 1984865.956 | 20.80874273 |
| 2018 | Male | 58 | 0.005919787 | 0.005902316 | 560.0877408 | 94612.82422 | 0.5 | 0.994097684 | 94892.86809 | 1889726.445 | 19.91431477 |
| 2018 | Male | 59 | 0.006745906 | 0.006723229 | 634.2208716 | 94015.66992 | 0.5 | 0.993276771 | 94332.78035 | 1795113.62 | 19.02958456 |
| 2018 | Male | 60 | 0.007669145 | 0.00763985 | 715.8429332 | 93340.63802 | 0.5 | 0.99236015 | 93698.55948 | 1701097.95 | 18.15500644 |
| 2018 | Male | 61 | 0.008693492 | 0.008655867 | 804.8460728 | 92580.29351 | 0.5 | 0.991344133 | 92982.71655 | 1607757.312 | 17.29092644 |
| 2018 | Male | 62 | 0.009820224 | 0.009772241 | 900.7844099 | 91727.47827 | 0.5 | 0.990227759 | 92177.87048 | 1515177.019 | 16.43753551 |
| 2018 | Male | 63 | 0.011047176 | 0.010986491 | 1002.814854 | 90775.67864 | 0.5 | 0.989013509 | 91277.08607 | 1423449.541 | 15.59481796 |
| 2018 | Male | 64 | 0.012368195 | 0.012292179 | 1109.667537 | 89719.43744 | 0.5 | 0.987707821 | 90274.27121 | 1332673.862 | 14.76249926 |
| 2018 | Male | 65 | 0.013772963 | 0.013678765 | 1219.661645 | 88554.77285 | 0.5 | 0.986321235 | 89164.60368 | 1242954.425 | 13.93999831 |
| 2018 | Male | 66 | 0.015247313 | 0.015131952 | 1330.778674 | 87279.55269 | 0.5 | 0.984868048 | 87944.94203 | 1154399.652 | 13.1263905 |
| 2018 | Male | 67 | 0.016774166 | 0.01663465 | 1440.796252 | 85893.76523 | 0.5 | 0.98336535 | 86614.16336 | 1067120.099 | 12.320388 |
| 2018 | Male | 68 | 0.018335058 | 0.018168498 | 1547.472144 | 84399.63103 | 0.5 | 0.981831502 | 85173.3671 | 981226.3338 | 11.52034218 |
| 2018 | Male | 69 | 0.0199121 | 0.019715808 | 1648.752116 | 82801.5189 | 0.5 | 0.980284192 | 83625.89496 | 896826.7028 | 10.72427031 |
| 2018 | Male | 70 | 0.021490002 | 0.021261547 | 1742.960836 | 81105.66242 | 0.5 | 0.978738453 | 81977.14284 | 814025.1839 | 9.929904308 |
| 2018 | Male | 71 | 0.023057643 | 0.022794845 | 1828.925771 | 79319.71912 | 0.5 | 0.977205155 | 80234.18201 | 732919.5215 | 9.13475408 |
| 2018 | Male | 72 | 0.02460848 | 0.024309372 | 1905.982535 | 77452.26497 | 0.5 | 0.975690628 | 78405.25624 | 653599.8024 | 8.336173284 |
| 2018 | Male | 73 | 0.026138973 | 0.025801757 | 1973.815678 | 75512.36586 | 0.5 | 0.974198243 | 76499.2737 | 576147.5374 | 7.531411862 |
| 2018 | Male | 74 | 0.027644059 | 0.027267171 | 2032.098431 | 73509.40881 | 0.5 | 0.972732829 | 74525.45802 | 500635.1715 | 6.717639647 |
| 2018 | Male | 75 | 0.029108561 | 0.028690984 | 2079.905814 | 71453.40668 | 0.5 | 0.971309016 | 72493.35959 | 427125.7627 | 5.891929483 |
| 2018 | Male | 76 | 0.030493274 | 0.030035336 | 2114.891776 | 69356.00789 | 0.5 | 0.969964664 | 70413.45378 | 355672.356 | 5.05119884 |
| 2018 | Male | 77 | 0.031714777 | 0.031219714 | 2132.261583 | 67232.43121 | 0.5 | 0.968780286 | 68298.562 | 286316.3481 | 4.192128498 |
| 2018 | Male | 78 | 0.03261956 | 0.03209608 | 2123.678889 | 65104.46097 | 0.5 | 0.96790392 | 66166.30042 | 219083.9169 | 3.311110271 |
| 2018 | Male | 79 | 0.032957907 | 0.0324236 | 2076.492313 | 63004.37537 | 0.5 | 0.9675764 | 64042.62153 | 153979.456 | 2.40432781 |
| 2018 | Male | 80 | 0.032373619 | 0.03185794 | 1974.113237 | 60979.0726 | 0.5 | 0.96814206 | 61966.12922 | 90975.08059 | 1.46814206 |

## Table 22: Male Life Table in 2019

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | Sex | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2019 | Male | 0 | 0.000803777 | 0.000803227 | 80.32271554 | 99931.53983 | 0.1476861 | 0.999196773 | 100000 | 7531438.821 | 75.31438821 |
| 2019 | Male | 1 | 0.000714481 | 0.000714226 | 71.36520963 | 99883.99468 | 0.5 | 0.999285774 | 99919.67728 | 7431507.282 | 74.37481269 |
| 2019 | Male | 2 | 0.000641724 | 0.000641518 | 64.05450826 | 99816.28482 | 0.5 | 0.999358482 | 99848.31207 | 7331623.287 | 73.42761369 |
| 2019 | Male | 3 | 0.000588642 | 0.000588469 | 58.71996219 | 99754.89759 | 0.5 | 0.999411531 | 99784.25757 | 7231807.002 | 72.47442812 |
| 2019 | Male | 4 | 0.000553923 | 0.000553769 | 55.22494517 | 99697.92513 | 0.5 | 0.999446231 | 99725.5376 | 7132052.105 | 71.51680779 |
| 2019 | Male | 5 | 0.000534776 | 0.000534633 | 53.28706911 | 99643.66912 | 0.5 | 0.999465367 | 99670.31266 | 7032354.179 | 70.55615651 |
| 2019 | Male | 6 | 0.000528158 | 0.000528018 | 52.59960215 | 99590.72579 | 0.5 | 0.999471982 | 99617.02559 | 6932710.51 | 69.5936309 |
| 2019 | Male | 7 | 0.000531107 | 0.000530966 | 52.865343 | 99537.99332 | 0.5 | 0.999469034 | 99564.42599 | 6833119.784 | 68.63013287 |
| 2019 | Male | 8 | 0.000540749 | 0.000540603 | 53.79625212 | 99484.66252 | 0.5 | 0.999459397 | 99511.56064 | 6733581.791 | 67.66632688 |
| 2019 | Male | 9 | 0.00055422 | 0.000554066 | 55.10616862 | 99430.21131 | 0.5 | 0.999445934 | 99457.76439 | 6634097.129 | 66.70265684 |
| 2019 | Male | 10 | 0.000568652 | 0.000568491 | 56.50948844 | 99374.40348 | 0.5 | 0.999431509 | 99402.65822 | 6534666.917 | 65.73935782 |
| 2019 | Male | 11 | 0.000581274 | 0.000581105 | 57.73055827 | 99317.28346 | 0.5 | 0.999418895 | 99346.14874 | 6435292.514 | 64.77646689 |
| 2019 | Male | 12 | 0.000589598 | 0.000589424 | 58.52298485 | 99259.15669 | 0.5 | 0.999410576 | 99288.41818 | 6335975.23 | 63.81383999 |
| 2019 | Male | 13 | 0.000591669 | 0.000591494 | 58.69385428 | 99200.54827 | 0.5 | 0.999408506 | 99229.89519 | 6236716.074 | 62.8511807 |
| 2019 | Male | 14 | 0.000586284 | 0.000586112 | 58.12546318 | 99142.13861 | 0.5 | 0.999413888 | 99171.20134 | 6137515.525 | 61.88808286 |
| 2019 | Male | 15 | 0.00057312 | 0.000572956 | 56.78740603 | 99084.68217 | 0.5 | 0.999427044 | 99113.07588 | 6038373.387 | 60.92408427 |
| 2019 | Male | 16 | 0.000552715 | 0.000552562 | 54.7347808 | 99028.92108 | 0.5 | 0.999447438 | 99056.28847 | 5939288.705 | 59.95872444 |
| 2019 | Male | 17 | 0.000526319 | 0.000526181 | 52.09270425 | 98975.50734 | 0.5 | 0.999473819 | 99001.55369 | 5840259.784 | 58.99159726 |
| 2019 | Male | 18 | 0.000495642 | 0.00049552 | 49.03140354 | 98924.94528 | 0.5 | 0.99950448 | 98949.46098 | 5741284.276 | 58.02239061 |
| 2019 | Male | 19 | 0.000462575 | 0.000462468 | 45.73830059 | 98877.56043 | 0.5 | 0.999537532 | 98900.42958 | 5642359.331 | 57.05090822 |
| 2019 | Male | 20 | 0.000428936 | 0.000428844 | 42.39322504 | 98833.49467 | 0.5 | 0.999571156 | 98854.69128 | 5543481.771 | 56.07707332 |
| 2019 | Male | 21 | 0.000396292 | 0.000396214 | 39.15080032 | 98792.72265 | 0.5 | 0.999603786 | 98812.29805 | 5444648.276 | 55.10091743 |
| 2019 | Male | 22 | 0.000365868 | 0.000365801 | 36.13133643 | 98755.08159 | 0.5 | 0.999634199 | 98773.14725 | 5345855.553 | 54.12255964 |
| 2019 | Male | 23 | 0.000338525 | 0.000338468 | 33.41930727 | 98720.30626 | 0.5 | 0.999661532 | 98737.01592 | 5247100.472 | 53.14218202 |
| 2019 | Male | 24 | 0.000314802 | 0.000314753 | 31.06723304 | 98688.06299 | 0.5 | 0.999685247 | 98703.59661 | 5148380.165 | 52.16000574 |
| 2019 | Male | 25 | 0.000294984 | 0.000294941 | 29.10252567 | 98657.97812 | 0.5 | 0.999705059 | 98672.52938 | 5049692.102 | 51.17627099 |
| 2019 | Male | 26 | 0.000279178 | 0.000279139 | 27.53525993 | 98629.65922 | 0.5 | 0.999720861 | 98643.42685 | 4951034.124 | 50.19122188 |
| 2019 | Male | 27 | 0.000267391 | 0.000267356 | 26.36551452 | 98602.70884 | 0.5 | 0.999732644 | 98615.89159 | 4852404.465 | 49.20509653 |
| 2019 | Male | 28 | 0.000259591 | 0.000259557 | 25.58959171 | 98576.73128 | 0.5 | 0.999740443 | 98589.52608 | 4753801.756 | 48.21812159 |
| 2019 | Male | 29 | 0.000255754 | 0.000255722 | 25.20492393 | 98551.33402 | 0.5 | 0.999744278 | 98563.93649 | 4655225.025 | 47.23051038 |
| 2019 | Male | 30 | 0.00025591 | 0.000255877 | 25.21377719 | 98526.12467 | 0.5 | 0.999744123 | 98538.73156 | 4556673.691 | 46.24246343 |
| 2019 | Male | 31 | 0.000260161 | 0.000260127 | 25.62599819 | 98500.70479 | 0.5 | 0.999739873 | 98513.51778 | 4458147.566 | 45.25417086 |
| 2019 | Male | 32 | 0.000268709 | 0.000268673 | 26.46107633 | 98474.66125 | 0.5 | 0.999731327 | 98487.89179 | 4359646.861 | 44.26581565 |
| 2019 | Male | 33 | 0.000281873 | 0.000281834 | 27.74975477 | 98447.55583 | 0.5 | 0.999718166 | 98461.43071 | 4261172.2 | 43.27757752 |
| 2019 | Male | 34 | 0.000300098 | 0.000300053 | 29.53536032 | 98418.91328 | 0.5 | 0.999699947 | 98433.68096 | 4162724.644 | 42.28963708 |
| 2019 | Male | 35 | 0.000323971 | 0.000323919 | 31.87495378 | 98388.20812 | 0.5 | 0.999676081 | 98404.1456 | 4064305.731 | 41.30217997 |
| 2019 | Male | 36 | 0.000354231 | 0.000354168 | 34.84034225 | 98354.85047 | 0.5 | 0.999645832 | 98372.27064 | 3965917.523 | 40.31540085 |
| 2019 | Male | 37 | 0.000391779 | 0.000391702 | 38.51895045 | 98318.17082 | 0.5 | 0.999608298 | 98337.4303 | 3867562.672 | 39.32950719 |
| 2019 | Male | 38 | 0.000437685 | 0.000437589 | 43.0145234 | 98277.40409 | 0.5 | 0.999562411 | 98298.91135 | 3769244.502 | 38.34472274 |
| 2019 | Male | 39 | 0.000493198 | 0.000493076 | 48.44763204 | 98231.67301 | 0.5 | 0.999506924 | 98255.89683 | 3670967.098 | 37.36129043 |
| 2019 | Male | 40 | 0.000559747 | 0.000559591 | 54.95597737 | 98179.9712 | 0.5 | 0.999440409 | 98207.44919 | 3572735.425 | 36.37947481 |
| 2019 | Male | 41 | 0.00063895 | 0.000638746 | 62.69453817 | 98121.14595 | 0.5 | 0.999361254 | 98152.49322 | 3474555.453 | 35.39956388 |
| 2019 | Male | 42 | 0.000732614 | 0.000732346 | 71.83567458 | 98053.88084 | 0.5 | 0.999267654 | 98089.79868 | 3376434.307 | 34.42187009 |
| 2019 | Male | 43 | 0.000842745 | 0.00084239 | 82.56937521 | 97976.67832 | 0.5 | 0.99915761 | 98017.963 | 3278380.427 | 33.44673085 |
| 2019 | Male | 44 | 0.00097156 | 0.000971088 | 95.10390032 | 97887.84168 | 0.5 | 0.999028912 | 97935.39363 | 3180403.748 | 32.47450825 |
| 2019 | Male | 45 | 0.001121507 | 0.001120879 | 109.6671065 | 97785.45617 | 0.5 | 0.998879121 | 97840.28973 | 3082515.907 | 31.5055885 |
| 2019 | Male | 46 | 0.001295302 | 0.001294463 | 126.5087192 | 97667.36826 | 0.5 | 0.998705537 | 97730.62262 | 2984730.45 | 30.540381 |
| 2019 | Male | 47 | 0.00149597 | 0.001494852 | 145.9037301 | 97531.16204 | 0.5 | 0.998505148 | 97604.1139 | 2887063.082 | 29.57931758 |
| 2019 | Male | 48 | 0.001726916 | 0.001725426 | 168.1569299 | 97374.13171 | 0.5 | 0.998274574 | 97458.21017 | 2789531.92 | 28.62285194 |
| 2019 | Male | 49 | 0.001991994 | 0.001990012 | 193.6083442 | 97193.24907 | 0.5 | 0.998009988 | 97290.05324 | 2692157.788 | 27.67145971 |
| 2019 | Male | 50 | 0.0022956 | 0.002292968 | 222.6390316 | 96985.12538 | 0.5 | 0.997707032 | 97096.4449 | 2594964.539 | 26.72563905 |
| 2019 | Male | 51 | 0.00264276 | 0.002639272 | 255.6763445 | 96745.96769 | 0.5 | 0.997360728 | 96873.80587 | 2497979.414 | 25.7859118 |
| 2019 | Male | 52 | 0.003039211 | 0.0030346 | 293.1973588 | 96471.53084 | 0.5 | 0.9969654 | 96618.12952 | 2401233.446 | 24.85282481 |
| 2019 | Male | 53 | 0.003491462 | 0.003485378 | 335.7287747 | 96157.06778 | 0.5 | 0.996514622 | 96324.93216 | 2304761.915 | 23.92695083 |
| 2019 | Male | 54 | 0.004006807 | 0.003998796 | 383.8412005 | 95797.28279 | 0.5 | 0.996001204 | 95989.20339 | 2208604.848 | 23.00888818 |
| 2019 | Male | 55 | 0.004593274 | 0.004582749 | 438.1354104 | 95386.29448 | 0.5 | 0.995417251 | 95605.36219 | 2112807.565 | 22.099258 |
| 2019 | Male | 56 | 0.005259487 | 0.005245693 | 499.2180091 | 94917.61777 | 0.5 | 0.994754307 | 95167.22678 | 2017421.27 | 21.19869769 |
| 2019 | Male | 57 | 0.006014399 | 0.005996367 | 567.6640931 | 94384.17672 | 0.5 | 0.994003633 | 94668.00877 | 1922503.653 | 20.30784927 |
| 2019 | Male | 58 | 0.006866885 | 0.006843388 | 643.9651868 | 93778.36208 | 0.5 | 0.993156612 | 94100.34468 | 1828119.476 | 19.42734091 |
| 2019 | Male | 59 | 0.007825173 | 0.007794676 | 728.4622054 | 93092.14839 | 0.5 | 0.992205324 | 93456.37949 | 1734341.114 | 18.55776056 |
| 2019 | Male | 60 | 0.008896121 | 0.008856725 | 821.2656981 | 92317.28443 | 0.5 | 0.991143275 | 92727.91728 | 1641248.965 | 17.69962071 |
| 2019 | Male | 61 | 0.010084351 | 0.010033759 | 922.1692131 | 91445.56698 | 0.5 | 0.989966241 | 91906.65158 | 1548931.681 | 16.85331425 |
| 2019 | Male | 62 | 0.011391347 | 0.011326833 | 1030.56607 | 90469.19934 | 0.5 | 0.988673167 | 90984.48237 | 1457486.114 | 16.01906255 |
| 2019 | Male | 63 | 0.012814597 | 0.012733012 | 1145.384333 | 89381.22414 | 0.5 | 0.987266988 | 89953.9163 | 1367016.915 | 15.19685825 |
| 2019 | Male | 64 | 0.014346965 | 0.01424478 | 1265.05799 | 88176.00297 | 0.5 | 0.98575522 | 88808.53197 | 1277635.691 | 14.38640705 |
| 2019 | Male | 65 | 0.015976479 | 0.015849867 | 1387.552394 | 86849.69778 | 0.5 | 0.984150133 | 87543.47398 | 1189459.688 | 13.58707432 |
| 2019 | Male | 66 | 0.017686708 | 0.017531669 | 1510.457124 | 85400.69302 | 0.5 | 0.982468331 | 86155.92159 | 1102609.99 | 12.79784337 |
| 2019 | Male | 67 | 0.019457839 | 0.01927036 | 1631.148544 | 83829.89019 | 0.5 | 0.98072964 | 84645.46446 | 1017209.297 | 12.0172924 |
| 2019 | Male | 68 | 0.021268457 | 0.021044663 | 1747.008302 | 82140.81177 | 0.5 | 0.978955337 | 83014.31592 | 933379.4065 | 11.24359571 |
| 2019 | Male | 69 | 0.023097807 | 0.022834098 | 1855.665685 | 80339.47477 | 0.5 | 0.977165902 | 81267.30762 | 851238.5948 | 10.47455145 |
| 2019 | Male | 70 | 0.024928155 | 0.024621274 | 1955.21577 | 78434.03405 | 0.5 | 0.975378726 | 79411.64193 | 770899.12 | 9.707633557 |
| 2019 | Male | 71 | 0.026746601 | 0.026393631 | 2044.356329 | 76434.248 | 0.5 | 0.973606369 | 77456.42616 | 692465.086 | 8.940059854 |
| 2019 | Male | 72 | 0.028545554 | 0.028143863 | 2122.386977 | 74350.87634 | 0.5 | 0.971856137 | 75412.06983 | 616030.838 | 8.168862615 |
| 2019 | Male | 73 | 0.030320908 | 0.029868094 | 2189.023149 | 72195.17128 | 0.5 | 0.970131906 | 73289.68285 | 541679.9616 | 7.390944271 |
| 2019 | Male | 74 | 0.032066791 | 0.031560764 | 2243.991173 | 69978.66412 | 0.5 | 0.968439236 | 71100.65971 | 469484.7903 | 6.603100341 |
| 2019 | Male | 75 | 0.033765596 | 0.033205002 | 2286.385838 | 67713.47561 | 0.5 | 0.966794998 | 68856.66853 | 399506.1262 | 5.801996157 |
| 2019 | Male | 76 | 0.035371848 | 0.034757136 | 2313.79235 | 65413.38652 | 0.5 | 0.965242864 | 66570.28269 | 331792.6506 | 4.984095563 |
| 2019 | Male | 77 | 0.036788777 | 0.036124293 | 2321.220276 | 63095.88021 | 0.5 | 0.963875707 | 64256.49034 | 266379.2641 | 4.145561992 |
| 2019 | Male | 78 | 0.037838315 | 0.037135738 | 2300.01197 | 60785.26408 | 0.5 | 0.962864262 | 61935.27007 | 203283.3839 | 3.282190966 |
| 2019 | Male | 79 | 0.038230793 | 0.037513703 | 2237.139387 | 58516.68841 | 0.5 | 0.962486297 | 59635.2581 | 142498.1198 | 2.389494476 |
| 2019 | Male | 80 | 0.037553025 | 0.036860906 | 2115.746669 | 56340.24538 | 0.5 | 0.963139094 | 57398.11871 | 83981.4314 | 1.463139094 |

Table 23: Male Life Table in 2020

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | Sex | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | Male | 0 | 0.000932373 | 0.000931632 | 93.16320054 | 99920.5718 | 0.1474295 | 0.999068368 | 100000 | 7448257.766 | 74.48257766 |
| 2020 | Male | 1 | 0.00082879 | 0.000828446 | 82.76745585 | 99865.45307 | 0.5 | 0.999171554 | 99906.8368 | 7348337.195 | 73.55189525 |
| 2020 | Male | 2 | 0.000744392 | 0.000744116 | 74.28064113 | 99786.92902 | 0.5 | 0.999255884 | 99824.06934 | 7248471.742 | 72.612465 |
| 2020 | Male | 3 | 0.000682818 | 0.000682585 | 68.08774701 | 99715.74483 | 0.5 | 0.999317415 | 99749.7887 | 7148684.813 | 71.66616497 |
| 2020 | Male | 4 | 0.000642544 | 0.000642338 | 64.02930609 | 99649.6863 | 0.5 | 0.999357662 | 99681.70096 | 7048969.068 | 70.71477513 |
| 2020 | Male | 5 | 0.000620334 | 0.000620142 | 61.77709935 | 99586.7831 | 0.5 | 0.999379858 | 99617.67165 | 6949319.381 | 69.75990571 |
| 2020 | Male | 6 | 0.000612657 | 0.000612469 | 60.97491599 | 99525.40709 | 0.5 | 0.999387531 | 99555.89455 | 6849732.598 | 68.80288334 |
| 2020 | Male | 7 | 0.000616078 | 0.000615889 | 61.27777756 | 99464.28075 | 0.5 | 0.999384111 | 99494.91963 | 6750207.191 | 67.84474239 |
| 2020 | Male | 8 | 0.000627263 | 0.000627066 | 62.3514754 | 99402.46612 | 0.5 | 0.999372934 | 99433.64186 | 6650742.911 | 66.8862448 |
| 2020 | Male | 9 | 0.000642888 | 0.000642682 | 63.86411391 | 99339.35832 | 0.5 | 0.999357318 | 99371.29038 | 6551340.444 | 65.92789949 |
| 2020 | Male | 10 | 0.00065963 | 0.000659413 | 65.4845791 | 99274.68398 | 0.5 | 0.999340587 | 99307.42627 | 6452001.086 | 64.96997585 |
| 2020 | Male | 11 | 0.000674271 | 0.000674044 | 66.89343112 | 99208.49497 | 0.5 | 0.999325956 | 99241.94169 | 6352726.402 | 64.01251622 |
| 2020 | Male | 12 | 0.000683927 | 0.000683693 | 67.80527886 | 99141.14562 | 0.5 | 0.999316307 | 99175.04826 | 6253517.907 | 63.05535532 |
| 2020 | Male | 13 | 0.000686329 | 0.000686093 | 67.99682417 | 99073.24457 | 0.5 | 0.999313907 | 99107.24298 | 6154376.761 | 62.09815324 |
| 2020 | Male | 14 | 0.000680083 | 0.000679852 | 67.33199816 | 99005.58015 | 0.5 | 0.999320148 | 99039.24615 | 6055303.517 | 61.14044434 |
| 2020 | Male | 15 | 0.000664813 | 0.000664592 | 65.7759044 | 98939.0262 | 0.5 | 0.999335408 | 98971.91416 | 5956297.937 | 60.18169889 |
| 2020 | Male | 16 | 0.000641143 | 0.000640938 | 63.39267338 | 98874.44191 | 0.5 | 0.999359062 | 98906.13825 | 5857358.911 | 59.22138923 |
| 2020 | Male | 17 | 0.000610524 | 0.000610338 | 60.32746825 | 98812.58184 | 0.5 | 0.999389662 | 98842.74558 | 5758484.469 | 58.25905012 |
| 2020 | Male | 18 | 0.00057494 | 0.000574774 | 56.77759821 | 98754.02931 | 0.5 | 0.999425226 | 98782.41811 | 5659671.887 | 57.29432418 |
| 2020 | Male | 19 | 0.000536582 | 0.000536438 | 52.96017678 | 98699.16042 | 0.5 | 0.999463562 | 98725.64051 | 5560917.857 | 56.32698688 |
| 2020 | Male | 20 | 0.000497561 | 0.000497437 | 49.08342793 | 98648.13862 | 0.5 | 0.999502563 | 98672.68033 | 5462218.697 | 55.35695066 |
| 2020 | Male | 21 | 0.000459695 | 0.000459589 | 45.32631407 | 98600.93375 | 0.5 | 0.999540411 | 98623.59691 | 5363570.558 | 54.38425211 |
| 2020 | Male | 22 | 0.000424403 | 0.000424313 | 41.82801993 | 98557.35658 | 0.5 | 0.999575687 | 98578.27059 | 5264969.625 | 53.40902811 |
| 2020 | Male | 23 | 0.000392685 | 0.000392608 | 38.686216 | 98517.09946 | 0.5 | 0.999607392 | 98536.44257 | 5166412.268 | 52.43148761 |
| 2020 | Male | 24 | 0.000365167 | 0.0003651 | 35.96157354 | 98479.77557 | 0.5 | 0.9996349 | 98497.75636 | 5067895.169 | 51.45188435 |
| 2020 | Male | 25 | 0.000342178 | 0.00034212 | 33.6857024 | 98444.95193 | 0.5 | 0.99965788 | 98461.79478 | 4969415.393 | 50.4704937 |
| 2020 | Male | 26 | 0.000323844 | 0.000323791 | 31.87015384 | 98412.174 | 0.5 | 0.999676209 | 98428.10908 | 4870970.441 | 49.48759543 |
| 2020 | Male | 27 | 0.000310171 | 0.000310123 | 30.51492042 | 98380.98147 | 0.5 | 0.999689877 | 98396.23893 | 4772558.267 | 48.50346232 |
| 2020 | Male | 28 | 0.000301122 | 0.000301077 | 29.61563436 | 98350.91619 | 0.5 | 0.999698923 | 98365.72401 | 4674177.286 | 47.51835391 |
| 2020 | Male | 29 | 0.000296672 | 0.000296628 | 29.16924379 | 98321.52375 | 0.5 | 0.999703372 | 98336.10837 | 4575826.369 | 46.5325143 |
| 2020 | Male | 30 | 0.000296852 | 0.000296808 | 29.17829523 | 98292.34998 | 0.5 | 0.999703192 | 98306.93913 | 4477504.846 | 45.54617289 |
| 2020 | Male | 31 | 0.000301783 | 0.000301738 | 29.65410806 | 98262.93378 | 0.5 | 0.999698262 | 98277.76083 | 4379212.496 | 44.55954693 |
| 2020 | Male | 32 | 0.0003117 | 0.000311651 | 30.61915539 | 98232.79715 | 0.5 | 0.999688349 | 98248.10673 | 4280949.562 | 43.57284537 |
| 2020 | Male | 33 | 0.00032697 | 0.000326917 | 32.10892185 | 98201.43311 | 0.5 | 0.999673083 | 98217.48757 | 4182716.765 | 42.58627326 |
| 2020 | Male | 34 | 0.000348111 | 0.00034805 | 34.17343453 | 98168.29193 | 0.5 | 0.99965195 | 98185.37865 | 4084515.332 | 41.60003646 |
| 2020 | Male | 35 | 0.000375803 | 0.000375732 | 36.87858409 | 98132.76592 | 0.5 | 0.999624268 | 98151.20521 | 3986347.04 | 40.61434632 |
| 2020 | Male | 36 | 0.000410904 | 0.00041082 | 40.30728317 | 98094.17299 | 0.5 | 0.99958918 | 98114.32663 | 3888214.274 | 39.62942424 |
| 2020 | Male | 37 | 0.000454459 | 0.000454355 | 44.56045762 | 98051.73912 | 0.5 | 0.999545645 | 98074.01935 | 3790120.101 | 38.64550598 |
| 2020 | Male | 38 | 0.000507709 | 0.00050758 | 49.75783742 | 98004.57997 | 0.5 | 0.99949242 | 98029.45889 | 3692068.362 | 37.66284547 |
| 2020 | Male | 39 | 0.000572104 | 0.00057194 | 56.03851234 | 97951.68179 | 0.5 | 0.99942806 | 97979.70105 | 3594063.782 | 36.68171818 |
| 2020 | Male | 40 | 0.0006493 | 0.00064909 | 63.5612456 | 97891.88192 | 0.5 | 0.99935091 | 97923.66254 | 3496112.1 | 35.7024238 |
| 2020 | Male | 41 | 0.000741175 | 0.0007409 | 72.50459462 | 97823.849 | 0.5 | 0.9992591 | 97860.10129 | 3398220.218 | 34.72528817 |
| 2020 | Male | 42 | 0.000849824 | 0.000849463 | 83.06696601 | 97746.06322 | 0.5 | 0.999150537 | 97787.5967 | 3300396.369 | 33.75066451 |
| 2020 | Male | 43 | 0.000977575 | 0.000977097 | 95.46681767 | 97656.79632 | 0.5 | 0.999022903 | 97704.52973 | 3202650.306 | 32.77893374 |
| 2020 | Male | 44 | 0.001126998 | 0.001126364 | 109.9432951 | 97554.09127 | 0.5 | 0.998873636 | 97609.06291 | 3104993.51 | 31.81050424 |
| 2020 | Male | 45 | 0.001300936 | 0.00130009 | 126.7576259 | 97435.74081 | 0.5 | 0.99869991 | 97499.11962 | 3007439.418 | 30.84581102 |
| 2020 | Male | 46 | 0.001502535 | 0.001501407 | 146.195571 | 97299.26421 | 0.5 | 0.998498593 | 97372.36199 | 2910003.677 | 29.88531466 |
| 2020 | Male | 47 | 0.001735308 | 0.001733804 | 168.5711271 | 97141.88086 | 0.5 | 0.998266196 | 97226.16642 | 2812704.413 | 28.92950033 |
| 2020 | Male | 48 | 0.002003203 | 0.002001198 | 194.231477 | 96960.47956 | 0.5 | 0.997998802 | 97057.5953 | 2715562.532 | 27.97887712 |
| 2020 | Male | 49 | 0.00231069 | 0.002308023 | 223.5628992 | 96751.58237 | 0.5 | 0.997691977 | 96863.36382 | 2618602.053 | 27.03397807 |
| 2020 | Male | 50 | 0.002662869 | 0.002659329 | 256.9969891 | 96511.30242 | 0.5 | 0.997340671 | 96639.80092 | 2521850.47 | 26.09536078 |
| 2020 | Male | 51 | 0.003065571 | 0.003060879 | 295.0161203 | 96235.29587 | 0.5 | 0.996939121 | 96382.80393 | 2425339.168 | 25.16360875 |
| 2020 | Male | 52 | 0.00352545 | 0.003519247 | 338.1566223 | 95918.7095 | 0.5 | 0.996480753 | 96087.78781 | 2329103.872 | 24.23933286 |
| 2020 | Male | 53 | 0.004050056 | 0.004041871 | 387.0076775 | 95556.12735 | 0.5 | 0.995958129 | 95749.63119 | 2233185.163 | 23.32317248 |
| 2020 | Male | 54 | 0.00464785 | 0.004637074 | 442.2035021 | 95141.52176 | 0.5 | 0.995362926 | 95362.62351 | 2137629.035 | 22.41579517 |
| 2020 | Male | 55 | 0.005328145 | 0.005313988 | 504.4060191 | 94668.217 | 0.5 | 0.994686012 | 94920.42001 | 2042487.514 | 21.51789376 |
| 2020 | Male | 56 | 0.006100945 | 0.006082391 | 574.2750854 | 94128.87645 | 0.5 | 0.993917609 | 94416.01399 | 1947819.297 | 20.63017929 |
| 2020 | Male | 57 | 0.006976634 | 0.006952382 | 652.4235735 | 93515.52712 | 0.5 | 0.993047618 | 93841.7389 | 1853690.42 | 19.75336819 |
| 2020 | Male | 58 | 0.007965507 | 0.007933908 | 739.3554884 | 92819.63759 | 0.5 | 0.992066092 | 93189.31533 | 1760174.893 | 18.88816209 |
| 2020 | Male | 59 | 0.009077111 | 0.0090361 | 835.387118 | 92032.26628 | 0.5 | 0.9909639 | 92449.95984 | 1667355.255 | 18.03521882 |
| 2020 | Male | 60 | 0.010319398 | 0.010266426 | 940.5542324 | 91144.29561 | 0.5 | 0.989733574 | 91614.57272 | 1575322.989 | 17.19511364 |
| 2020 | Male | 61 | 0.011697731 | 0.011629711 | 1054.512618 | 90146.76218 | 0.5 | 0.988370289 | 90674.01849 | 1484178.694 | 16.3682907 |
| 2020 | Male | 62 | 0.013213832 | 0.013127102 | 1176.44442 | 89031.28366 | 0.5 | 0.986872898 | 89619.50587 | 1394031.931 | 15.55500577 |
| 2020 | Male | 63 | 0.014864785 | 0.014755119 | 1304.987893 | 87790.56751 | 0.5 | 0.985244881 | 88443.06145 | 1305000.648 | 14.75526317 |
| 2020 | Male | 64 | 0.016642314 | 0.016504974 | 1438.211596 | 86418.96776 | 0.5 | 0.983495026 | 87138.07356 | 1217210.08 | 13.96875132 |
| 2020 | Male | 65 | 0.018532532 | 0.018362382 | 1573.653567 | 84913.03518 | 0.5 | 0.981637618 | 85699.86196 | 1130791.112 | 13.19478336 |
| 2020 | Male | 66 | 0.020516378 | 0.020308054 | 1708.439599 | 83271.9886 | 0.5 | 0.979691946 | 84126.2084 | 1045878.077 | 12.43225027 |
| 2020 | Male | 67 | 0.02257087 | 0.022318991 | 1839.481407 | 81498.02809 | 0.5 | 0.977681009 | 82417.7688 | 962606.0887 | 11.67959413 |
| 2020 | Male | 68 | 0.024671165 | 0.024370541 | 1963.736421 | 79596.41918 | 0.5 | 0.975629459 | 80578.28739 | 881108.0606 | 10.93480749 |
| 2020 | Male | 69 | 0.026793191 | 0.026438998 | 2078.489965 | 77575.30599 | 0.5 | 0.973561002 | 78614.55097 | 801511.6414 | 10.19546167 |
| 2020 | Male | 70 | 0.028916373 | 0.028504254 | 2181.603296 | 75445.25936 | 0.5 | 0.971495746 | 76536.06101 | 723936.3354 | 9.458761346 |
| 2020 | Male | 71 | 0.03102575 | 0.030551803 | 2271.662772 | 73218.62632 | 0.5 | 0.969448197 | 74354.45771 | 648491.076 | 8.721616646 |
| 2020 | Male | 72 | 0.033112515 | 0.032573224 | 2347.96904 | 70908.81042 | 0.5 | 0.967426776 | 72082.79494 | 575272.4497 | 7.980717871 |
| 2020 | Male | 73 | 0.035171905 | 0.034564063 | 2410.318906 | 68529.66644 | 0.5 | 0.965435937 | 69734.8259 | 504363.6393 | 7.232593368 |
| 2020 | Male | 74 | 0.037197109 | 0.036517928 | 2458.551495 | 66095.23124 | 0.5 | 0.963482072 | 67324.50699 | 435833.9729 | 6.473630366 |
| 2020 | Male | 75 | 0.039167703 | 0.038415382 | 2491.850443 | 63620.03027 | 0.5 | 0.961584618 | 64865.9555 | 369738.7416 | 5.700043093 |
| 2020 | Male | 76 | 0.041030937 | 0.04020609 | 2507.818887 | 61120.19561 | 0.5 | 0.95979391 | 62374.10505 | 306118.7113 | 4.907785227 |
| 2020 | Male | 77 | 0.042674559 | 0.041783023 | 2501.39439 | 58615.58897 | 0.5 | 0.958216977 | 59866.28617 | 244998.5157 | 4.092428835 |
| 2020 | Male | 78 | 0.043892011 | 0.042949442 | 2463.790082 | 56132.99674 | 0.5 | 0.957050558 | 57364.89178 | 186382.9268 | 3.249076587 |
| 2020 | Male | 79 | 0.04434728 | 0.043385271 | 2381.899164 | 53710.15211 | 0.5 | 0.956614729 | 54901.10169 | 130249.93 | 2.372446563 |
| 2020 | Male | 80 | 0.043561078 | 0.042632519 | 2239.025882 | 51399.68959 | 0.5 | 0.957367481 | 52519.20253 | 76539.77791 | 1.457367481 |

Table 24: Male Life Table in 2021

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | Sex | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | Male | 0 | 0.001081541 | 0.001080545 | 108.054476 | 99907.84377 | 0.1471318 | 0.998919455 | 100000 | 7356276.977 | 73.56276977 |
| 2021 | Male | 1 | 0.000961386 | 0.000960925 | 95.98862589 | 99843.95121 | 0.5 | 0.999039075 | 99891.94552 | 7256369.134 | 72.64218447 |
| 2021 | Male | 2 | 0.000863487 | 0.000863114 | 86.13529707 | 99752.88925 | 0.5 | 0.999136886 | 99795.9569 | 7156525.182 | 71.71157434 |
| 2021 | Male | 3 | 0.000792062 | 0.000791748 | 78.94504774 | 99670.34908 | 0.5 | 0.999208252 | 99709.8216 | 7056772.293 | 70.77309115 |
| 2021 | Male | 4 | 0.000745344 | 0.000745066 | 74.2315754 | 99593.76077 | 0.5 | 0.999254934 | 99630.87655 | 6957101.944 | 69.82877382 |
| 2021 | Male | 5 | 0.000719581 | 0.000719322 | 71.61327264 | 99520.83834 | 0.5 | 0.999280678 | 99556.64498 | 6857508.183 | 68.88046684 |
| 2021 | Male | 6 | 0.000710675 | 0.000710422 | 70.676394 | 99449.69351 | 0.5 | 0.999289578 | 99485.03171 | 6757987.345 | 67.92968981 |
| 2021 | Male | 7 | 0.000714644 | 0.000714388 | 71.02046161 | 99378.84508 | 0.5 | 0.999285612 | 99414.35531 | 6658537.651 | 66.97762743 |
| 2021 | Male | 8 | 0.000727618 | 0.000727353 | 72.25768189 | 99307.20601 | 0.5 | 0.999272647 | 99343.33485 | 6559158.806 | 66.02515223 |
| 2021 | Male | 9 | 0.000745743 | 0.000745465 | 74.00312426 | 99234.07561 | 0.5 | 0.999254535 | 99271.07717 | 6459851.6 | 65.07284684 |
| 2021 | Male | 10 | 0.000765163 | 0.000764871 | 75.87294722 | 99159.13757 | 0.5 | 0.999235129 | 99197.07404 | 6360617.525 | 64.12101956 |
| 2021 | Male | 11 | 0.000782147 | 0.000781841 | 77.4970276 | 99082.45258 | 0.5 | 0.999218159 | 99121.2011 | 6261458.387 | 63.16971867 |
| 2021 | Male | 12 | 0.000793347 | 0.000793033 | 78.54488251 | 99004.43163 | 0.5 | 0.999206967 | 99043.70407 | 6162375.935 | 62.21875477 |
| 2021 | Male | 13 | 0.000796134 | 0.000795817 | 78.75813312 | 98925.78012 | 0.5 | 0.999204183 | 98965.15919 | 6063371.503 | 61.26773859 |
| 2021 | Male | 14 | 0.000788888 | 0.000788577 | 77.9795664 | 98847.41127 | 0.5 | 0.999211423 | 98886.40105 | 5964445.723 | 60.3161371 |
| 2021 | Male | 15 | 0.000771175 | 0.000770878 | 76.16920414 | 98770.33688 | 0.5 | 0.999229122 | 98808.42149 | 5865598.312 | 59.36334397 |
| 2021 | Male | 16 | 0.000743719 | 0.000743442 | 73.4017283 | 98695.55142 | 0.5 | 0.999256558 | 98732.25228 | 5766827.975 | 58.40875541 |
| 2021 | Male | 17 | 0.000708201 | 0.00070795 | 69.8455648 | 98623.92777 | 0.5 | 0.99929205 | 98658.85055 | 5668132.423 | 57.45183926 |
| 2021 | Male | 18 | 0.000666923 | 0.000666701 | 65.72938456 | 98556.1403 | 0.5 | 0.999333299 | 98589.00499 | 5569508.495 | 56.49218689 |
| 2021 | Male | 19 | 0.000622429 | 0.000622235 | 61.30464171 | 98492.62328 | 0.5 | 0.999377765 | 98523.2756 | 5470952.355 | 55.52954184 |
| 2021 | Male | 20 | 0.000577165 | 0.000576998 | 56.81236783 | 98433.56478 | 0.5 | 0.999423002 | 98461.97096 | 5372459.732 | 54.56380447 |
| 2021 | Male | 21 | 0.00053324 | 0.000533098 | 52.45962134 | 98378.92878 | 0.5 | 0.999466902 | 98405.1586 | 5274026.167 | 53.5950172 |
| 2021 | Male | 22 | 0.000492302 | 0.000492181 | 48.40735341 | 98328.4953 | 0.5 | 0.999507819 | 98352.69897 | 5175647.238 | 52.62333716 |
| 2021 | Male | 23 | 0.00045551 | 0.000455407 | 44.76843349 | 98281.9074 | 0.5 | 0.999544593 | 98304.29162 | 5077318.743 | 51.64900392 |
| 2021 | Male | 24 | 0.00042359 | 0.0004235 | 41.61290196 | 98238.71674 | 0.5 | 0.9995765 | 98259.52319 | 4979036.836 | 50.67230813 |
| 2021 | Male | 25 | 0.000396923 | 0.000396844 | 38.97717419 | 98198.4217 | 0.5 | 0.999603156 | 98217.91029 | 4880798.119 | 49.6935651 |
| 2021 | Male | 26 | 0.000375655 | 0.000375584 | 36.87446804 | 98160.49588 | 0.5 | 0.999624416 | 98178.93311 | 4782599.697 | 48.71309502 |
| 2021 | Male | 27 | 0.000359795 | 0.00035973 | 35.30464259 | 98124.40632 | 0.5 | 0.99964027 | 98142.05864 | 4684439.201 | 47.7312099 |
| 2021 | Male | 28 | 0.000349298 | 0.000349237 | 34.26252614 | 98089.62274 | 0.5 | 0.999650763 | 98106.754 | 4586314.795 | 46.7482065 |
| 2021 | Male | 29 | 0.000344136 | 0.000344077 | 33.74448019 | 98055.61923 | 0.5 | 0.999655923 | 98072.49147 | 4488225.172 | 45.76436373 |
| 2021 | Male | 30 | 0.000344345 | 0.000344286 | 33.75334876 | 98021.87032 | 0.5 | 0.999655714 | 98038.74699 | 4390169.553 | 44.77994352 |
| 2021 | Male | 31 | 0.000350065 | 0.000350004 | 34.30212469 | 97987.84258 | 0.5 | 0.999649996 | 98004.99365 | 4292147.683 | 43.79519372 |
| 2021 | Male | 32 | 0.000361568 | 0.000361503 | 35.41669646 | 97952.98317 | 0.5 | 0.999638497 | 97970.69152 | 4194159.84 | 42.81035251 |
| 2021 | Male | 33 | 0.000379281 | 0.00037921 | 37.13798853 | 97916.70583 | 0.5 | 0.99962079 | 97935.27482 | 4096206.857 | 41.82565336 |
| 2021 | Male | 34 | 0.000403804 | 0.000403723 | 39.52372153 | 97878.37497 | 0.5 | 0.999596277 | 97898.13684 | 3998290.151 | 40.84133039 |
| 2021 | Male | 35 | 0.000435927 | 0.000435832 | 42.64992691 | 97837.28815 | 0.5 | 0.999564168 | 97858.61311 | 3900411.776 | 39.85762369 |
| 2021 | Male | 36 | 0.000476644 | 0.00047653 | 46.61226948 | 97792.65705 | 0.5 | 0.99952347 | 97815.96319 | 3802574.488 | 38.87478448 |
| 2021 | Male | 37 | 0.000527167 | 0.000527028 | 51.5271713 | 97743.58733 | 0.5 | 0.999472972 | 97769.35092 | 3704781.831 | 37.89307995 |
| 2021 | Male | 38 | 0.000588937 | 0.000588764 | 57.53269661 | 97689.0574 | 0.5 | 0.999411236 | 97717.82375 | 3607038.244 | 36.91279754 |
| 2021 | Male | 39 | 0.000663634 | 0.000663413 | 64.78915541 | 97627.89647 | 0.5 | 0.999336587 | 97660.29105 | 3509349.186 | 35.93424869 |
| 2021 | Male | 40 | 0.000753181 | 0.000752898 | 73.47941487 | 97558.76219 | 0.5 | 0.999247102 | 97595.50189 | 3411721.29 | 34.95777186 |
| 2021 | Male | 41 | 0.000859755 | 0.000859385 | 83.80897215 | 97480.11799 | 0.5 | 0.999140615 | 97522.02248 | 3314162.528 | 33.98373458 |
| 2021 | Male | 42 | 0.000985786 | 0.000985301 | 96.00593116 | 97390.21054 | 0.5 | 0.999014699 | 97438.21351 | 3216682.41 | 33.01253475 |
| 2021 | Male | 43 | 0.001133975 | 0.001133333 | 110.3211246 | 97287.04701 | 0.5 | 0.998866667 | 97342.20758 | 3119292.199 | 32.04460097 |
| 2021 | Male | 44 | 0.001307305 | 0.001306451 | 127.0287061 | 97168.3721 | 0.5 | 0.998693549 | 97231.88645 | 3022005.152 | 31.08039206 |
| 2021 | Male | 45 | 0.00150907 | 0.001507933 | 146.4275786 | 97031.64396 | 0.5 | 0.998492067 | 97104.85775 | 2924836.78 | 30.12039611 |
| 2021 | Male | 46 | 0.001742924 | 0.001741406 | 168.8439932 | 96874.00817 | 0.5 | 0.998258594 | 96958.43017 | 2827805.136 | 29.16512913 |
| 2021 | Male | 47 | 0.002012938 | 0.002010914 | 194.635528 | 96692.26841 | 0.5 | 0.997989086 | 96789.58617 | 2730931.128 | 28.21513384 |
| 2021 | Male | 48 | 0.002323692 | 0.002320995 | 224.1964226 | 96482.85243 | 0.5 | 0.997679005 | 96594.95065 | 2634238.859 | 27.27097888 |
| 2021 | Male | 49 | 0.002680374 | 0.002676786 | 257.963912 | 96241.77227 | 0.5 | 0.997323214 | 96370.75422 | 2537756.007 | 26.33325875 |
| 2021 | Male | 50 | 0.003088898 | 0.003084135 | 296.4247774 | 95964.57792 | 0.5 | 0.996915865 | 96112.79031 | 2441514.235 | 25.40259446 |
| 2021 | Male | 51 | 0.003556027 | 0.003549716 | 340.1208418 | 95646.30511 | 0.5 | 0.996450284 | 95816.36553 | 2345549.657 | 24.47963501 |
| 2021 | Male | 52 | 0.004089482 | 0.004081137 | 389.651607 | 95281.41889 | 0.5 | 0.995918863 | 95476.24469 | 2249903.352 | 23.56505913 |
| 2021 | Male | 53 | 0.004698019 | 0.004687009 | 445.6716902 | 94863.75724 | 0.5 | 0.995312991 | 95086.59308 | 2154621.933 | 22.65957653 |
| 2021 | Male | 54 | 0.005391452 | 0.005376958 | 508.8802153 | 94386.48129 | 0.5 | 0.994623042 | 94640.92139 | 2059758.175 | 21.76392775 |
| 2021 | Male | 55 | 0.006180587 | 0.006161546 | 579.9989363 | 93842.04171 | 0.5 | 0.993838454 | 94132.04118 | 1965371.694 | 20.87888109 |
| 2021 | Male | 56 | 0.007077026 | 0.007052072 | 659.7357445 | 93222.17437 | 0.5 | 0.992947928 | 93552.04224 | 1871529.652 | 20.00522498 |
| 2021 | Male | 57 | 0.008092815 | 0.0080602 | 748.7305686 | 92517.94121 | 0.5 | 0.9919398 | 92892.3065 | 1778307.478 | 19.14375415 |
| 2021 | Male | 58 | 0.009239897 | 0.009197405 | 847.4818066 | 91719.83503 | 0.5 | 0.990802595 | 92143.57593 | 1685789.537 | 18.29524761 |
| 2021 | Male | 59 | 0.010529345 | 0.010474201 | 956.2536825 | 90817.96728 | 0.5 | 0.989525799 | 91296.09412 | 1594069.702 | 17.46043702 |
| 2021 | Male | 60 | 0.011970383 | 0.011899164 | 1074.96857 | 89802.35616 | 0.5 | 0.988100836 | 90339.84044 | 1503251.735 | 16.63996446 |
| 2021 | Male | 61 | 0.013569234 | 0.013477792 | 1203.093413 | 88663.32516 | 0.5 | 0.986522208 | 89264.87187 | 1413449.378 | 15.83432933 |
| 2021 | Male | 62 | 0.015327893 | 0.015211314 | 1339.535406 | 87392.01075 | 0.5 | 0.984788686 | 88061.77846 | 1324786.053 | 15.04382578 |
| 2021 | Male | 63 | 0.01724298 | 0.01709559 | 1482.567917 | 85980.95909 | 0.5 | 0.98290441 | 86722.24305 | 1237394.042 | 14.26847368 |
| 2021 | Male | 64 | 0.019304893 | 0.019120335 | 1629.811139 | 84424.76956 | 0.5 | 0.980879665 | 85239.67513 | 1151413.083 | 13.50794781 |
| 2021 | Male | 65 | 0.021497524 | 0.02126891 | 1778.290673 | 82720.71866 | 0.5 | 0.97873109 | 83609.864 | 1066988.314 | 12.76151237 |
| 2021 | Male | 66 | 0.023798763 | 0.023518902 | 1924.588781 | 80869.27893 | 0.5 | 0.976481098 | 81831.57332 | 984267.5952 | 12.02796861 |
| 2021 | Male | 67 | 0.02618195 | 0.025843632 | 2065.086669 | 78874.44121 | 0.5 | 0.974156368 | 79906.98454 | 903398.3162 | 11.30562393 |
| 2021 | Male | 68 | 0.028618268 | 0.028214543 | 2196.273543 | 76743.7611 | 0.5 | 0.971785457 | 77841.89787 | 824523.875 | 10.59228895 |
| 2021 | Male | 69 | 0.031079793 | 0.030604207 | 2315.074347 | 74488.08716 | 0.5 | 0.969395793 | 75645.62433 | 747780.1139 | 9.885305602 |
| 2021 | Male | 70 | 0.033542661 | 0.032989385 | 2419.129746 | 72120.98511 | 0.5 | 0.967010615 | 73330.54998 | 673292.0268 | 9.181603397 |
| 2021 | Male | 71 | 0.035989513 | 0.035353338 | 2506.95543 | 69657.94252 | 0.5 | 0.964646662 | 70911.42024 | 601171.0417 | 8.477774661 |
| 2021 | Male | 72 | 0.038410137 | 0.037686367 | 2577.915794 | 67115.50691 | 0.5 | 0.962313633 | 68404.46481 | 531513.0992 | 7.770152148 |
| 2021 | Male | 73 | 0.040799005 | 0.039983365 | 2631.966909 | 64510.56556 | 0.5 | 0.960016635 | 65826.54901 | 464397.5922 | 7.054867667 |
| 2021 | Male | 74 | 0.043148218 | 0.042236993 | 2669.149119 | 61860.00754 | 0.5 | 0.957763007 | 63194.5821 | 399887.0267 | 6.327868836 |
| 2021 | Male | 75 | 0.045434085 | 0.044424883 | 2688.835291 | 59181.01534 | 0.5 | 0.955575117 | 60525.43298 | 338027.0191 | 5.584875687 |
| 2021 | Male | 76 | 0.047595415 | 0.046489082 | 2688.770309 | 56492.21254 | 0.5 | 0.953510918 | 57836.59769 | 278846.0038 | 4.821272601 |
| 2021 | Male | 77 | 0.049501998 | 0.048306367 | 2663.991175 | 53815.8318 | 0.5 | 0.951693633 | 55147.82738 | 222353.7913 | 4.031959223 |
| 2021 | Male | 78 | 0.050914228 | 0.049650275 | 2605.836901 | 51180.91776 | 0.5 | 0.950349725 | 52483.83621 | 168537.9595 | 3.211235528 |
| 2021 | Male | 79 | 0.051442335 | 0.050152358 | 2501.499282 | 48627.24967 | 0.5 | 0.949847642 | 49877.99931 | 117357.0417 | 2.352881899 |
| 2021 | Male | 80 | 0.05053035 | 0.049285152 | 2334.957992 | 46209.02103 | 0.5 | 0.950714848 | 47376.50003 | 68729.79205 | 1.450714848 |

# Table 25: Male Life Table in 2022

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | Sex | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2022 | Male | 0 | 0.001254576 | 0.001253234 | 125.3234184 | 99893.07238 | 0.1467866 | 0.998746766 | 100000 | 7255206.252 | 72.55206252 |
| 2022 | Male | 1 | 0.001115197 | 0.001114576 | 111.3178969 | 99819.01763 | 0.5 | 0.998885424 | 99874.67658 | 7155313.18 | 71.64291715 |
| 2022 | Male | 2 | 0.001001635 | 0.001001133 | 99.87642131 | 99713.42047 | 0.5 | 0.998998867 | 99763.35868 | 7055494.162 | 70.7222998 |
| 2022 | Male | 3 | 0.000918782 | 0.00091836 | 91.52699223 | 99617.71877 | 0.5 | 0.99908164 | 99663.48226 | 6955780.742 | 69.79267214 |
| 2022 | Male | 4 | 0.00086459 | 0.000864216 | 86.05172174 | 99528.92941 | 0.5 | 0.999135784 | 99571.95527 | 6856163.023 | 68.85636628 |
| 2022 | Male | 5 | 0.000834705 | 0.000834357 | 83.00676982 | 99444.40016 | 0.5 | 0.999165643 | 99485.90355 | 6756634.094 | 67.91549207 |
| 2022 | Male | 6 | 0.000824375 | 0.000824035 | 81.91146381 | 99361.94105 | 0.5 | 0.999175965 | 99402.89678 | 6657189.693 | 66.97178763 |
| 2022 | Male | 7 | 0.000828978 | 0.000828635 | 82.30084189 | 99279.83489 | 0.5 | 0.999171365 | 99320.98532 | 6557827.752 | 66.02660788 |
| 2022 | Male | 8 | 0.000844028 | 0.000843672 | 83.7249133 | 99196.82202 | 0.5 | 0.999156328 | 99238.68447 | 6458547.917 | 65.08095055 |
| 2022 | Male | 9 | 0.000865053 | 0.000864679 | 85.73725033 | 99112.09094 | 0.5 | 0.999135321 | 99154.95956 | 6359351.095 | 64.13548171 |
| 2022 | Male | 10 | 0.000887581 | 0.000887187 | 87.89293363 | 99025.27584 | 0.5 | 0.999112813 | 99069.22231 | 6260239.004 | 63.19055362 |
| 2022 | Male | 11 | 0.000907281 | 0.00090687 | 89.76319387 | 98936.44778 | 0.5 | 0.99909313 | 98981.32938 | 6161213.729 | 62.24622126 |
| 2022 | Male | 12 | 0.000920274 | 0.00091985 | 90.96543732 | 98846.08346 | 0.5 | 0.99908015 | 98891.56618 | 6062277.281 | 61.30226788 |
| 2022 | Male | 13 | 0.000923506 | 0.00092308 | 91.2008131 | 98755.00034 | 0.5 | 0.99907692 | 98800.60075 | 5963431.197 | 60.35824835 |
| 2022 | Male | 14 | 0.000915101 | 0.000914683 | 90.28779516 | 98664.25603 | 0.5 | 0.999085317 | 98709.39993 | 5864676.197 | 59.41355333 |
| 2022 | Male | 15 | 0.000894554 | 0.000894154 | 88.18068145 | 98575.0218 | 0.5 | 0.999105846 | 98619.11214 | 5766011.941 | 58.46748988 |
| 2022 | Male | 16 | 0.000862705 | 0.000862333 | 84.96649218 | 98488.44821 | 0.5 | 0.999137667 | 98530.93146 | 5667436.919 | 57.51936813 |
| 2022 | Male | 17 | 0.000821505 | 0.000821168 | 80.84064955 | 98405.54464 | 0.5 | 0.999178832 | 98445.96496 | 5568948.471 | 56.56858027 |
| 2022 | Male | 18 | 0.000773623 | 0.000773324 | 76.06813216 | 98327.09025 | 0.5 | 0.999226676 | 98365.12431 | 5470542.926 | 55.61465981 |
| 2022 | Male | 19 | 0.00072201 | 0.00072175 | 70.94009252 | 98253.58614 | 0.5 | 0.99927825 | 98289.05618 | 5372215.836 | 54.6573143 |
| 2022 | Male | 20 | 0.000669504 | 0.00066928 | 65.73544481 | 98185.24837 | 0.5 | 0.99933072 | 98218.11609 | 5273962.25 | 53.69643056 |
| 2022 | Male | 21 | 0.000618553 | 0.000618362 | 60.69365472 | 98122.03382 | 0.5 | 0.999381638 | 98152.38064 | 5175777.002 | 52.73205773 |
| 2022 | Male | 22 | 0.000571065 | 0.000570902 | 56.00075059 | 98063.68661 | 0.5 | 0.999429098 | 98091.68699 | 5077654.968 | 51.764376 |
| 2022 | Male | 23 | 0.000528387 | 0.000528247 | 51.78708646 | 98009.7927 | 0.5 | 0.999471753 | 98035.68624 | 4979591.281 | 50.79365966 |
| 2022 | Male | 24 | 0.000491359 | 0.000491238 | 48.13345565 | 97959.83242 | 0.5 | 0.999508762 | 97983.89915 | 4881581.488 | 49.82024118 |
| 2022 | Male | 25 | 0.000460426 | 0.00046032 | 45.08176211 | 97913.22482 | 0.5 | 0.99953968 | 97935.7657 | 4783621.656 | 48.84448109 |
| 2022 | Male | 26 | 0.000435755 | 0.00043566 | 42.64709527 | 97869.36039 | 0.5 | 0.99956434 | 97890.68394 | 4685708.431 | 47.86674526 |
| 2022 | Male | 27 | 0.000417358 | 0.000417271 | 40.82911451 | 97827.62228 | 0.5 | 0.999582729 | 97848.03684 | 4587839.071 | 46.88739007 |
| 2022 | Male | 28 | 0.000405182 | 0.0004051 | 39.62168009 | 97787.39689 | 0.5 | 0.9995949 | 97807.20773 | 4490011.449 | 45.90675425 |
| 2022 | Male | 29 | 0.000399194 | 0.000399114 | 39.02043971 | 97748.07583 | 0.5 | 0.999600886 | 97767.58605 | 4392224.052 | 44.92515597 |
| 2022 | Male | 30 | 0.000399436 | 0.000399357 | 39.02854535 | 97709.05133 | 0.5 | 0.999600643 | 97728.56561 | 4294475.976 | 43.94289376 |
| 2022 | Male | 31 | 0.000406072 | 0.000405989 | 39.66088444 | 97669.70662 | 0.5 | 0.999594011 | 97689.53706 | 4196766.925 | 42.9602499 |
| 2022 | Male | 32 | 0.000419415 | 0.000419327 | 40.94724623 | 97629.40255 | 0.5 | 0.999580673 | 97649.87618 | 4099097.218 | 41.9774953 |
| 2022 | Male | 33 | 0.000439962 | 0.000439865 | 42.93478483 | 97587.46154 | 0.5 | 0.999560135 | 97608.92893 | 4001467.815 | 40.99489523 |
| 2022 | Male | 34 | 0.000468408 | 0.000468299 | 45.69004007 | 97543.14912 | 0.5 | 0.999531701 | 97565.99414 | 3903880.354 | 40.01271538 |
| 2022 | Male | 35 | 0.00050567 | 0.000505543 | 49.30067061 | 97495.65377 | 0.5 | 0.999494457 | 97520.3041 | 3806337.205 | 39.0312278 |
| 2022 | Male | 36 | 0.000552901 | 0.000552749 | 53.8769598 | 97444.06495 | 0.5 | 0.999447251 | 97471.00343 | 3708841.551 | 38.05071683 |
| 2022 | Male | 37 | 0.000611507 | 0.00061132 | 59.55308467 | 97387.34993 | 0.5 | 0.99938868 | 97417.12647 | 3611397.486 | 37.07148442 |
| 2022 | Male | 38 | 0.00068316 | 0.000682927 | 66.48809915 | 97324.32934 | 0.5 | 0.999317073 | 97357.57339 | 3514010.136 | 36.09385499 |
| 2022 | Male | 39 | 0.000769807 | 0.000769511 | 74.86657946 | 97253.652 | 0.5 | 0.999230489 | 97291.08529 | 3416685.807 | 35.1181796 |
| 2022 | Male | 40 | 0.000873681 | 0.0008733 | 84.89891554 | 97173.76925 | 0.5 | 0.9991267 | 97216.21871 | 3319432.155 | 34.14483919 |
| 2022 | Male | 41 | 0.000997305 | 0.000996808 | 96.82130591 | 97082.90914 | 0.5 | 0.999003192 | 97131.3198 | 3222258.385 | 33.1742469 |
| 2022 | Male | 42 | 0.001143501 | 0.001142847 | 110.8956151 | 96979.05068 | 0.5 | 0.998857153 | 97034.49849 | 3125175.476 | 32.20684936 |
| 2022 | Male | 43 | 0.001315399 | 0.001314534 | 127.4093656 | 96859.89819 | 0.5 | 0.998685466 | 96923.60287 | 3028196.426 | 31.24312692 |
| 2022 | Male | 44 | 0.001516459 | 0.00151531 | 146.6762313 | 96722.85539 | 0.5 | 0.99848469 | 96796.19351 | 2931336.527 | 30.28359299 |
| 2022 | Male | 45 | 0.001750504 | 0.001748973 | 169.0374434 | 96564.99856 | 0.5 | 0.998251027 | 96649.51728 | 2834613.672 | 29.32879286 |
| 2022 | Male | 46 | 0.002021771 | 0.00201973 | 194.8644815 | 96383.04759 | 0.5 | 0.99798027 | 96480.47983 | 2738048.673 | 28.37930199 |
| 2022 | Male | 47 | 0.002334985 | 0.002332262 | 224.5632709 | 96173.33372 | 0.5 | 0.997667738 | 96285.61535 | 2641665.626 | 27.4357246 |
| 2022 | Male | 48 | 0.002695456 | 0.002691828 | 258.5798339 | 95931.76216 | 0.5 | 0.997308172 | 96061.05208 | 2545492.292 | 26.49869262 |
| 2022 | Male | 49 | 0.003109203 | 0.003104377 | 297.406951 | 95653.76877 | 0.5 | 0.996895623 | 95802.47225 | 2449560.53 | 25.56886553 |
| 2022 | Male | 50 | 0.003583086 | 0.003576678 | 341.5908868 | 95334.26985 | 0.5 | 0.996423322 | 95505.0653 | 2353906.761 | 24.64693107 |
| 2022 | Male | 51 | 0.00412495 | 0.00411646 | 391.7366674 | 94967.60608 | 0.5 | 0.99588354 | 95163.47441 | 2258572.491 | 23.73360688 |
| 2022 | Male | 52 | 0.004743752 | 0.004732527 | 448.5097754 | 94547.48285 | 0.5 | 0.995267473 | 94771.73774 | 2163604.885 | 22.82964243 |
| 2022 | Male | 53 | 0.005449648 | 0.005434839 | 512.6315138 | 94066.91221 | 0.5 | 0.994565161 | 94323.22797 | 2069057.402 | 21.93582055 |
| 2022 | Male | 54 | 0.006254023 | 0.006234527 | 584.8647254 | 93518.16409 | 0.5 | 0.993765473 | 93810.59645 | 1974990.49 | 21.05295739 |
| 2022 | Male | 55 | 0.00716941 | 0.007143802 | 665.9861567 | 92892.73865 | 0.5 | 0.992856198 | 93225.73173 | 1881472.326 | 20.18189926 |
| 2022 | Male | 56 | 0.008209269 | 0.00817571 | 756.741677 | 92181.37473 | 0.5 | 0.99182429 | 92559.74557 | 1788579.587 | 19.32351451 |
| 2022 | Male | 57 | 0.009387572 | 0.009343715 | 857.7810874 | 91374.11335 | 0.5 | 0.990656285 | 91803.00389 | 1696398.213 | 18.4786787 |
| 2022 | Male | 58 | 0.010718174 | 0.010661041 | 969.5707127 | 90460.43745 | 0.5 | 0.989338959 | 90945.22281 | 1605024.099 | 17.64825078 |
| 2022 | Male | 59 | 0.012213919 | 0.012139782 | 1092.284773 | 89429.50971 | 0.5 | 0.987860218 | 89975.65209 | 1514563.662 | 16.83303901 |
| 2022 | Male | 60 | 0.013885506 | 0.013789767 | 1225.680961 | 88270.52684 | 0.5 | 0.986210233 | 88883.36732 | 1425134.152 | 16.03375519 |
| 2022 | Male | 61 | 0.015740156 | 0.015617247 | 1368.971706 | 86973.20051 | 0.5 | 0.984382753 | 87657.68636 | 1336863.625 | 15.25095722 |
| 2022 | Male | 62 | 0.01778018 | 0.017623505 | 1520.709626 | 85528.35984 | 0.5 | 0.982376495 | 86288.71465 | 1249890.425 | 14.48498138 |
| 2022 | Male | 63 | 0.020001658 | 0.019803606 | 1678.712138 | 83928.64896 | 0.5 | 0.980196394 | 84768.00503 | 1164362.065 | 13.73586726 |
| 2022 | Male | 64 | 0.022393454 | 0.022145497 | 1840.053675 | 82169.26605 | 0.5 | 0.977854503 | 83089.29289 | 1080433.416 | 13.00328091 |
| 2022 | Male | 65 | 0.024936881 | 0.024629786 | 2001.151396 | 80248.66352 | 0.5 | 0.975370214 | 81249.23921 | 998264.1501 | 12.28644305 |
| 2022 | Male | 66 | 0.027606291 | 0.027230426 | 2157.959167 | 78169.10823 | 0.5 | 0.972769574 | 79248.08782 | 918015.4865 | 11.58407113 |
| 2022 | Male | 67 | 0.030370761 | 0.029916468 | 2306.264369 | 75936.99647 | 0.5 | 0.970083532 | 77090.12865 | 839846.3783 | 10.89434397 |
| 2022 | Male | 68 | 0.033196862 | 0.032654843 | 2442.055355 | 73562.8366 | 0.5 | 0.967345157 | 74783.86428 | 763909.3818 | 10.21489581 |
| 2022 | Male | 69 | 0.036052203 | 0.03541383 | 2561.900498 | 71060.85868 | 0.5 | 0.96458617 | 72341.80893 | 690346.5452 | 9.54284328 |
| 2022 | Male | 70 | 0.038909101 | 0.038166587 | 2663.260966 | 68448.27795 | 0.5 | 0.961833413 | 69779.90843 | 619285.6866 | 8.874842351 |
| 2022 | Male | 71 | 0.041747421 | 0.040893816 | 2744.655817 | 65744.31955 | 0.5 | 0.959106184 | 67116.64746 | 550837.4086 | 8.207165128 |
| 2022 | Male | 72 | 0.044555317 | 0.04358436 | 2805.612033 | 62969.18563 | 0.5 | 0.95641564 | 64371.99165 | 485093.0891 | 7.535778787 |
| 2022 | Male | 73 | 0.047326377 | 0.046232372 | 2846.359761 | 60143.19973 | 0.5 | 0.953767628 | 61566.37961 | 422123.9034 | 6.856402895 |
| 2022 | Male | 74 | 0.050051437 | 0.048829446 | 2867.26601 | 57286.38685 | 0.5 | 0.951170554 | 58720.01985 | 361980.7037 | 6.164519437 |
| 2022 | Male | 75 | 0.052703017 | 0.05134987 | 2868.031652 | 54418.73802 | 0.5 | 0.94865013 | 55852.75384 | 304694.3168 | 5.455314122 |
| 2022 | Male | 76 | 0.055210135 | 0.053726997 | 2846.71002 | 51561.36718 | 0.5 | 0.946273003 | 52984.72219 | 250275.5788 | 4.723542343 |
| 2022 | Male | 77 | 0.057421748 | 0.055819132 | 2798.660327 | 48738.68201 | 0.5 | 0.944180868 | 50138.01217 | 198714.2117 | 3.963344439 |
| 2022 | Male | 78 | 0.059059919 | 0.057365906 | 2715.664812 | 45981.51944 | 0.5 | 0.942634094 | 47339.35184 | 149975.5296 | 3.168094276 |
| 2022 | Male | 79 | 0.059672518 | 0.057943695 | 2585.661295 | 43330.85638 | 0.5 | 0.942056305 | 44623.68703 | 103994.0102 | 2.330466555 |
| 2022 | Male | 80 | 0.058614625 | 0.056945699 | 2393.88478 | 40841.08335 | 0.5 | 0.943054301 | 42038.02574 | 60663.15382 | 1.4430543 |

Table 26: Female Life Table in 2018

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | Sex | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2018 | Female | 0 | 0.000845859 | 0.000845249 | 84.52492166 | 99927.92488 | 0.147292 | 0.999154751 | 100000 | 7773929.025 | 77.73929025 |
| 2018 | Female | 1 | 0.000638625 | 0.000638421 | 63.78811253 | 99883.58102 | 0.5 | 0.999361579 | 99915.47508 | 7674001.1 | 76.80493031 |
| 2018 | Female | 2 | 0.000504462 | 0.000504335 | 50.35870918 | 99826.50761 | 0.5 | 0.999495665 | 99851.68697 | 7574117.519 | 75.85367608 |
| 2018 | Female | 3 | 0.000416625 | 0.000416538 | 41.57108409 | 99780.54271 | 0.5 | 0.999583462 | 99801.32826 | 7474291.012 | 74.89169876 |
| 2018 | Female | 4 | 0.000358628 | 0.000358564 | 35.77022518 | 99741.87206 | 0.5 | 0.999641436 | 99759.75717 | 7374510.469 | 73.92269867 |
| 2018 | Female | 5 | 0.00032024 | 0.000320189 | 31.93047669 | 99708.02171 | 0.5 | 0.999679811 | 99723.98695 | 7274768.597 | 72.94903483 |
| 2018 | Female | 6 | 0.000294972 | 0.000294929 | 29.40204906 | 99677.35545 | 0.5 | 0.999705071 | 99692.05647 | 7175060.575 | 71.97223961 |
| 2018 | Female | 7 | 0.000278566 | 0.000278527 | 27.75876267 | 99648.77504 | 0.5 | 0.999721473 | 99662.65442 | 7075383.22 | 70.99332504 |
| 2018 | Female | 8 | 0.000268096 | 0.00026806 | 26.70815451 | 99621.54158 | 0.5 | 0.99973194 | 99634.89566 | 6975734.445 | 70.01296482 |
| 2018 | Female | 9 | 0.000261451 | 0.000261417 | 26.03922508 | 99595.16789 | 0.5 | 0.999738583 | 99608.1875 | 6876112.903 | 69.03160348 |
| 2018 | Female | 10 | 0.000257037 | 0.000257004 | 25.59300443 | 99569.35178 | 0.5 | 0.999742996 | 99582.14828 | 6776517.735 | 68.04952346 |
| 2018 | Female | 11 | 0.000253627 | 0.000253595 | 25.24704285 | 99543.93175 | 0.5 | 0.999746405 | 99556.55527 | 6676948.383 | 67.06688841 |
| 2018 | Female | 12 | 0.000250286 | 0.000250255 | 24.90819644 | 99518.85413 | 0.5 | 0.999749745 | 99531.30823 | 6577404.452 | 66.08377372 |
| 2018 | Female | 13 | 0.000246345 | 0.000246314 | 24.50984022 | 99494.14512 | 0.5 | 0.999753686 | 99506.40004 | 6477885.598 | 65.10019049 |
| 2018 | Female | 14 | 0.000241387 | 0.000241358 | 24.01072168 | 99469.88483 | 0.5 | 0.999758642 | 99481.8902 | 6378391.452 | 64.11610636 |
| 2018 | Female | 15 | 0.000235238 | 0.000235211 | 23.39354918 | 99446.1827 | 0.5 | 0.999764789 | 99457.87947 | 6278921.568 | 63.1314643 |
| 2018 | Female | 16 | 0.000227938 | 0.000227912 | 22.6622819 | 99423.15478 | 0.5 | 0.999772088 | 99434.48592 | 6179475.385 | 62.14619935 |
| 2018 | Female | 17 | 0.000219695 | 0.000219671 | 21.83792254 | 99400.90468 | 0.5 | 0.999780329 | 99411.82364 | 6080052.23 | 61.16025245 |
| 2018 | Female | 18 | 0.000210841 | 0.000210819 | 20.95326883 | 99379.50909 | 0.5 | 0.999789181 | 99389.98572 | 5980651.325 | 60.17358069 |
| 2018 | Female | 19 | 0.000201768 | 0.000201747 | 20.04743477 | 99359.00873 | 0.5 | 0.999798253 | 99369.03245 | 5881271.816 | 59.18616365 |
| 2018 | Female | 20 | 0.000192884 | 0.000192865 | 19.16097624 | 99339.40453 | 0.5 | 0.999807135 | 99348.98502 | 5781912.808 | 58.19800581 |
| 2018 | Female | 21 | 0.000184576 | 0.000184559 | 18.33222925 | 99320.65793 | 0.5 | 0.999815441 | 99329.82404 | 5682573.403 | 57.20913591 |
| 2018 | Female | 22 | 0.000177187 | 0.000177171 | 17.59512927 | 99302.69425 | 0.5 | 0.999822829 | 99311.49181 | 5583252.745 | 56.21960403 |
| 2018 | Female | 23 | 0.000171007 | 0.000170992 | 16.97846219 | 99285.40745 | 0.5 | 0.999829008 | 99293.89668 | 5483950.051 | 55.22947768 |
| 2018 | Female | 24 | 0.000166279 | 0.000166265 | 16.50628296 | 99268.66508 | 0.5 | 0.999833735 | 99276.91822 | 5384664.643 | 54.23883759 |
| 2018 | Female | 25 | 0.000163212 | 0.000163198 | 16.19915017 | 99252.31236 | 0.5 | 0.999836802 | 99260.41194 | 5285395.978 | 53.24777396 |
| 2018 | Female | 26 | 0.000161996 | 0.000161983 | 16.07583878 | 99236.17487 | 0.5 | 0.999838017 | 99244.21279 | 5186143.666 | 52.25638373 |
| 2018 | Female | 27 | 0.000162823 | 0.000162809 | 16.15526674 | 99220.05931 | 0.5 | 0.999837191 | 99228.13695 | 5086907.491 | 51.26476872 |
| 2018 | Female | 28 | 0.000165906 | 0.000165892 | 16.45846116 | 99203.75245 | 0.5 | 0.999834108 | 99211.98168 | 4987687.432 | 50.27303504 |
| 2018 | Female | 29 | 0.000171499 | 0.000171484 | 17.01046768 | 99187.01799 | 0.5 | 0.999828516 | 99195.52322 | 4888483.679 | 49.28129336 |
| 2018 | Female | 30 | 0.000179916 | 0.000179899 | 17.84215634 | 99169.59167 | 0.5 | 0.999820101 | 99178.51275 | 4789296.661 | 48.28966001 |
| 2018 | Female | 31 | 0.000191545 | 0.000191526 | 18.99189376 | 99151.17465 | 0.5 | 0.999808474 | 99160.6706 | 4690127.07 | 47.29825889 |
| 2018 | Female | 32 | 0.000206867 | 0.000206846 | 20.5070368 | 99131.42518 | 0.5 | 0.999793154 | 99141.6787 | 4590975.895 | 46.30722371 |
| 2018 | Female | 33 | 0.000226467 | 0.000226442 | 22.4451605 | 99109.94908 | 0.5 | 0.999773558 | 99121.17167 | 4491844.47 | 45.31670071 |
| 2018 | Female | 34 | 0.000251043 | 0.000251011 | 24.87487102 | 99086.28907 | 0.5 | 0.999748989 | 99098.7265 | 4392734.521 | 44.32685137 |
| 2018 | Female | 35 | 0.000281405 | 0.000281366 | 27.87598182 | 99059.91364 | 0.5 | 0.999718634 | 99073.85163 | 4293648.232 | 43.33785516 |
| 2018 | Female | 36 | 0.000318476 | 0.000318426 | 31.53876515 | 99030.20627 | 0.5 | 0.999681574 | 99045.97565 | 4194588.318 | 42.34991165 |
| 2018 | Female | 37 | 0.000363265 | 0.000363199 | 35.9619536 | 98996.45591 | 0.5 | 0.999636801 | 99014.43689 | 4095558.112 | 41.36324197 |
| 2018 | Female | 38 | 0.000416836 | 0.000416749 | 41.24918972 | 98957.85034 | 0.5 | 0.999583251 | 98978.47493 | 3996561.656 | 40.37808886 |
| 2018 | Female | 39 | 0.000480255 | 0.00048014 | 47.50373847 | 98913.47387 | 0.5 | 0.99951986 | 98937.22574 | 3897603.806 | 39.39471494 |
| 2018 | Female | 40 | 0.000554524 | 0.00055437 | 54.82151463 | 98862.31125 | 0.5 | 0.99944563 | 98889.722 | 3798690.332 | 38.41339883 |
| 2018 | Female | 41 | 0.000640493 | 0.000640288 | 63.28283838 | 98803.25907 | 0.5 | 0.999359712 | 98834.90049 | 3699828.02 | 37.43442855 |
| 2018 | Female | 42 | 0.000738782 | 0.00073851 | 72.94378121 | 98735.14576 | 0.5 | 0.99926149 | 98771.61765 | 3601024.761 | 36.45809239 |
| 2018 | Female | 43 | 0.000849698 | 0.000849337 | 83.82841276 | 98656.75966 | 0.5 | 0.999150663 | 98698.67387 | 3502289.616 | 35.48466741 |
| 2018 | Female | 44 | 0.000973183 | 0.000972709 | 95.92357696 | 98566.88367 | 0.5 | 0.999027291 | 98614.84546 | 3403632.856 | 34.51440643 |
| 2018 | Female | 45 | 0.001108806 | 0.001108192 | 109.1778654 | 98464.33295 | 0.5 | 0.998891808 | 98518.92188 | 3305065.972 | 33.54752477 |
| 2018 | Female | 46 | 0.001255807 | 0.001255019 | 123.5061115 | 98347.99096 | 0.5 | 0.998744981 | 98409.74402 | 3206601.639 | 32.5841884 |
| 2018 | Female | 47 | 0.0014132 | 0.001412202 | 138.799987 | 98216.83791 | 0.5 | 0.998587798 | 98286.2379 | 3108253.648 | 31.62450527 |
| 2018 | Female | 48 | 0.001579936 | 0.001578689 | 154.9442606 | 98069.96579 | 0.5 | 0.998421311 | 98147.43792 | 3010036.811 | 30.66852151 |
| 2018 | Female | 49 | 0.001755114 | 0.001753575 | 171.8372147 | 97906.57505 | 0.5 | 0.998246425 | 97992.49366 | 2911966.845 | 29.71622352 |
| 2018 | Female | 50 | 0.001938205 | 0.001936328 | 189.412886 | 97725.95 | 0.5 | 0.998063672 | 97820.65644 | 2814060.27 | 28.76754637 |
| 2018 | Female | 51 | 0.002129272 | 0.002127008 | 207.6624368 | 97527.41234 | 0.5 | 0.997872992 | 97631.24356 | 2716334.32 | 27.8223878 |
| 2018 | Female | 52 | 0.00232917 | 0.002326461 | 226.6521495 | 97310.25504 | 0.5 | 0.997673539 | 97423.58112 | 2618806.907 | 26.88062661 |
| 2018 | Female | 53 | 0.002539681 | 0.00253646 | 246.5361656 | 97073.66089 | 0.5 | 0.99746354 | 97196.92897 | 2521496.652 | 25.94214322 |
| 2018 | Female | 54 | 0.002763605 | 0.002759792 | 267.5629085 | 96816.61135 | 0.5 | 0.997240208 | 96950.3928 | 2424422.991 | 25.00684032 |
| 2018 | Female | 55 | 0.00300478 | 0.003000272 | 290.0747977 | 96537.7925 | 0.5 | 0.996999728 | 96682.8299 | 2327606.38 | 24.07466127 |
| 2018 | Female | 56 | 0.003268036 | 0.003262705 | 314.5011168 | 96235.50454 | 0.5 | 0.996737295 | 96392.7551 | 2231068.588 | 23.14560451 |
| 2018 | Female | 57 | 0.003559088 | 0.003552766 | 341.3435499 | 95907.58221 | 0.5 | 0.996447234 | 96078.25398 | 2134833.083 | 22.2197323 |
| 2018 | Female | 58 | 0.003884331 | 0.003876801 | 371.152976 | 95551.33394 | 0.5 | 0.996123199 | 95736.91043 | 2038925.501 | 21.29717255 |
| 2018 | Female | 59 | 0.004250524 | 0.00424151 | 404.4947842 | 95163.51006 | 0.5 | 0.99575849 | 95365.75745 | 1943374.167 | 20.37811284 |
| 2018 | Female | 60 | 0.004664315 | 0.004653463 | 441.8986756 | 94740.31333 | 0.5 | 0.995346537 | 94961.26267 | 1848210.657 | 19.46278519 |
| 2018 | Female | 61 | 0.005131537 | 0.005118405 | 483.7883557 | 94277.46982 | 0.5 | 0.994881595 | 94519.364 | 1753470.343 | 18.55144035 |
| 2018 | Female | 62 | 0.00565624 | 0.005640289 | 530.3877794 | 93770.38175 | 0.5 | 0.994359711 | 94035.57564 | 1659192.874 | 17.64431028 |
| 2018 | Female | 63 | 0.006239435 | 0.006220031 | 581.6051403 | 93214.38529 | 0.5 | 0.993779969 | 93505.18786 | 1565422.492 | 16.74155764 |
| 2018 | Female | 64 | 0.006877644 | 0.006854074 | 636.905104 | 92605.13017 | 0.5 | 0.993145926 | 92923.58272 | 1472208.107 | 15.84321292 |
| 2018 | Female | 65 | 0.00756147 | 0.007532989 | 695.1945664 | 91939.08033 | 0.5 | 0.992467011 | 92286.67762 | 1379602.976 | 14.94910221 |
| 2018 | Female | 66 | 0.008274662 | 0.008240568 | 754.7658395 | 91214.10013 | 0.5 | 0.991759432 | 91591.48305 | 1287663.896 | 14.0587733 |
| 2018 | Female | 67 | 0.008994332 | 0.008954065 | 813.3578268 | 90430.0383 | 0.5 | 0.991045935 | 90836.71721 | 1196449.796 | 13.17143367 |
| 2018 | Female | 68 | 0.009693138 | 0.009646386 | 868.4000814 | 89589.15934 | 0.5 | 0.990353614 | 90023.35938 | 1106019.758 | 12.28591962 |
| 2018 | Female | 69 | 0.010344128 | 0.010290903 | 917.4850077 | 88696.2168 | 0.5 | 0.989709097 | 89154.9593 | 1016430.598 | 11.40071855 |
| 2018 | Female | 70 | 0.01092854 | 0.010869148 | 959.0662091 | 87757.94119 | 0.5 | 0.989130852 | 88237.47429 | 927734.3815 | 10.5140632 |
| 2018 | Female | 71 | 0.011446226 | 0.01138109 | 993.3234533 | 86781.74636 | 0.5 | 0.98861891 | 87278.40808 | 839976.4403 | 9.624103587 |
| 2018 | Female | 72 | 0.011928098 | 0.01185738 | 1023.115045 | 85773.52711 | 0.5 | 0.98814262 | 86285.08463 | 753194.694 | 8.729141279 |
| 2018 | Female | 73 | 0.012451074 | 0.012374039 | 1055.034965 | 84734.4521 | 0.5 | 0.987625961 | 85261.96959 | 667421.1669 | 7.827888214 |
| 2018 | Female | 74 | 0.013159958 | 0.013073932 | 1100.915746 | 83656.47675 | 0.5 | 0.986926068 | 84206.93462 | 582686.7148 | 6.919699873 |
| 2018 | Female | 75 | 0.014311007 | 0.014209332 | 1180.880982 | 82515.57838 | 0.5 | 0.985790668 | 83106.01888 | 499030.238 | 6.004742433 |
| 2018 | Female | 76 | 0.016378301 | 0.016245267 | 1330.895702 | 81259.69004 | 0.5 | 0.983754733 | 81925.13789 | 416514.6596 | 5.0840886 |
| 2018 | Female | 77 | 0.020342646 | 0.020137817 | 1622.992124 | 79782.74613 | 0.5 | 0.979862183 | 80594.24219 | 335254.9696 | 4.1597881 |
| 2018 | Female | 78 | 0.02856084 | 0.028158721 | 2223.72941 | 77859.38536 | 0.5 | 0.971841279 | 78971.25007 | 255472.2235 | 3.235002906 |
| 2018 | Female | 79 | 0.047782924 | 0.046667958 | 3581.650056 | 74956.69563 | 0.5 | 0.953332042 | 76747.52066 | 177612.8381 | 2.314248546 |
| 2018 | Female | 80 | 0.101877483 | 0.096939507 | 7092.663419 | 69619.53889 | 0.5 | 0.903060493 | 73165.8706 | 102656.1425 | 1.403060493 |

Table 27: Female Life Table in 2019

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | Sex | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2019 | Female | 0 | 0.001426184 | 0.00142445 | 142.4449521 | 99878.36608 | 0.146099 | 0.99857555 | 100000 | 7548863.422 | 75.48863422 |
| 2019 | Female | 1 | 0.001076771 | 0.001076192 | 107.4658671 | 99803.82211 | 0.5 | 0.998923808 | 99857.55505 | 7448985.056 | 74.59610895 |
| 2019 | Female | 2 | 0.000850563 | 0.000850201 | 84.80765851 | 99707.68535 | 0.5 | 0.999149799 | 99750.08918 | 7349181.234 | 73.67593647 |
| 2019 | Female | 3 | 0.000702463 | 0.000702216 | 69.98655262 | 99630.28825 | 0.5 | 0.999297784 | 99665.28152 | 7249473.548 | 72.73820369 |
| 2019 | Female | 4 | 0.000604675 | 0.000604492 | 60.20456516 | 99565.19269 | 0.5 | 0.999395508 | 99595.29497 | 7149843.26 | 71.78896616 |
| 2019 | Female | 5 | 0.000539949 | 0.000539804 | 53.72940258 | 99508.2257 | 0.5 | 0.999460196 | 99535.0904 | 7050278.067 | 70.83208584 |
| 2019 | Female | 6 | 0.000497346 | 0.000497223 | 49.46437791 | 99456.62881 | 0.5 | 0.999502777 | 99481.361 | 6950769.842 | 69.87007186 |
| 2019 | Female | 7 | 0.000469684 | 0.000469574 | 46.69061676 | 99408.55132 | 0.5 | 0.999530426 | 99431.89662 | 6851313.213 | 68.90458138 |
| 2019 | Female | 8 | 0.000452031 | 0.000451929 | 44.91505591 | 99362.74848 | 0.5 | 0.999548071 | 99385.20601 | 6751904.662 | 67.93671747 |
| 2019 | Female | 9 | 0.000440826 | 0.000440729 | 43.78216447 | 99318.39987 | 0.5 | 0.999559271 | 99340.29095 | 6652541.913 | 66.96720786 |
| 2019 | Female | 10 | 0.000433384 | 0.000433291 | 43.02423922 | 99274.99667 | 0.5 | 0.999566709 | 99296.50879 | 6553223.513 | 65.99651482 |
| 2019 | Female | 11 | 0.000427635 | 0.000427544 | 42.43521101 | 99232.26694 | 0.5 | 0.999572456 | 99253.48455 | 6453948.517 | 65.02490614 |
| 2019 | Female | 12 | 0.000422002 | 0.000421913 | 41.85844185 | 99190.12012 | 0.5 | 0.999578087 | 99211.04934 | 6354716.25 | 64.05250516 |
| 2019 | Female | 13 | 0.000415356 | 0.00041527 | 41.18198419 | 99148.5999 | 0.5 | 0.99958473 | 99169.19089 | 6255526.13 | 63.07933011 |
| 2019 | Female | 14 | 0.000406997 | 0.000406914 | 40.33660468 | 99107.84061 | 0.5 | 0.999593086 | 99128.00891 | 6156377.53 | 62.10532822 |
| 2019 | Female | 15 | 0.00039663 | 0.000396552 | 39.29336599 | 99068.02562 | 0.5 | 0.999603448 | 99087.67231 | 6057269.689 | 61.13040652 |
| 2019 | Female | 16 | 0.000384321 | 0.000384247 | 38.05903307 | 99029.34942 | 0.5 | 0.999615753 | 99048.37894 | 5958201.663 | 60.15445914 |
| 2019 | Female | 17 | 0.000370424 | 0.000370355 | 36.66897288 | 98991.98542 | 0.5 | 0.999629645 | 99010.31991 | 5859172.314 | 59.17738999 |
| 2019 | Female | 18 | 0.000355494 | 0.000355431 | 35.17831776 | 98956.06178 | 0.5 | 0.999644569 | 98973.65093 | 5760180.329 | 58.19912951 |
| 2019 | Female | 19 | 0.000340196 | 0.000340138 | 33.65275476 | 98921.64624 | 0.5 | 0.999659862 | 98938.47262 | 5661224.267 | 57.21964487 |
| 2019 | Female | 20 | 0.000325217 | 0.000325165 | 32.16034126 | 98888.73969 | 0.5 | 0.999674835 | 98904.81986 | 5562302.621 | 56.23894395 |
| 2019 | Female | 21 | 0.00031121 | 0.000311161 | 30.76536425 | 98857.27684 | 0.5 | 0.999688839 | 98872.65952 | 5463413.881 | 55.25707417 |
| 2019 | Female | 22 | 0.000298751 | 0.000298706 | 29.52469011 | 98827.13181 | 0.5 | 0.999701294 | 98841.89416 | 5364556.604 | 54.27411777 |
| 2019 | Female | 23 | 0.000288331 | 0.000288289 | 28.48651777 | 98798.12621 | 0.5 | 0.999711711 | 98812.36947 | 5265729.472 | 53.29018523 |
| 2019 | Female | 24 | 0.000280359 | 0.00028032 | 27.69108985 | 98770.0374 | 0.5 | 0.99971968 | 98783.88295 | 5166931.346 | 52.30540845 |
| 2019 | Female | 25 | 0.000275188 | 0.00027515 | 27.17276962 | 98742.60547 | 0.5 | 0.99972485 | 98756.19186 | 5068161.309 | 51.31993461 |
| 2019 | Female | 26 | 0.000273138 | 0.0002731 | 26.96291658 | 98715.53763 | 0.5 | 0.9997269 | 98729.01909 | 4969418.703 | 50.33392157 |
| 2019 | Female | 27 | 0.000274532 | 0.000274494 | 27.09311669 | 98688.50961 | 0.5 | 0.999725506 | 98702.05617 | 4870703.166 | 49.34753494 |
| 2019 | Female | 28 | 0.00027973 | 0.000279691 | 27.59847515 | 98661.16382 | 0.5 | 0.999720309 | 98674.96306 | 4772014.656 | 48.36094697 |
| 2019 | Female | 29 | 0.000289161 | 0.000289119 | 28.52080954 | 98633.10418 | 0.5 | 0.999710881 | 98647.36458 | 4673353.492 | 47.37433698 |
| 2019 | Female | 30 | 0.000303352 | 0.000303306 | 29.91166453 | 98603.88794 | 0.5 | 0.999696694 | 98618.84377 | 4574720.388 | 46.38789316 |
| 2019 | Female | 31 | 0.00032296 | 0.000322907 | 31.83509669 | 98573.01456 | 0.5 | 0.999677093 | 98588.93211 | 4476116.5 | 45.40181544 |
| 2019 | Female | 32 | 0.000348794 | 0.000348733 | 34.37015234 | 98539.91193 | 0.5 | 0.999651267 | 98557.09701 | 4377543.485 | 44.41631925 |
| 2019 | Female | 33 | 0.000381842 | 0.000381769 | 37.61289003 | 98503.92041 | 0.5 | 0.999618231 | 98522.72686 | 4279003.573 | 43.43163968 |
| 2019 | Female | 34 | 0.000423277 | 0.000423188 | 41.67769463 | 98464.27512 | 0.5 | 0.999576812 | 98485.11397 | 4180499.653 | 42.4480359 |
| 2019 | Female | 35 | 0.000474471 | 0.000474359 | 46.69750754 | 98420.08752 | 0.5 | 0.999525641 | 98443.43627 | 4082035.378 | 41.46579531 |
| 2019 | Female | 36 | 0.000536976 | 0.000536832 | 52.82248706 | 98370.32752 | 0.5 | 0.999463168 | 98396.73876 | 3983615.29 | 40.48523702 |
| 2019 | Female | 37 | 0.000612493 | 0.000612306 | 60.21655055 | 98313.808 | 0.5 | 0.999387694 | 98343.91628 | 3885244.963 | 39.50671389 |
| 2019 | Female | 38 | 0.000702818 | 0.000702571 | 69.05129121 | 98249.17408 | 0.5 | 0.999297429 | 98283.69973 | 3786931.155 | 38.53061256 |
| 2019 | Female | 39 | 0.000809748 | 0.000809421 | 79.49696129 | 98174.89996 | 0.5 | 0.999190579 | 98214.64844 | 3688681.981 | 37.55735055 |
| 2019 | Female | 40 | 0.000934971 | 0.000934534 | 91.71061707 | 98089.29617 | 0.5 | 0.999065466 | 98135.15147 | 3590507.081 | 36.58736984 |
| 2019 | Female | 41 | 0.001079922 | 0.001079339 | 105.8221332 | 97990.52979 | 0.5 | 0.998920661 | 98043.44086 | 3492417.785 | 35.62112625 |
| 2019 | Female | 42 | 0.001245645 | 0.001244869 | 121.9195534 | 97876.65895 | 0.5 | 0.998755131 | 97937.61872 | 3394427.255 | 34.65907482 |
| 2019 | Female | 43 | 0.001432657 | 0.001431631 | 140.0360009 | 97745.68117 | 0.5 | 0.998568369 | 97815.69917 | 3296550.596 | 33.70165141 |
| 2019 | Female | 44 | 0.001640862 | 0.001639517 | 160.1409025 | 97595.59272 | 0.5 | 0.998360483 | 97675.66317 | 3198804.915 | 32.74925208 |
| 2019 | Female | 45 | 0.001869534 | 0.001867788 | 182.1383336 | 97424.4531 | 0.5 | 0.998132212 | 97515.52227 | 3101209.322 | 31.8022121 |
| 2019 | Female | 46 | 0.002117389 | 0.00211515 | 205.8746922 | 97230.44659 | 0.5 | 0.99788485 | 97333.38393 | 3003784.869 | 30.8607874 |
| 2019 | Female | 47 | 0.002382765 | 0.00237993 | 231.1566292 | 97011.93093 | 0.5 | 0.99762007 | 97127.50924 | 2906554.422 | 29.92514114 |
| 2019 | Female | 48 | 0.002663896 | 0.002660352 | 257.7784176 | 96767.4634 | 0.5 | 0.997339648 | 96896.35261 | 2809542.491 | 28.99533796 |
| 2019 | Female | 49 | 0.00295926 | 0.002954888 | 285.5561291 | 96495.79613 | 0.5 | 0.997045112 | 96638.57419 | 2712775.028 | 28.07134781 |
| 2019 | Female | 50 | 0.003267965 | 0.003262634 | 314.3645884 | 96195.83577 | 0.5 | 0.996737366 | 96353.01807 | 2616279.232 | 27.15305949 |
| 2019 | Female | 51 | 0.00359012 | 0.003583687 | 344.172485 | 95866.56723 | 0.5 | 0.996416313 | 96038.65348 | 2520083.396 | 26.2403033 |
| 2019 | Female | 52 | 0.003927163 | 0.003919467 | 375.0713681 | 95506.94531 | 0.5 | 0.996080533 | 95694.48099 | 2424216.829 | 25.33288026 |
| 2019 | Female | 53 | 0.004282101 | 0.004272953 | 407.2953451 | 95115.76195 | 0.5 | 0.995727047 | 95319.40962 | 2328709.884 | 24.43059491 |
| 2019 | Female | 54 | 0.004659655 | 0.004648824 | 441.2297126 | 94691.49942 | 0.5 | 0.995351176 | 94912.11428 | 2233594.122 | 23.53328802 |
| 2019 | Female | 55 | 0.005066294 | 0.005053492 | 477.4079008 | 94232.18062 | 0.5 | 0.994946508 | 94470.88457 | 2138902.622 | 22.64086583 |
| 2019 | Female | 56 | 0.005510165 | 0.005495026 | 516.4965593 | 93735.22839 | 0.5 | 0.994504974 | 93993.47667 | 2044670.442 | 21.75332283 |
| 2019 | Female | 57 | 0.006000901 | 0.00598295 | 559.2680762 | 93197.34607 | 0.5 | 0.99401705 | 93476.98011 | 1950935.213 | 20.87075568 |
| 2019 | Female | 58 | 0.006549285 | 0.006527909 | 606.5583572 | 92614.43285 | 0.5 | 0.993472091 | 92917.71203 | 1857737.867 | 19.99336646 |
| 2019 | Female | 59 | 0.007166716 | 0.007141127 | 659.20566 | 91981.55084 | 0.5 | 0.992858873 | 92311.15367 | 1765123.434 | 19.12145352 |
| 2019 | Female | 60 | 0.0078644 | 0.007833597 | 717.9644253 | 91292.9658 | 0.5 | 0.992166403 | 91651.94801 | 1673141.883 | 18.25538813 |
| 2019 | Female | 61 | 0.008652173 | 0.008614905 | 783.3875992 | 90542.28979 | 0.5 | 0.991385095 | 90933.98359 | 1581848.918 | 17.39557485 |
| 2019 | Female | 62 | 0.009536863 | 0.009491603 | 855.6736767 | 89722.75915 | 0.5 | 0.990508397 | 90150.59599 | 1491306.628 | 16.54239344 |
| 2019 | Female | 63 | 0.010520176 | 0.010465129 | 934.4828736 | 88827.68087 | 0.5 | 0.989534871 | 89294.92231 | 1401583.869 | 15.69612059 |
| 2019 | Female | 64 | 0.011596246 | 0.011529397 | 1018.742573 | 87851.06815 | 0.5 | 0.988470603 | 88360.43944 | 1312756.188 | 14.85683182 |
| 2019 | Female | 65 | 0.01274923 | 0.012668473 | 1106.48592 | 86788.45391 | 0.5 | 0.987331527 | 87341.69687 | 1224905.12 | 14.0242881 |
| 2019 | Female | 66 | 0.013951727 | 0.013855076 | 1194.795432 | 85637.81323 | 0.5 | 0.986144924 | 86235.21095 | 1138116.666 | 13.19781854 |
| 2019 | Female | 67 | 0.015165148 | 0.015051023 | 1279.945234 | 84400.4429 | 0.5 | 0.984948977 | 85040.41551 | 1052478.853 | 12.37621954 |
| 2019 | Female | 68 | 0.016343389 | 0.016210918 | 1357.834151 | 83081.5532 | 0.5 | 0.983789082 | 83760.47028 | 968078.4097 | 11.55770027 |
| 2019 | Female | 69 | 0.017441009 | 0.017290229 | 1424.76049 | 81690.25588 | 0.5 | 0.982709771 | 82402.63613 | 884996.8565 | 10.73990952 |
| 2019 | Female | 70 | 0.018426374 | 0.018258159 | 1478.50689 | 80238.62219 | 0.5 | 0.981741841 | 80977.87564 | 803306.6006 | 9.920075012 |
| 2019 | Female | 71 | 0.019299232 | 0.019114782 | 1519.613092 | 78739.5622 | 0.5 | 0.980885218 | 79499.36875 | 723067.9784 | 9.095266916 |
| 2019 | Female | 72 | 0.020111707 | 0.01991148 | 1552.692333 | 77203.40949 | 0.5 | 0.98008852 | 77979.75566 | 644328.4162 | 8.262765262 |
| 2019 | Female | 73 | 0.020993486 | 0.020775412 | 1587.803693 | 75633.16148 | 0.5 | 0.979224588 | 76427.06332 | 567125.0067 | 7.420473613 |
| 2019 | Female | 74 | 0.022188719 | 0.021945251 | 1642.366336 | 74018.07646 | 0.5 | 0.978054749 | 74839.25963 | 491491.8452 | 6.567299672 |
| 2019 | Female | 75 | 0.024129477 | 0.023841831 | 1745.147991 | 72324.3193 | 0.5 | 0.976158169 | 73196.89329 | 417473.7688 | 5.703435624 |
| 2019 | Female | 76 | 0.027615098 | 0.027238994 | 1946.273675 | 70478.60847 | 0.5 | 0.972761006 | 71451.7453 | 345149.4495 | 4.830525105 |
| 2019 | Female | 77 | 0.034299292 | 0.033720989 | 2343.793256 | 68333.575 | 0.5 | 0.966279011 | 69505.47163 | 274670.841 | 3.951787314 |
| 2019 | Female | 78 | 0.04815581 | 0.047023581 | 3158.182624 | 65582.58706 | 0.5 | 0.952976419 | 67161.67837 | 206337.266 | 3.072247017 |
| 2019 | Female | 79 | 0.080565748 | 0.077446001 | 4956.814775 | 61525.08836 | 0.5 | 0.922553999 | 64003.49575 | 140754.679 | 2.199171738 |
| 2019 | Female | 80 | 0.171773409 | 0.158187229 | 9340.430861 | 54376.46554 | 0.5 | 0.841812771 | 59046.68097 | 79229.5906 | 1.341812771 |

## Table 28: Female Life Table in 2020

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | Sex | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | Female | 0 | 0.001649371 | 0.00164705 | 164.7049822 | 99859.28267 | 0.14564 | 0.99835295 | 100000 | 7468395.966 | 74.68395966 |
| 2020 | Female | 1 | 0.001245277 | 0.001244502 | 124.245256 | 99773.17239 | 0.5 | 0.998755498 | 99835.29502 | 7368536.683 | 73.80693052 |
| 2020 | Female | 2 | 0.000983669 | 0.000983186 | 98.03447743 | 99662.03252 | 0.5 | 0.999016814 | 99711.04976 | 7268763.511 | 72.89827485 |
| 2020 | Female | 3 | 0.000812392 | 0.000812063 | 80.8920028 | 99572.56928 | 0.5 | 0.999187937 | 99613.01528 | 7169101.478 | 71.96952585 |
| 2020 | Female | 4 | 0.000699302 | 0.000699057 | 69.57864858 | 99497.33396 | 0.5 | 0.999300943 | 99532.12328 | 7069528.909 | 71.02761075 |
| 2020 | Female | 5 | 0.000624447 | 0.000624252 | 62.08971683 | 99431.49977 | 0.5 | 0.999375748 | 99462.54463 | 6970031.575 | 70.07694807 |
| 2020 | Female | 6 | 0.000575177 | 0.000575012 | 57.15641344 | 99371.87671 | 0.5 | 0.999424988 | 99400.45492 | 6870600.075 | 69.12040877 |
| 2020 | Female | 7 | 0.000543186 | 0.000543038 | 53.94723202 | 99316.32489 | 0.5 | 0.999456962 | 99343.2985 | 6771228.199 | 68.159889 |
| 2020 | Female | 8 | 0.00052277 | 0.000522634 | 51.89197239 | 99263.40528 | 0.5 | 0.999477366 | 99289.35127 | 6671911.874 | 67.19665088 |
| 2020 | Female | 9 | 0.000509812 | 0.000509682 | 50.57956858 | 99212.16951 | 0.5 | 0.999490318 | 99237.4593 | 6572648.468 | 66.23152704 |
| 2020 | Female | 10 | 0.000501206 | 0.00050108 | 49.70057175 | 99162.02944 | 0.5 | 0.99949892 | 99186.87973 | 6473436.299 | 65.26504631 |
| 2020 | Female | 11 | 0.000494557 | 0.000494434 | 49.016838 | 99112.67074 | 0.5 | 0.999505566 | 99137.17916 | 6374274.27 | 64.29751506 |
| 2020 | Female | 12 | 0.000488042 | 0.000487923 | 48.34739867 | 99063.98862 | 0.5 | 0.999512077 | 99088.16232 | 6275161.599 | 63.32907435 |
| 2020 | Female | 13 | 0.000480356 | 0.000480241 | 47.56295911 | 99016.03344 | 0.5 | 0.999519759 | 99039.81492 | 6176097.61 | 62.35974507 |
| 2020 | Female | 14 | 0.000470689 | 0.000470578 | 46.58359403 | 98968.96017 | 0.5 | 0.999529422 | 98992.25196 | 6077081.577 | 61.38946692 |
| 2020 | Female | 15 | 0.0004587 | 0.000458594 | 45.37593406 | 98922.9804 | 0.5 | 0.999541406 | 98945.66837 | 5978112.617 | 60.41813366 |
| 2020 | Female | 16 | 0.000444464 | 0.000444365 | 43.94784223 | 98878.31851 | 0.5 | 0.999555635 | 98900.29243 | 5879189.636 | 59.44562439 |
| 2020 | Female | 17 | 0.000428392 | 0.0004283 | 42.34019988 | 98835.17449 | 0.5 | 0.9995717 | 98856.34459 | 5780311.318 | 58.47182942 |
| 2020 | Female | 18 | 0.000411126 | 0.000411042 | 40.61669277 | 98793.69605 | 0.5 | 0.999588958 | 98814.00439 | 5681476.143 | 57.49666941 |
| 2020 | Female | 19 | 0.000393434 | 0.000393357 | 38.85317104 | 98753.96111 | 0.5 | 0.999606643 | 98773.3877 | 5582682.447 | 56.52010706 |
| 2020 | Female | 20 | 0.000376111 | 0.000376041 | 37.12819922 | 98715.97043 | 0.5 | 0.999623959 | 98734.53453 | 5483928.486 | 55.54215161 |
| 2020 | Female | 21 | 0.000359912 | 0.000359847 | 35.51596926 | 98679.64834 | 0.5 | 0.999640153 | 98697.40633 | 5385212.516 | 54.56285748 |
| 2020 | Female | 22 | 0.000345503 | 0.000345443 | 34.08209089 | 98644.84931 | 0.5 | 0.999654557 | 98661.89036 | 5286532.867 | 53.58231885 |
| 2020 | Female | 23 | 0.000333452 | 0.000333396 | 32.8821568 | 98611.36719 | 0.5 | 0.999666604 | 98627.80827 | 5187888.018 | 52.60066212 |
| 2020 | Female | 24 | 0.000324233 | 0.000324181 | 31.96256732 | 98578.94483 | 0.5 | 0.999675819 | 98594.92611 | 5089276.651 | 51.61803808 |
| 2020 | Female | 25 | 0.000318253 | 0.000318202 | 31.36293046 | 98547.28208 | 0.5 | 0.999681798 | 98562.96354 | 4990697.706 | 50.63461493 |
| 2020 | Female | 26 | 0.000315881 | 0.000315831 | 31.11938197 | 98516.04092 | 0.5 | 0.999684169 | 98531.60061 | 4892150.424 | 49.65057295 |
| 2020 | Female | 27 | 0.000317494 | 0.000317443 | 31.2683131 | 98484.84708 | 0.5 | 0.999682557 | 98500.48123 | 4793634.383 | 48.66610115 |
| 2020 | Female | 28 | 0.000323505 | 0.000323453 | 31.85016871 | 98453.28783 | 0.5 | 0.999676547 | 98469.21292 | 4695149.536 | 47.68139601 |
| 2020 | Female | 29 | 0.000334412 | 0.000334356 | 32.91312857 | 98420.90619 | 0.5 | 0.999665644 | 98437.36275 | 4596696.248 | 46.69666191 |
| 2020 | Female | 30 | 0.000350824 | 0.000350762 | 34.51658053 | 98387.19133 | 0.5 | 0.999649238 | 98404.44962 | 4498275.342 | 45.71211321 |
| 2020 | Female | 31 | 0.0003735 | 0.00037343 | 36.73432582 | 98351.56588 | 0.5 | 0.99962657 | 98369.93304 | 4399888.15 | 44.72797749 |
| 2020 | Female | 32 | 0.000403378 | 0.000403296 | 39.65742671 | 98313.37 | 0.5 | 0.999596704 | 98333.19872 | 4301536.585 | 43.74449973 |
| 2020 | Female | 33 | 0.000441597 | 0.000441499 | 43.39652452 | 98271.84303 | 0.5 | 0.999558501 | 98293.54129 | 4203223.215 | 42.76194712 |
| 2020 | Female | 34 | 0.000489517 | 0.000489397 | 48.08333419 | 98226.1031 | 0.5 | 0.999510603 | 98250.14476 | 4104951.372 | 41.78061398 |
| 2020 | Female | 35 | 0.000548722 | 0.000548572 | 53.8708814 | 98175.12599 | 0.5 | 0.999451428 | 98202.06143 | 4006725.268 | 40.80082648 |
| 2020 | Female | 36 | 0.000621008 | 0.000620816 | 60.931919 | 98117.72459 | 0.5 | 0.999379184 | 98148.19055 | 3908550.142 | 39.82294651 |
| 2020 | Female | 37 | 0.000708344 | 0.000708093 | 69.45488954 | 98052.53118 | 0.5 | 0.999291907 | 98087.25863 | 3810432.418 | 38.84737397 |
| 2020 | Female | 38 | 0.000812803 | 0.000812473 | 79.63684768 | 97977.98532 | 0.5 | 0.999187527 | 98017.80374 | 3712379.887 | 37.87454672 |
| 2020 | Female | 39 | 0.000936468 | 0.000936029 | 91.67298827 | 97892.3304 | 0.5 | 0.999063971 | 97938.16689 | 3614401.901 | 36.90493723 |
| 2020 | Female | 40 | 0.001081286 | 0.001080702 | 105.7428937 | 97793.62246 | 0.5 | 0.998919298 | 97846.4939 | 3516509.571 | 35.93904524 |
| 2020 | Female | 41 | 0.001248921 | 0.001248142 | 121.9943234 | 97679.75385 | 0.5 | 0.998751858 | 97740.75101 | 3418715.949 | 34.97738572 |
| 2020 | Female | 42 | 0.001440578 | 0.001439541 | 140.526249 | 97548.49356 | 0.5 | 0.998560459 | 97618.75669 | 3321036.195 | 34.02047217 |
| 2020 | Female | 43 | 0.001656856 | 0.001655485 | 161.373711 | 97397.54358 | 0.5 | 0.998344515 | 97478.23044 | 3223487.701 | 33.06879584 |
| 2020 | Female | 44 | 0.001897644 | 0.001895845 | 184.497687 | 97224.60788 | 0.5 | 0.998104155 | 97316.85673 | 3126090.158 | 32.12280239 |
| 2020 | Female | 45 | 0.002162101 | 0.002159767 | 209.7832156 | 97027.46743 | 0.5 | 0.997840233 | 97132.35904 | 3028865.55 | 31.1828682 |
| 2020 | Female | 46 | 0.002448744 | 0.002445749 | 237.0483175 | 96804.05167 | 0.5 | 0.997554251 | 96922.57582 | 2931838.082 | 30.24927946 |
| 2020 | Female | 47 | 0.002755649 | 0.002751857 | 266.0647654 | 96552.49512 | 0.5 | 0.997248143 | 96685.52751 | 2835034.031 | 29.32221713 |
| 2020 | Female | 48 | 0.003080774 | 0.003076036 | 296.5897219 | 96271.16788 | 0.5 | 0.996923964 | 96419.46274 | 2738481.535 | 28.40175062 |
| 2020 | Female | 49 | 0.00342236 | 0.003416514 | 328.4051617 | 95958.67044 | 0.5 | 0.996583486 | 96122.87302 | 2642210.368 | 27.48784222 |
| 2020 | Female | 50 | 0.003779375 | 0.003772247 | 361.360376 | 95613.78767 | 0.5 | 0.996227753 | 95794.46786 | 2546251.697 | 26.58036267 |
| 2020 | Female | 51 | 0.004151945 | 0.004143344 | 395.4121843 | 95235.40139 | 0.5 | 0.995856656 | 95433.10748 | 2450637.909 | 25.67911676 |
| 2020 | Female | 52 | 0.004541733 | 0.004531443 | 430.6578887 | 94822.36635 | 0.5 | 0.995468557 | 95037.6953 | 2355402.508 | 24.78387655 |
| 2020 | Female | 53 | 0.004952216 | 0.004939984 | 467.3572963 | 94373.35876 | 0.5 | 0.995060016 | 94607.03741 | 2260580.142 | 23.89441847 |
| 2020 | Female | 54 | 0.005388854 | 0.005374373 | 505.9417677 | 93886.70923 | 0.5 | 0.994625627 | 94139.68011 | 2166206.783 | 23.01056027 |
| 2020 | Female | 55 | 0.005859128 | 0.005842014 | 547.0096025 | 93360.23354 | 0.5 | 0.994157986 | 93633.73835 | 2072320.074 | 22.13219413 |
| 2020 | Female | 56 | 0.006372462 | 0.006352222 | 591.3075942 | 92791.07495 | 0.5 | 0.993647778 | 93086.72874 | 1978959.84 | 21.25931233 |
| 2020 | Female | 57 | 0.006939995 | 0.006915996 | 639.6979906 | 92175.57215 | 0.5 | 0.993084004 | 92495.42115 | 1886168.765 | 20.39202311 |
| 2020 | Female | 58 | 0.007574197 | 0.007545621 | 693.108445 | 91509.16894 | 0.5 | 0.992454379 | 91855.72316 | 1793993.193 | 19.53055435 |
| 2020 | Female | 59 | 0.00828825 | 0.008254045 | 752.4602824 | 90786.38457 | 0.5 | 0.991745955 | 91162.61471 | 1702484.024 | 18.67524346 |
| 2020 | Female | 60 | 0.009095117 | 0.009053943 | 818.568406 | 90000.87023 | 0.5 | 0.990946057 | 90410.15443 | 1611697.64 | 17.8265113 |
| 2020 | Female | 61 | 0.01000617 | 0.009956358 | 892.0058631 | 89145.58309 | 0.5 | 0.990043642 | 89591.58602 | 1521696.769 | 16.98481785 |
| 2020 | Female | 62 | 0.011029307 | 0.010968817 | 972.9294996 | 88213.11541 | 0.5 | 0.989031183 | 88699.58016 | 1432551.186 | 16.15059715 |
| 2020 | Female | 63 | 0.012166501 | 0.012092936 | 1060.872795 | 87196.21426 | 0.5 | 0.987907064 | 87726.65066 | 1344338.071 | 15.32416957 |
| 2020 | Female | 64 | 0.013410966 | 0.013321638 | 1154.530138 | 86088.5128 | 0.5 | 0.986678362 | 86665.77787 | 1257141.857 | 14.50563172 |
| 2020 | Female | 65 | 0.014744383 | 0.01463648 | 1251.583663 | 84885.4559 | 0.5 | 0.98536352 | 85511.24773 | 1171053.344 | 13.69472876 |
| 2020 | Female | 66 | 0.016135062 | 0.016005934 | 1348.654609 | 83585.33676 | 0.5 | 0.983994066 | 84259.66406 | 1086167.888 | 12.89072179 |
| 2020 | Female | 67 | 0.017538374 | 0.017385913 | 1441.483636 | 82190.26764 | 0.5 | 0.982614087 | 82911.00946 | 1002582.551 | 12.09227288 |
| 2020 | Female | 68 | 0.018901 | 0.018724048 | 1525.439337 | 80706.80615 | 0.5 | 0.981275952 | 81469.52582 | 920392.2835 | 11.29738113 |
| 2020 | Female | 69 | 0.020170389 | 0.019968997 | 1596.403259 | 79145.88485 | 0.5 | 0.980031003 | 79944.08648 | 839685.4773 | 10.5034095 |
| 2020 | Female | 70 | 0.021309956 | 0.021085293 | 1651.98382 | 77521.69131 | 0.5 | 0.978914707 | 78347.68322 | 760539.5925 | 9.707237804 |
| 2020 | Female | 71 | 0.022319409 | 0.02207308 | 1692.910305 | 75849.24425 | 0.5 | 0.97792692 | 76695.6994 | 683017.9012 | 8.905556719 |
| 2020 | Female | 72 | 0.023259029 | 0.022991648 | 1724.437706 | 74140.57025 | 0.5 | 0.977008352 | 75002.7891 | 607168.6569 | 8.095281045 |
| 2020 | Female | 73 | 0.0242788 | 0.023987605 | 1757.772122 | 72399.46533 | 0.5 | 0.976012395 | 73278.35139 | 533028.0867 | 7.274018541 |
| 2020 | Female | 74 | 0.025661078 | 0.025336004 | 1812.045654 | 70614.55645 | 0.5 | 0.974663996 | 71520.57927 | 460628.6213 | 6.440504622 |
| 2020 | Female | 75 | 0.027905549 | 0.027521547 | 1918.48667 | 68749.29028 | 0.5 | 0.972478453 | 69708.53362 | 390014.0649 | 5.59492568 |
| 2020 | Female | 76 | 0.031936642 | 0.031434683 | 2130.958617 | 66724.56764 | 0.5 | 0.968565317 | 67790.04695 | 321264.7746 | 4.739114207 |
| 2020 | Female | 77 | 0.03966686 | 0.03889543 | 2553.838457 | 64382.1691 | 0.5 | 0.96110457 | 65659.08833 | 254540.207 | 3.876694201 |
| 2020 | Female | 78 | 0.055691813 | 0.054183037 | 3419.234095 | 61395.63283 | 0.5 | 0.945816963 | 63105.24987 | 190158.0379 | 3.013347356 |
| 2020 | Female | 79 | 0.093173649 | 0.089026201 | 5313.619239 | 57029.20616 | 0.5 | 0.910973799 | 59686.01578 | 128762.405 | 2.157329541 |
| 2020 | Female | 80 | 0.198654586 | 0.180705589 | 9825.395934 | 49459.69857 | 0.5 | 0.819294411 | 54372.39654 | 71733.19887 | 1.319294411 |

## Table 29: Female Life Table in 2021

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | Sex | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | Female | 0 | 0.001308356 | 0.001306896 | 130.6896213 | 99888.43563 | 0.146341 | 0.998693104 | 100000 | 7592651.122 | 75.92651122 |
| 2021 | Female | 1 | 0.00098781 | 0.000987323 | 98.60325027 | 99820.00875 | 0.5 | 0.999012677 | 99869.31038 | 7492762.687 | 75.02567764 |
| 2021 | Female | 2 | 0.000780291 | 0.000779987 | 77.8198406 | 99731.79721 | 0.5 | 0.999220013 | 99770.70713 | 7392942.678 | 74.09933126 |
| 2021 | Female | 3 | 0.000644427 | 0.000644219 | 64.22405599 | 99660.77526 | 0.5 | 0.999355781 | 99692.88729 | 7293210.881 | 73.15678259 |
| 2021 | Female | 4 | 0.000554718 | 0.000554564 | 55.25047336 | 99601.038 | 0.5 | 0.999445436 | 99628.66323 | 7193550.106 | 72.20361964 |
| 2021 | Female | 5 | 0.00049534 | 0.000495217 | 49.31046823 | 99548.75752 | 0.5 | 0.999504783 | 99573.41276 | 7093949.068 | 71.24340596 |
| 2021 | Female | 6 | 0.000456257 | 0.000456152 | 45.3981626 | 99501.40321 | 0.5 | 0.999543848 | 99524.10229 | 6994400.31 | 70.27845667 |
| 2021 | Female | 7 | 0.00043088 | 0.000430787 | 42.85413015 | 99457.27706 | 0.5 | 0.999569213 | 99478.70413 | 6894898.907 | 69.31030081 |
| 2021 | Female | 8 | 0.000414685 | 0.000414599 | 41.22603371 | 99415.23698 | 0.5 | 0.999585401 | 99435.85 | 6795441.63 | 68.33995616 |
| 2021 | Female | 9 | 0.000404406 | 0.000404324 | 40.18767261 | 99374.53013 | 0.5 | 0.999595676 | 99394.62396 | 6696026.393 | 67.36809423 |
| 2021 | Female | 10 | 0.000397579 | 0.0003975 | 39.49339881 | 99334.68959 | 0.5 | 0.9996025 | 99354.43629 | 6596651.863 | 66.39514156 |
| 2021 | Female | 11 | 0.000392305 | 0.000392228 | 38.95409546 | 99295.46584 | 0.5 | 0.999607772 | 99314.94289 | 6497317.173 | 65.42134531 |
| 2021 | Female | 12 | 0.000387137 | 0.000387062 | 38.42598943 | 99256.7758 | 0.5 | 0.999612938 | 99275.9888 | 6398021.707 | 64.44681926 |
| 2021 | Female | 13 | 0.00038104 | 0.000380968 | 37.80630998 | 99218.65965 | 0.5 | 0.999619032 | 99237.56281 | 6298764.931 | 63.47158025 |
| 2021 | Female | 14 | 0.000373372 | 0.000373302 | 37.03148392 | 99181.24076 | 0.5 | 0.999626698 | 99199.7565 | 6199546.272 | 62.49557953 |
| 2021 | Female | 15 | 0.000363861 | 0.000363795 | 36.07492421 | 99144.68755 | 0.5 | 0.999636205 | 99162.72501 | 6100365.031 | 61.51873126 |
| 2021 | Female | 16 | 0.000352569 | 0.000352507 | 34.94282031 | 99109.17868 | 0.5 | 0.999647493 | 99126.65009 | 6001220.343 | 60.54093766 |
| 2021 | Female | 17 | 0.00033982 | 0.000339762 | 33.6676257 | 99074.87346 | 0.5 | 0.999660238 | 99091.70727 | 5902111.165 | 59.56210996 |
| 2021 | Female | 18 | 0.000326124 | 0.000326071 | 32.29994893 | 99041.88967 | 0.5 | 0.999673929 | 99058.03964 | 5803036.291 | 58.58218386 |
| 2021 | Female | 19 | 0.00031209 | 0.000312041 | 30.90009892 | 99010.28964 | 0.5 | 0.999687959 | 99025.73969 | 5703994.402 | 57.60112895 |
| 2021 | Female | 20 | 0.000298349 | 0.000298304 | 29.53057038 | 98980.07431 | 0.5 | 0.999701696 | 98994.8396 | 5604984.112 | 56.61895241 |
| 2021 | Female | 21 | 0.000285498 | 0.000285458 | 28.2504042 | 98951.18382 | 0.5 | 0.999714542 | 98965.30903 | 5506004.038 | 55.63569792 |
| 2021 | Female | 22 | 0.000274069 | 0.000274031 | 27.11183393 | 98923.5027 | 0.5 | 0.999725969 | 98937.05862 | 5407052.854 | 54.65144132 |
| 2021 | Female | 23 | 0.000264509 | 0.000264474 | 26.15913889 | 98896.86722 | 0.5 | 0.999735526 | 98909.94679 | 5308129.351 | 53.66628457 |
| 2021 | Female | 24 | 0.000257197 | 0.000257163 | 25.42929566 | 98871.073 | 0.5 | 0.999742837 | 98883.78765 | 5209232.484 | 52.68034941 |
| 2021 | Female | 25 | 0.000252452 | 0.000252421 | 24.95388423 | 98845.88141 | 0.5 | 0.999747579 | 98858.35835 | 5110361.411 | 51.69377174 |
| 2021 | Female | 26 | 0.000250571 | 0.00025054 | 24.76172832 | 98821.0236 | 0.5 | 0.99974946 | 98833.40447 | 5011515.53 | 50.70669736 |
| 2021 | Female | 27 | 0.00025185 | 0.000251819 | 24.88186212 | 98796.20181 | 0.5 | 0.999748181 | 98808.64274 | 4912694.506 | 49.7192793 |
| 2021 | Female | 28 | 0.000256619 | 0.000256586 | 25.34655514 | 98771.0876 | 0.5 | 0.999743414 | 98783.76088 | 4813898.304 | 48.73167676 |
| 2021 | Female | 29 | 0.000265271 | 0.000265236 | 26.19424647 | 98745.3172 | 0.5 | 0.999734764 | 98758.41432 | 4715127.217 | 47.74405552 |
| 2021 | Female | 30 | 0.000278289 | 0.000278251 | 27.47231593 | 98718.48392 | 0.5 | 0.999721749 | 98732.22008 | 4616381.899 | 46.75658965 |
| 2021 | Female | 31 | 0.000296277 | 0.000296233 | 29.23964532 | 98690.12794 | 0.5 | 0.999703767 | 98704.74776 | 4517663.415 | 45.76946416 |
| 2021 | Female | 32 | 0.000319978 | 0.000319926 | 31.56889897 | 98659.72367 | 0.5 | 0.999680074 | 98675.50811 | 4418973.287 | 44.78287847 |
| 2021 | Female | 33 | 0.000350295 | 0.000350233 | 34.54838814 | 98626.66502 | 0.5 | 0.999649767 | 98643.93922 | 4320313.564 | 43.79705026 |
| 2021 | Female | 34 | 0.000388307 | 0.000388232 | 38.28328688 | 98590.24918 | 0.5 | 0.999611768 | 98609.39083 | 4221686.899 | 42.81221964 |
| 2021 | Female | 35 | 0.000435271 | 0.000435177 | 42.89585573 | 98549.65961 | 0.5 | 0.999564823 | 98571.10754 | 4123096.65 | 41.82865296 |
| 2021 | Female | 36 | 0.000492612 | 0.000492491 | 48.52422698 | 98503.94957 | 0.5 | 0.999507509 | 98528.21169 | 4024546.99 | 40.84664606 |
| 2021 | Female | 37 | 0.00056189 | 0.000561733 | 55.31924891 | 98452.02783 | 0.5 | 0.999438267 | 98479.68746 | 3926043.04 | 39.8665262 |
| 2021 | Female | 38 | 0.000644753 | 0.000644545 | 63.43892297 | 98392.64875 | 0.5 | 0.999355455 | 98424.36821 | 3827591.013 | 38.88865209 |
| 2021 | Female | 39 | 0.000742849 | 0.000742573 | 73.0401506 | 98324.40921 | 0.5 | 0.999257427 | 98360.92929 | 3729198.364 | 37.91341126 |
| 2021 | Female | 40 | 0.000857725 | 0.000857358 | 84.2678757 | 98245.7552 | 0.5 | 0.999142642 | 98287.88914 | 3630873.955 | 36.94121409 |
| 2021 | Female | 41 | 0.000990701 | 0.000990211 | 97.24226982 | 98155.00013 | 0.5 | 0.999009789 | 98203.62126 | 3532628.199 | 35.97248405 |
| 2021 | Female | 42 | 0.001142732 | 0.00114208 | 112.0453033 | 98050.35634 | 0.5 | 0.99885792 | 98106.37899 | 3434473.199 | 35.0076441 |
| 2021 | Female | 43 | 0.001314294 | 0.00131343 | 128.7087399 | 97929.97932 | 0.5 | 0.99868657 | 97994.33369 | 3336422.843 | 34.04709964 |
| 2021 | Female | 44 | 0.001505297 | 0.001504165 | 147.2060788 | 97792.02191 | 0.5 | 0.998495835 | 97865.62495 | 3238492.864 | 33.09121937 |
| 2021 | Female | 45 | 0.001715077 | 0.001713608 | 167.4510219 | 97634.69336 | 0.5 | 0.998286392 | 97718.41887 | 3140700.842 | 32.1403158 |
| 2021 | Female | 46 | 0.001942455 | 0.00194057 | 189.3044941 | 97456.3156 | 0.5 | 0.99805943 | 97550.96785 | 3043066.148 | 31.19462795 |
| 2021 | Female | 47 | 0.002185906 | 0.002183519 | 212.5910799 | 97255.36781 | 0.5 | 0.997816481 | 97361.66335 | 2945609.833 | 30.25430885 |
| 2021 | Female | 48 | 0.00244381 | 0.002440828 | 237.1241378 | 97030.5102 | 0.5 | 0.997559172 | 97149.07227 | 2848354.465 | 29.31942013 |
| 2021 | Female | 49 | 0.002714772 | 0.002711092 | 262.7371982 | 96780.57954 | 0.5 | 0.997288908 | 96911.94813 | 2751323.955 | 28.38993548 |
| 2021 | Female | 50 | 0.002997972 | 0.002993485 | 289.3179631 | 96504.55195 | 0.5 | 0.997006515 | 96649.21094 | 2654543.375 | 27.46575321 |
| 2021 | Female | 51 | 0.003293512 | 0.003288097 | 316.8406857 | 96201.47263 | 0.5 | 0.996711903 | 96359.89297 | 2558038.823 | 26.54671715 |
| 2021 | Female | 52 | 0.003602709 | 0.003596231 | 345.3930148 | 95870.35578 | 0.5 | 0.996403769 | 96043.05229 | 2461837.351 | 25.63264382 |
| 2021 | Female | 53 | 0.003928323 | 0.003920622 | 375.19439 | 95510.06208 | 0.5 | 0.996079378 | 95697.65927 | 2365966.995 | 24.72335283 |
| 2021 | Female | 54 | 0.004274684 | 0.004265567 | 406.6043577 | 95119.1627 | 0.5 | 0.995734433 | 95322.46488 | 2270456.933 | 23.81869726 |
| 2021 | Female | 55 | 0.004647727 | 0.004636951 | 440.1202322 | 94695.80041 | 0.5 | 0.995363049 | 94915.86052 | 2175337.77 | 22.91859082 |
| 2021 | Female | 56 | 0.005054926 | 0.005042183 | 476.3639298 | 94237.55833 | 0.5 | 0.994957817 | 94475.74029 | 2080641.97 | 22.02302901 |
| 2021 | Female | 57 | 0.005505119 | 0.005490008 | 516.057306 | 93741.34771 | 0.5 | 0.994509992 | 93999.37636 | 1986404.411 | 21.13210202 |
| 2021 | Female | 58 | 0.006008197 | 0.005990202 | 559.9839611 | 93203.32708 | 0.5 | 0.994009798 | 93483.31906 | 1892663.064 | 20.24599771 |
| 2021 | Female | 59 | 0.006574617 | 0.006553075 | 608.933579 | 92618.86831 | 0.5 | 0.993446925 | 92923.3351 | 1799459.737 | 19.36499303 |
| 2021 | Female | 60 | 0.00721466 | 0.007188728 | 663.623103 | 91982.58997 | 0.5 | 0.992811272 | 92314.40152 | 1706840.868 | 18.4894322 |
| 2021 | Female | 61 | 0.007937349 | 0.007905973 | 724.5885516 | 91288.48414 | 0.5 | 0.992094027 | 91650.77841 | 1614858.278 | 17.61968972 |
| 2021 | Female | 62 | 0.008748947 | 0.008710842 | 792.0436767 | 90530.16802 | 0.5 | 0.991289158 | 90926.18986 | 1523569.794 | 16.7561161 |
| 2021 | Female | 63 | 0.009651021 | 0.009604674 | 865.7090803 | 89701.29165 | 0.5 | 0.990395326 | 90134.14619 | 1433039.626 | 15.8989649 |
| 2021 | Female | 64 | 0.010638188 | 0.010581902 | 944.6298447 | 88796.12218 | 0.5 | 0.989418098 | 89268.4371 | 1343338.334 | 15.04830126 |
| 2021 | Female | 65 | 0.011695915 | 0.011627915 | 1027.02174 | 87810.29639 | 0.5 | 0.988372085 | 88323.80726 | 1254542.212 | 14.20389645 |
| 2021 | Female | 66 | 0.012799065 | 0.012717678 | 1110.212374 | 86741.67933 | 0.5 | 0.987282322 | 87296.78552 | 1166731.916 | 13.36511887 |
| 2021 | Female | 67 | 0.013912235 | 0.013816129 | 1190.764788 | 85591.19075 | 0.5 | 0.986183871 | 86186.57315 | 1079990.237 | 12.53084091 |
| 2021 | Female | 68 | 0.014993132 | 0.014881572 | 1264.871211 | 84363.37275 | 0.5 | 0.985118428 | 84995.80836 | 994399.0458 | 11.69938924 |
| 2021 | Female | 69 | 0.016000069 | 0.015873084 | 1329.068194 | 83066.40305 | 0.5 | 0.984126916 | 83730.93715 | 910035.673 | 10.86857145 |
| 2021 | Female | 70 | 0.016904026 | 0.01676235 | 1381.248974 | 81711.24447 | 0.5 | 0.98323765 | 82401.86895 | 826969.27 | 10.0358072 |
| 2021 | Female | 71 | 0.01770477 | 0.017549416 | 1421.864533 | 80309.68771 | 0.5 | 0.982450584 | 81020.61998 | 745258.0255 | 9.198374756 |
| 2021 | Female | 72 | 0.018450119 | 0.018281472 | 1455.1824 | 78871.16425 | 0.5 | 0.981718528 | 79598.75545 | 664948.3378 | 8.353752946 |
| 2021 | Female | 73 | 0.019259048 | 0.019075361 | 1490.616863 | 77398.26462 | 0.5 | 0.980924639 | 78143.57305 | 586077.1736 | 7.500004808 |
| 2021 | Female | 74 | 0.020355534 | 0.020150447 | 1544.591341 | 75880.66051 | 0.5 | 0.979849553 | 76652.95618 | 508678.9089 | 6.636129045 |
| 2021 | Female | 75 | 0.02213595 | 0.021893632 | 1644.394869 | 74286.16741 | 0.5 | 0.978106368 | 75108.36484 | 432798.2484 | 5.762317544 |
| 2021 | Female | 76 | 0.025333596 | 0.025016714 | 1837.827153 | 72545.0564 | 0.5 | 0.974983286 | 73463.96997 | 358512.081 | 4.880107638 |
| 2021 | Female | 77 | 0.031465556 | 0.030978183 | 2218.847775 | 70516.71893 | 0.5 | 0.969021817 | 71626.14282 | 285967.0246 | 3.992495105 |
| 2021 | Female | 78 | 0.044177278 | 0.04322255 | 2999.960297 | 67907.3149 | 0.5 | 0.95677745 | 69407.29505 | 215450.3057 | 3.104144968 |
| 2021 | Female | 79 | 0.073909574 | 0.071275599 | 4733.222576 | 64040.72346 | 0.5 | 0.928724401 | 66407.33475 | 147542.9908 | 2.221787568 |
| 2021 | Female | 80 | 0.157581848 | 0.146072649 | 9008.900923 | 57169.66171 | 0.5 | 0.853927351 | 61674.11217 | 83502.26734 | 1.353927351 |

## Table 30: Female Life Table in 2022

**National Life Tables, Ghana, period expectation of life, based on data for the years 2018-2020**

| Year | Sex | age | mx | qx | dx | Lx | ax | px | lx | Tx | ex |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2022 | Female | 0 | 0.000711866 | 0.000711435 | 71.14345572 | 99939.35496 | 0.147567 | 0.999288565 | 100000 | 7829443.462 | 78.29443462 |
| 2022 | Female | 1 | 0.00053746 | 0.000537316 | 53.69333501 | 99902.00988 | 0.5 | 0.999462684 | 99928.85654 | 7729504.107 | 77.35007059 |
| 2022 | Female | 2 | 0.00042455 | 0.00042446 | 42.39303799 | 99853.96669 | 0.5 | 0.99957554 | 99875.16321 | 7629602.098 | 76.39138553 |
| 2022 | Female | 3 | 0.000350628 | 0.000350566 | 34.9979806 | 99815.27118 | 0.5 | 0.999649434 | 99832.77017 | 7529748.131 | 75.42361209 |
| 2022 | Female | 4 | 0.000301818 | 0.000301772 | 30.11618652 | 99782.7141 | 0.5 | 0.999698228 | 99797.77219 | 7429932.86 | 74.44988697 |
| 2022 | Female | 5 | 0.000269511 | 0.000269474 | 26.88481539 | 99754.2136 | 0.5 | 0.999730526 | 99767.656 | 7330150.146 | 73.47220972 |
| 2022 | Female | 6 | 0.000248246 | 0.000248215 | 24.75713682 | 99728.39262 | 0.5 | 0.999751785 | 99740.77119 | 7230395.932 | 72.49187916 |
| 2022 | Female | 7 | 0.000234438 | 0.000234411 | 23.37451732 | 99704.32679 | 0.5 | 0.999765589 | 99716.01405 | 7130667.539 | 71.50975304 |
| 2022 | Female | 8 | 0.000225627 | 0.000225602 | 22.49081701 | 99681.39413 | 0.5 | 0.999774398 | 99692.63953 | 7030963.213 | 70.5264024 |
| 2022 | Female | 9 | 0.000220034 | 0.00022001 | 21.92843427 | 99659.1845 | 0.5 | 0.99977999 | 99670.14872 | 6931281.818 | 69.54220404 |
| 2022 | Female | 10 | 0.00021632 | 0.000216296 | 21.55354322 | 99637.44351 | 0.5 | 0.999783704 | 99648.22028 | 6831622.634 | 68.55739736 |
| 2022 | Female | 11 | 0.00021345 | 0.000213427 | 21.26304636 | 99616.03522 | 0.5 | 0.999786573 | 99626.66674 | 6731985.19 | 67.57212111 |
| 2022 | Female | 12 | 0.000210638 | 0.000210616 | 20.97850738 | 99594.91444 | 0.5 | 0.999789384 | 99605.40369 | 6632369.155 | 66.58643918 |
| 2022 | Female | 13 | 0.000207321 | 0.0002073 | 20.6438106 | 99574.10328 | 0.5 | 0.9997927 | 99584.42519 | 6532774.241 | 65.60036099 |
| 2022 | Female | 14 | 0.000203149 | 0.000203128 | 20.22420118 | 99553.66928 | 0.5 | 0.999796872 | 99563.78138 | 6433200.137 | 64.61385906 |
| 2022 | Female | 15 | 0.000197974 | 0.000197955 | 19.70510142 | 99533.70462 | 0.5 | 0.999802045 | 99543.55717 | 6333646.468 | 63.62688503 |
| 2022 | Female | 16 | 0.00019183 | 0.000191812 | 19.08983296 | 99514.30716 | 0.5 | 0.999808188 | 99523.85207 | 6234112.764 | 62.63938376 |
| 2022 | Female | 17 | 0.000184893 | 0.000184876 | 18.39607663 | 99495.5642 | 0.5 | 0.999815124 | 99504.76224 | 6134598.456 | 61.65130511 |
| 2022 | Female | 18 | 0.000177442 | 0.000177426 | 17.65145393 | 99477.54044 | 0.5 | 0.999822574 | 99486.36616 | 6035102.892 | 60.66261263 |
| 2022 | Female | 19 | 0.000169806 | 0.000169791 | 16.88891308 | 99460.27025 | 0.5 | 0.999830209 | 99468.71471 | 5935625.352 | 59.67328892 |
| 2022 | Female | 20 | 0.000162329 | 0.000162316 | 16.14262282 | 99443.75449 | 0.5 | 0.999837684 | 99451.8258 | 5836165.082 | 58.68333773 |
| 2022 | Female | 21 | 0.000155337 | 0.000155325 | 15.44488684 | 99427.96073 | 0.5 | 0.999844675 | 99435.68317 | 5736721.327 | 57.69278335 |
| 2022 | Female | 22 | 0.000149119 | 0.000149108 | 14.82430552 | 99412.82613 | 0.5 | 0.999850892 | 99420.23829 | 5637293.366 | 56.70166823 |
| 2022 | Female | 23 | 0.000143917 | 0.000143907 | 14.30514368 | 99398.26141 | 0.5 | 0.999856093 | 99405.41398 | 5537880.54 | 55.71004957 |
| 2022 | Female | 24 | 0.000139939 | 0.000139929 | 13.90768227 | 99384.155 | 0.5 | 0.999860071 | 99391.10884 | 5438482.279 | 54.71799583 |
| 2022 | Female | 25 | 0.000137357 | 0.000137348 | 13.6492579 | 99370.37653 | 0.5 | 0.999862652 | 99377.20116 | 5339098.124 | 53.72558355 |
| 2022 | Female | 26 | 0.000136334 | 0.000136325 | 13.54570574 | 99356.77904 | 0.5 | 0.999863675 | 99363.5519 | 5239727.747 | 52.73289498 |
| 2022 | Female | 27 | 0.00013703 | 0.00013702 | 13.61298297 | 99343.1997 | 0.5 | 0.99986298 | 99350.00619 | 5140370.968 | 51.74001659 |
| 2022 | Female | 28 | 0.000139625 | 0.000139615 | 13.8688261 | 99329.4588 | 0.5 | 0.999860385 | 99336.39321 | 5041027.769 | 50.74703848 |
| 2022 | Female | 29 | 0.000144332 | 0.000144321 | 14.33436095 | 99315.3572 | 0.5 | 0.999855679 | 99322.52438 | 4941698.31 | 49.75405469 |
| 2022 | Female | 30 | 0.000151415 | 0.000151404 | 15.03562587 | 99300.67221 | 0.5 | 0.999848596 | 99308.19002 | 4842382.953 | 48.76116412 |
| 2022 | Female | 31 | 0.000161202 | 0.000161189 | 16.0049831 | 99285.1519 | 0.5 | 0.999838811 | 99293.1544 | 4743082.28 | 47.76847215 |
| 2022 | Female | 32 | 0.000174097 | 0.000174082 | 17.28238051 | 99268.50822 | 0.5 | 0.999825918 | 99277.14941 | 4643797.128 | 46.77609254 |
| 2022 | Female | 33 | 0.000190593 | 0.000190574 | 18.91639061 | 99250.40884 | 0.5 | 0.999809426 | 99259.86703 | 4544528.62 | 45.78414979 |
| 2022 | Female | 34 | 0.000211275 | 0.000211253 | 20.96490124 | 99230.46819 | 0.5 | 0.999788747 | 99240.95064 | 4445278.211 | 44.79278143 |
| 2022 | Female | 35 | 0.000236828 | 0.0002368 | 23.49527167 | 99208.2381 | 0.5 | 0.9997632 | 99219.98574 | 4346047.743 | 43.80214037 |
| 2022 | Female | 36 | 0.000268026 | 0.00026799 | 26.58371169 | 99183.19861 | 0.5 | 0.99973201 | 99196.49047 | 4246839.505 | 42.81239674 |
| 2022 | Female | 37 | 0.00030572 | 0.000305673 | 30.31361005 | 99154.74995 | 0.5 | 0.999694327 | 99169.90676 | 4147656.306 | 41.8237391 |
| 2022 | Female | 38 | 0.000350805 | 0.000350743 | 34.77255788 | 99122.20687 | 0.5 | 0.999649257 | 99139.59315 | 4048501.556 | 40.83637453 |
| 2022 | Female | 39 | 0.000404178 | 0.000404096 | 40.04791068 | 99084.79663 | 0.5 | 0.999595904 | 99104.82059 | 3949379.35 | 39.85052721 |
| 2022 | Female | 40 | 0.000466682 | 0.000466573 | 46.22093196 | 99041.66221 | 0.5 | 0.999533427 | 99064.77268 | 3850294.553 | 38.86643505 |
| 2022 | Female | 41 | 0.000539033 | 0.000538888 | 53.35986508 | 98991.87181 | 0.5 | 0.999461112 | 99018.55175 | 3751252.891 | 37.88434414 |
| 2022 | Female | 42 | 0.000621752 | 0.000621559 | 61.51265715 | 98934.43555 | 0.5 | 0.999378441 | 98965.19188 | 3652261.019 | 36.90450096 |
| 2022 | Female | 43 | 0.000715097 | 0.000714841 | 70.70043677 | 98868.32901 | 0.5 | 0.999285159 | 98903.67922 | 3553326.583 | 35.92714256 |
| 2022 | Female | 44 | 0.000819021 | 0.000818685 | 80.91311466 | 98792.52223 | 0.5 | 0.999181315 | 98832.97879 | 3454458.254 | 34.95248546 |
| 2022 | Female | 45 | 0.00093316 | 0.000932725 | 92.1085118 | 98706.01142 | 0.5 | 0.999067275 | 98752.06567 | 3355665.732 | 33.98071432 |
| 2022 | Female | 46 | 0.001056875 | 0.001056316 | 104.2161316 | 98607.8491 | 0.5 | 0.998943684 | 98659.95716 | 3256959.721 | 33.01197177 |
| 2022 | Female | 47 | 0.001189334 | 0.001188628 | 117.1460712 | 98497.16799 | 0.5 | 0.998811372 | 98555.74103 | 3158351.872 | 32.04635102 |
| 2022 | Female | 48 | 0.001329658 | 0.001328775 | 130.8027116 | 98373.1936 | 0.5 | 0.998671225 | 98438.59496 | 3059854.704 | 31.0838925 |
| 2022 | Female | 49 | 0.001477086 | 0.001475996 | 145.10193 | 98235.24128 | 0.5 | 0.998524004 | 98307.79225 | 2961481.51 | 30.12458568 |
| 2022 | Female | 50 | 0.001631173 | 0.001629844 | 159.9898823 | 98082.69538 | 0.5 | 0.998370156 | 98162.69032 | 2863246.269 | 29.16837609 |
| 2022 | Female | 51 | 0.001791974 | 0.00179037 | 175.4610993 | 97914.96988 | 0.5 | 0.99820963 | 98002.70043 | 2765163.573 | 28.21517735 |
| 2022 | Female | 52 | 0.001960206 | 0.001958287 | 191.5737899 | 97731.45244 | 0.5 | 0.998041713 | 97827.23934 | 2667248.604 | 27.26488677 |
| 2022 | Female | 53 | 0.00213737 | 0.002135088 | 208.4607761 | 97531.43516 | 0.5 | 0.997864912 | 97635.66555 | 2569517.151 | 26.31740294 |
| 2022 | Female | 54 | 0.002325822 | 0.002323121 | 226.3351613 | 97314.03719 | 0.5 | 0.997676879 | 97427.20477 | 2471985.716 | 25.37264332 |
| 2022 | Female | 55 | 0.002528792 | 0.002525599 | 245.4904026 | 97078.12441 | 0.5 | 0.997474401 | 97200.86961 | 2374671.679 | 24.43056002 |
| 2022 | Female | 56 | 0.002750346 | 0.002746569 | 266.2946618 | 96822.23187 | 0.5 | 0.997253431 | 96955.37921 | 2277593.554 | 23.49115204 |
| 2022 | Female | 57 | 0.002995293 | 0.002990813 | 289.179019 | 96544.49503 | 0.5 | 0.997009187 | 96689.08454 | 2180771.322 | 22.55447275 |
| 2022 | Female | 58 | 0.003269013 | 0.003263679 | 314.6183362 | 96242.59636 | 0.5 | 0.996736321 | 96399.90552 | 2084226.827 | 21.62063143 |
| 2022 | Female | 59 | 0.003577198 | 0.003570811 | 343.1024252 | 95913.73598 | 0.5 | 0.996429189 | 96085.28719 | 1987984.231 | 20.6897881 |
| 2022 | Female | 60 | 0.00392544 | 0.003917751 | 375.0940372 | 95554.63774 | 0.5 | 0.996082249 | 95742.18476 | 1892070.495 | 19.76214037 |
| 2022 | Female | 61 | 0.00431865 | 0.004309345 | 410.9696605 | 95161.6059 | 0.5 | 0.995690655 | 95367.09073 | 1796515.857 | 18.83790146 |
| 2022 | Female | 62 | 0.004760234 | 0.004748931 | 450.9400966 | 94730.65102 | 0.5 | 0.995251069 | 94956.12107 | 1701354.251 | 17.91726781 |
| 2022 | Female | 63 | 0.005251046 | 0.005237295 | 494.9515233 | 94257.70521 | 0.5 | 0.994762705 | 94505.18097 | 1606623.6 | 17.00037589 |
| 2022 | Female | 64 | 0.005788155 | 0.005771452 | 542.5755699 | 93738.94166 | 0.5 | 0.994228548 | 94010.22945 | 1512365.895 | 16.08724821 |
| 2022 | Female | 65 | 0.006363656 | 0.006343473 | 592.9094952 | 93171.19913 | 0.5 | 0.993656527 | 93467.65388 | 1418626.954 | 15.17773149 |
| 2022 | Female | 66 | 0.006963872 | 0.006939708 | 644.5236191 | 92552.48257 | 0.5 | 0.993060292 | 92874.74438 | 1325455.754 | 14.27143367 |
| 2022 | Female | 67 | 0.007569539 | 0.007540998 | 695.5079338 | 91882.46679 | 0.5 | 0.992459002 | 92230.22076 | 1232903.272 | 13.36767127 |
| 2022 | Female | 68 | 0.008157647 | 0.008124508 | 743.6745451 | 91162.87555 | 0.5 | 0.991875492 | 91534.71283 | 1141020.805 | 12.46544365 |
| 2022 | Female | 69 | 0.008705513 | 0.008667785 | 786.9571648 | 90397.5597 | 0.5 | 0.991332215 | 90791.03828 | 1049857.93 | 11.56345328 |
| 2022 | Female | 70 | 0.009197349 | 0.009155247 | 824.0096009 | 89592.07632 | 0.5 | 0.990844753 | 90004.08112 | 959460.3698 | 10.66018738 |
| 2022 | Female | 71 | 0.009633028 | 0.009586853 | 854.9561945 | 88752.59342 | 0.5 | 0.990413147 | 89180.07152 | 869868.2935 | 9.754065888 |
| 2022 | Female | 72 | 0.010038567 | 0.009988432 | 882.2294013 | 87884.00062 | 0.5 | 0.990011568 | 88325.11532 | 781115.7001 | 8.843642006 |
| 2022 | Female | 73 | 0.010478698 | 0.010424083 | 911.5118853 | 86987.12998 | 0.5 | 0.989575917 | 87442.88592 | 693231.6995 | 7.92782274 |
| 2022 | Female | 74 | 0.011075288 | 0.011014295 | 953.0820412 | 86054.83301 | 0.5 | 0.988985705 | 86531.37404 | 606244.5695 | 7.0060666 |
| 2022 | Female | 75 | 0.012043998 | 0.011971904 | 1024.535058 | 85066.02447 | 0.5 | 0.988028096 | 85578.29199 | 520189.7365 | 6.078524405 |
| 2022 | Female | 76 | 0.013783813 | 0.013689466 | 1157.495809 | 83975.00903 | 0.5 | 0.986310534 | 84553.75694 | 435123.712 | 5.1461192 |
| 2022 | Female | 77 | 0.017120165 | 0.016974859 | 1415.639733 | 82688.44126 | 0.5 | 0.983025141 | 83396.26113 | 351148.703 | 4.210604867 |
| 2022 | Female | 78 | 0.024036514 | 0.023751067 | 1947.127247 | 81007.05777 | 0.5 | 0.976248933 | 81980.6214 | 268460.2617 | 3.274679517 |
| 2022 | Female | 79 | 0.040213625 | 0.039420995 | 3154.999936 | 78455.99418 | 0.5 | 0.960579005 | 80033.49415 | 187453.2039 | 2.342184431 |
| 2022 | Female | 80 | 0.085739059 | 0.08221456 | 6320.531572 | 73718.22843 | 0.5 | 0.91778544 | 76878.49421 | 108997.2098 | 1.41778544 |

# 6 Conclusion

**Brief Summary**

In conclusion, the construction of mortality table experiences 4 parts of process:

- the calculation of observed death count and the exposure from the raw data (which is calculated completely in Microsoft Excel).
- Choose the best fitted model by the likelihood ratio test and AIC, BIC criteria, to model the fitted values of death count and exposure, with the calculation of fitted mortality rate followed.
- the assessment of the model, including the residual analysis, upper tail assessment, and the forecasting part.
- The final construction of the mortality table.

Although the model behaves significantly well in the view of the consistency with the observed data, the anscombe residual, simulated DHARMa residual, indicates that there may be some assumptions of the model is violated in the exposure model. Moreover, due to the lack of data, many problems are formed, including the unreasonable upper tails for the age variable and the inaccurate forecast to the further year from 2023 to 2025. Finally, we construct the mortality table for all the fitted data that is concordant with the reality. It includes 15 tables, for female, male and combined sex data, each within 5 years.

**Other Results**

From the mortality table, we have some small results derived:

**Mortality Table Results:**

i) The mortality rate will generally decrease in the next few years, leading to a corresponding decreasing insurance fee.

ii) The mortality rate for male is higher than that of female for most of years and of ages, leading to the higher insurance fee for male than female.

**Possible Reasons for this:**

i) The mitigation of COVID19 over years

ii) Increasing life welfare of people

iii) Improvement of medical technology and level.

iv) The innate mortality rate of male is higher than female naturally

Moreover, if we plot the male mortality rate and the female mortality rate, which is shown as the figure below (for those forecasting years):

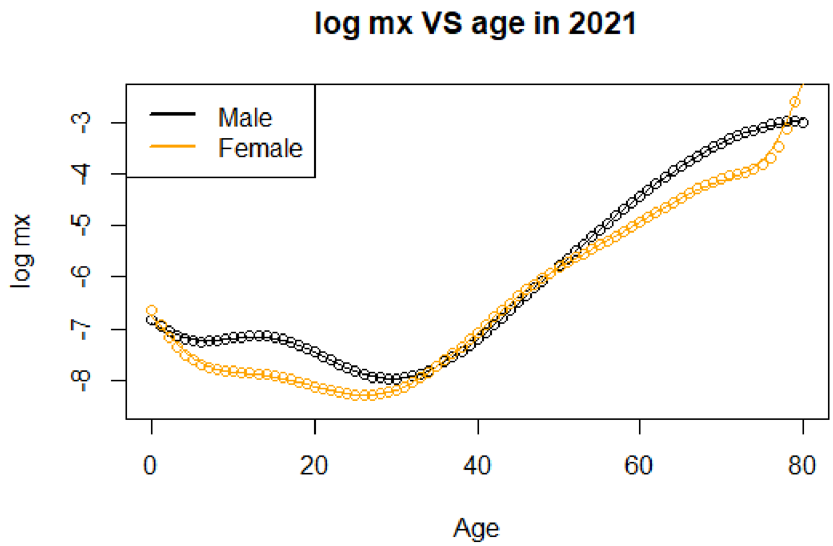



Figure 43: Male and Female Mortality Rate in 2021

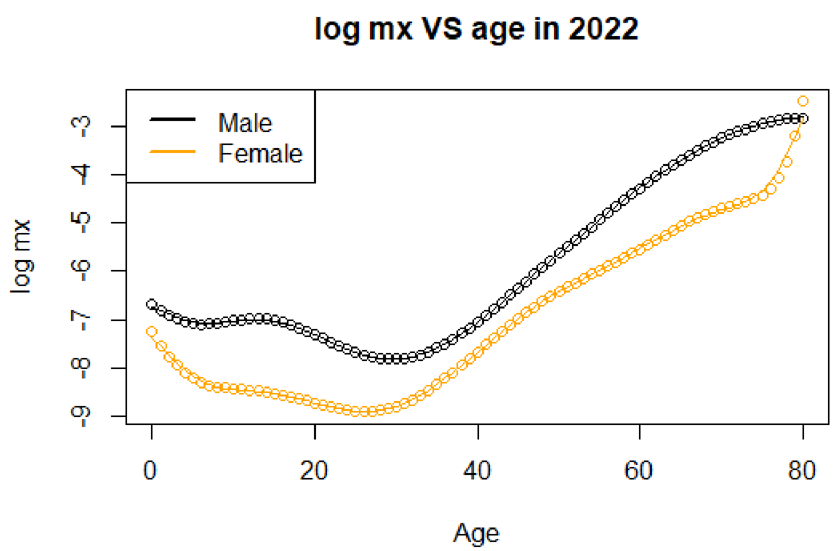



Figure 44: Male and Female Mortality Rate in 2022

The mortality rate for female is generally lower than male for the whole life span. As acknowledged, The mortality table is used for deciding the insurance policy. Thus, this will lead to a generally higher cost of insurance fee for male.

**Known Advantages and Weakness**

**Advantages:**

i) fit the model very well in view of overdispersion, and have one age brackets for the precise prediction

ii) Resemble the generic pattern that appears in most of the life table over the world very precisely

iii) Can predict the further two-year mortality rate with minor fluctuations

**Deficiencies:**

i) The residuals of the exposure model behave not precisely well

ii) Cannot predict the upper tail mortality

iii) Huge discrepancies with reality for the further year predictions after 2023

With more data, (e.g., the observed death count and the exposure for the age span from 80's to 100's, the observed data for more years for us to forecast for further years, or even census for the Ghana demographic), the upper tail problem and the forecasting sensitivity to the year can be efficaciously solved, though the exposure data may not fit the prerequisites of the Negative Binomial Model [3]. The residual problem might not be possible to be mitigated, many other models and methods are also provided for the demographical models, such as Lee-Carter Models. These methods can be applied simultaneously to compare which is the best model for the Ghana mortality rate and the construction of mortality table.

# 7 Acknowledgments

We are deeply indebted to the Department of Mathematical Science in University of Liverpool, most especially to all the affable lecturers, including but not limited to Dr. Ian Thompson, Dr. Kai Liu and Dr. Alena Haddley, who taught us useful preliminary knowledge for modelling and analysing data.

We are also strongly grateful to the MATH391 Summer Industrial Project Team for giving us the first foray into the experience of processing formal academic projects. We would like to extend our gratitute to the module leader Dr. Corina Constantinescu, who organizes this extraordinary activity every year successfully, and Dr. Rock Zhu, who came to Liverpool from Dutch and gave us incessant help and guidance during the summer.

Finally, We would like to express our sincere appreciation to our Tutor, Mr. Cedric Koffi and our supervisor Dr. Emmanuel Coffie, who were involved during the whole summer session, and gave us significant support consistently. Without their help, we would not accomplish such exacting and onerous works by ourselves.

# A Appendix: R code

Provided below are R codes used for the entire thesis.
**Note:** Since the R codes are significantly repetitious for Female, Male and Total models, we choose the R codes for female model here for example.

```
#Import data
#Importing data: Female
FemaleMortality <- read.table("FemaleMortality.csv", header = TRUE, sep="," )
FemaleMortality <- FemaleMortality[, -c(1)]
FemaleMortality <- na.omit(FemaleMortality)
attach(FemaleMortality)

#Modeling
dx <- FemaleMortality$dx
Age <- FemaleMortality$Age
Year <- FemaleMortality$Year
Exposure <- FemaleMortality$Exposure
library(MASS)
#Section 2

#Section 2.2
#3D plot of the observed death count data
library(rgl)
plot <- plot3d(Age, Year, dx,
xlab = "Age", ylab = "Year", zlab = "death count", type = "s",size = c(1),
col = c('blue', 'orange', 'yellow'),ylim = c(2018,2020))

library(htmlwidgets)
rglwidget(x = scene3d(plot), width = figWidth(), height = figHeight(),
          webGLoptions = list(preserveDrawingBuffer = TRUE),
          shinyBrush = NULL, )

#Section 2.3
#3D plot of the observed exposure data
library(rgl)
plot <- plot3d(Age, Year, Exposure,
xlab = "Age", ylab = "Year", zlab = "death count", type = "s",size = c(1),
col = c('blue', 'orange', 'yellow'),ylim = c(2018,2020))

library(htmlwidgets)
rglwidget(x = scene3d(plot), width = figWidth(), height = figHeight(),
          webGLoptions = list(preserveDrawingBuffer = TRUE), shinyBrush = NULL, )

#Section 2.4
#3D plot of the observe mortality rate
library(rgl)
plot <- plot3d(Age, Year, log(Observedmx+0.01),
xlab = "Age", ylab = "Year", zlab = "Observed Mortality Rate", type = "s",size = c(1),
col = c('blue', 'orange', 'yellow'),ylim = c(2018,2020))

library(htmlwidgets)
rglwidget(x = scene3d(plot), width = figWidth(), height = figHeight(),
          webGLoptions = list(preserveDrawingBuffer = TRUE), shinyBrush = NULL, )
```

```
#Section 3

#Section 3.1.2
#Display of some examples for Negative Binomial Distribution
library(dplyr)
library(ggplot2)

#NB(5,.25)
data.frame(x = 0:30, prob = dnbinom(x = 0:30, size = 4,prob = 4/9)) %>%
  mutate(Failures = ifelse(x == 4, 4, "other")) %>%
  ggplot(aes(x = factor(x), y = prob, fill = Failures)) +
  geom_col() +
  geom_text(
    aes(label = round(prob,2), y = prob + 0.01),
    position = position_dodge(0.9),
    size = 3,
    vjust = 0
  ) +
  labs(title = "Histogram for y ~ NB(mu = 5, kappa = 0.25)",
       subtitle = "The example of y=4 is marked red",
       x = "Failed Trials y", y = "Probability")

#NB(5,1)
data.frame(x = 0:30, prob = dnbinom(x = 0:30, size = 1, prob = 1/6)) %>%
  mutate(Failures = ifelse(x == 4, 4, "other")) %>%
  ggplot(aes(x = factor(x), y = prob, fill = Failures)) +
  geom_col() +
  geom_text(
    aes(label = round(prob,2), y = prob + 0.01),
    position = position_dodge(0.9),
    size = 3,
    vjust = 0
  ) +
  labs(title = "Histogram for y ~ NB(mu = 5, kappa = 1)",
       subtitle = "The example of y=4 is marked red",
       x = "Failed Trials y",
       y = "Probability")

#NB(10,.25)
data.frame(x = 0:30, prob = dnbinom(x = 0:30, size = 4, prob = 4/14)) %>%
  mutate(Failures = ifelse(x == 4, 4, "other")) %>%
  ggplot(aes(x = factor(x), y = prob, fill = Failures)) +
  geom_col() +
  geom_text(
    aes(label = round(prob,2), y = prob + 0.01),
    position = position_dodge(0.9),
    size = 3,
    vjust = 0
  ) +
  labs(title = "Histogram for y ~ NB(mu = 10, kappa = 0.25)",
       subtitle = "The example of y=4 is marked red",
       x = "Failed Trials y",
       y = "Probability")
```

```
#NB(10,1)
data.frame(x = 0:30, prob = dnbinom(x = 0:30, size = 1, prob = 1/11)) %>%
  mutate(Failures = ifelse(x == 4, 4, "other")) %>%
  ggplot(aes(x = factor(x), y = prob, fill = Failures)) +
  geom_col() +
  geom_text(
    aes(label = round(prob,2), y = prob + 0.01),
    position = position_dodge(0.9),
    size = 3,
    vjust = 0
  ) +
  labs(title = "Histogram for y ~ NB(mu = 10, kappa = 1)",
       subtitle = "The example of y=4 is marked red",
       x = "Failed Trials y",
       y = "Probability")

#Section 3.2 Construction of Model
#Poisson Regression Model test the over-dispersion
fit <- glm(dx~poly(Year,2)+poly(Age,3),offset(log(ex)),
              data=Femaledata, family=poisson())
c<-deviance(fit)/df.residual(fit)
c

#Section 3.2.2 Likelihood Ratio Test
#Likelihood Ratio Test
#Case 1
model.1<-glm.nb(dx~log(ex)+poly(Year,1)+poly(age,4),
                  data=Maledata,link=log)
model.2<-glm.nb(dx~log(ex)+poly(Year,2)+poly(age,4),
                  data=Maledata,link=log)
library(lmtest)
lrtest(model.1,model.2)

#Case 2
model.3<-glm.nb(ex~poly(Year,1)+poly(age,9),
                  data=Maledata,link=log)
model.4<-glm.nb(ex~poly(Year,1)+poly(age,10),
                  data=Maledata,link=log)
library(lmtest)
lrtest(model.3,model.4)

#Section 3.2.3
#AIC
model.5<-glm.nb(dx~poly(Year,2)+poly(age,3)+offset(log(ex))
                 ,data=Femaledata,link=log)
model.6<-glm.nb(dx~poly(Year,2)+poly(age,3)+log(ex)
                 ,data=Femaledata,link=log)
summary(model.5,correlation=F)
summary(model.6,correlation=F)

#BIC
BIC(model.5)
BIC(model.6)
```

```
#Section 3.2.4 Modeling of Death Count
#take 2018 as the example
model.6<-glm.nb(dx~poly(Year,2)+poly(age,3)+log(ex)
                ,data=Femaledata,link=log)
x <- seq(0, 77)
d<- dx[1:78]
fit2018 <- fitted.values(model.6)[0:78]
plot(x, d,type = "n", xlab="age",ylab = "dx",
          main="death count and its fit in 2018")
lines(smooth.spline(x,d,df = 15))
par(new=TRUE)
points(x, fit2018,col = "red", type = "n", ylab = NULL)
lines(smooth.spline(x,fit2018,df = 15),col = "red")

#Section 3.2.5 Modeling of Exposure
#take 2018 as the example
model.7<-glm.nb(ex~poly(Year,1)+poly(age,10),
                   data=Femaledata,link=log)
x <- seq(0, 77)
e<- ex[1:78]
fit2018 <- fitted.values(model.7)[1:78]
plot(x, e,ylim=c(0, 4000),type = "n", xlab="age",ylab = "exposure",
main="exposure and its fit in 2018")
lines(smooth.spline(x,e,df = 15))
par(new=TRUE)
points(x, fit2018,col = "red", type = "n", ylab = NULL)
lines(smooth.spline(x,fit2018,df = 15),col = "red")

#Section 3.3
#Derivation and plots of the fitted mortality rate
Observedmx <- dx / Exposure #Observed death rate

a0 <- predict.glm(model.ex10, newdata = data.frame(Age = 0:80, Year = 2018)
              ,type = "response")
b0 <- predict.glm(model.7, newdata = data.frame(Age = 0:80, Year = 2018,
                                            Exposure = a0), type = "response")
Modeledmx2018 <- b0 / a0    #2018

a1 <- predict.glm(model.ex10, newdata = data.frame(Age = 0:80, Year = 2019)
              ,type = "response")
b1 <- predict.glm(model.7, newdata = data.frame(Age = 0:80, Year = 2019,
                                            Exposure = a1), type = "response")
Modeledmx2019 <- b1 / a1  #2019

a2 <- predict.glm(model.ex10, newdata = data.frame(Age = 0:80, Year = 2020)
                  ,type = "response")
b2 <- predict.glm(model.7, newdata = data.frame(Age = 0:80, Year = 2020,
                                                Exposure = a2), type = "response")
Modeledmx2020 <- b2 / a2  #2020
x <- seq(0, 80)
y <- seq(0, 77)
plot(x, log(Modeledmx2019+0.001),xlab = "Age", ylab = "log mx",
main ="log mx and its fitted values in 2019", ylim = c(-7.5, -3))
lines(smooth.spline(y,log(Observedmx[79:156]+0.001),df = 15), col = "blue")
```

```
par(new=TRUE)
points(y, log(Observedmx[79:156]+0.001),col = "blue", ylab = NULL)
lines(smooth.spline(x,log(Modeledmx2019+0.001),df = 15))


x <- seq(0, 80)
y <- seq(0, 77)
plot(x, log(Modeledmx2020+0.001),xlab = "Age", ylab = "log mx",  main =
"log mx and its fitted values in 2020",ylim = c(-7.5, -3))
lines(smooth.spline(y,log(Observedmx[157:234]+0.001),df = 15), col = "blue")
par(new=TRUE)
points(y, log(Observedmx[157:234]+0.001),col = "blue", ylab = NULL)
lines(smooth.spline(x,log(Modeledmx2020+0.001),df = 15),col = "black")


x <- seq(0, 80)
y <- seq(0, 77)
plot(x, log(Modeledmx2018+0.0001),xlab ="Age", ylab = "log
mx and its fitted value in 2018")
lines(smooth.spline(y,Observedmx[1:78]+0.0001,df = 15), col = "blue")
par(new=TRUE)
points(y, Observedmx[1:78]+0.0001,col = "blue", ylab = NULL)
lines(smooth.spline(x,Modeledmx2018+0.0001,df = 15),col = "black")

#Section 4.1 Residual Analysis
#Section 4.1.1 Deviance Residual

#Deviance Residual Plot for dx model
devres <- residuals.glm(model.7, type = "deviance")
plot(fitted.values(model.7), devres, xlab = "Fitted Values
of Death Count",
     ylab = "Deviance Residual", main = "Deviance Residual Plot
     for Female
     Death Count Model")
abline(h = seq(-2.5, 3.2, by = 0.4),v = -1:18, col =
"lightgray", lty = 3)
lines(smooth.spline(fitted.values(model.7),devres,df = 10
),col = "red")
lines(smooth.spline(fitted.values(model.7),devres,df = 25
),col = "blue")
lines(smooth.spline(fitted.values(model.7),devres,df = 40
),col = "green")
legend("topright",
       legend=c("10-degree spline","25-degree spline","40
       -degree spline"),
       col=c("red","blue","green"),
       lty=1,lwd=2)

#Deviance Residual Plot for Exposure Model
devres <- residuals.glm(model.ex10, type = "deviance")
plot(fitted.values(model.ex10), devres, xlab = "Fitted Val
ues of Exposure",
     ylab = "Deviance Residual", main = "Deviance Residual
     Plot for Female
```

```
    Exposure Model")
abline(h = seq(-6.9, 3.2, by = 0.4),v = seq(0,4500,by = 200
), col = "lightgray", lty = 3)
lines(smooth.spline(fitted.values(model.ex10),devres,df = 10
),col = "red")
lines(smooth.spline(fitted.values(model.ex10),devres,df = 25
),col = "blue")
lines(smooth.spline(fitted.values(model.ex10),devres,df = 40
),col = "green")
legend("bottomright",
       legend=c("10-degree spline","25-degree spline","40-
       degree spline"),
       col=c("red","blue","green"),
       lty=1,lwd=2)

#Section 4.1.2 Anscombe Residual
library(surveillance)
ansresdx <- anscombe.residuals(m = model.7, phi = 1)
hist(ansresdx, breaks = 10, col = "purple", xlab
= "Anscombe Residual",main = "Histogram of Anscombe
Residuals of Female dx Model")
qqnorm(ansresdx, col = "orange", main = "Normal Q-Q Plot
for Death Count")
qqline(ansresdx, col = "blue")
ansresex <- anscombe.residuals(m = model.ex10, phi = 1)
hist(ansresdx, breaks = 10, col = "purple", xlab =
"Anscombe Residual", main = "Histogram of Anscombe
Residuals of Female Exposure Model")
qqnorm(ansresex, col = "orange", main = "Normal Q-Q Plot
for Exposure")
qqline(ansresex, col = "blue")

library(nortest)
ad.test(ansresdx)
ad.test(ansresex)

#Section 4.1.3 Simulated Residual: DHARMa Package
library(DHARMa)
simulationOutput <- simulateResiduals(model.7, plot = T)
simulationOutputex <- simulateResiduals(model.ex10, plot = T)
testDispersion(simulationOutput)
testDispersion(simulationOutputex)

#Section 4.3
#Forcasting and the 3D plot
a3 <- predict.glm(model.ex10, newdata = data.frame(Age = 0:80, Year = 2021)
                  ,type = "response")
b3 <- predict.glm(model.7, newdata = data.frame(Age = 0:80, Year = 2021,
                                                Exposure = a3), type = "response")
Modeledmx2021 <- b3 / a3  #2021

a4 <- predict.glm(model.ex10, newdata = data.frame(Age = 0:80, Year = 2022)
                  ,type = "response")
b4 <- predict.glm(model.7, newdata = data.frame(Age = 0:80, Year = 2022,
```

```
                                                      Exposure = a4), type = "response")
Modeledmx2022 <- b4 / a4  #2022

a5 <- predict.glm(model.ex10, newdata = data.frame(Age = 0:80, Year = 2023)
                  ,type = "response")
b5 <- predict.glm(model.7, newdata = data.frame(Age = 0:80, Year = 2023,
                                                      Exposure = a5), type = "response")
Modeledmx2023 <- b5 / a5  #2023

a6 <- predict.glm(model.ex10, newdata = data.frame(Age = 0:80, Year = 2024)
                  ,type = "response")
b6 <- predict.glm(model.7, newdata = data.frame(Age = 0:80, Year = 2024,
                                                      Exposure = a6), type = "response")
Modeledmx2024 <- b6 / a6  #2024

a7 <- predict.glm(model.ex10, newdata = data.frame(Age = 0:80, Year = 2025)
                  ,type = "response")
b7 <- predict.glm(model.7, newdata = data.frame(Age = 0:80, Year = 2025,
                                                      Exposure = a7), type = "response")
Modeledmx2025 <- b7 / a7  #2025

library(rgl)
plot <- plot3d(Age, Year, log(mx),
xlab = "Age", ylab = "Year", zlab = "log mortality rate", type = "s", size = c(0.5),
col = c('blue', 'orange', 'yellow'),ylim = c(2018,2025),  zlim = c(-11, -3))

#Section 5.2
#Construction of life table
#Year for dataframe
Year <- c[1:405]
Year[1:81] <- c(2018)
Year[82:162] <- c(2019)
Year[163:243] <- c(2020)
Year[244:324] <- c(2021)
Year[325:405] <- c(2022)

#Age for dataframe
Age <- c[1:405]
Age[1:81] <- seq(0, 80)
Age[82:162] <- seq(0, 80)
Age[163:243] <- seq(0, 80)
Age[244:324] <- seq(0, 80)
Age[325:405] <- seq(0, 80)
#mx for dataframe
mx <- c[1:405]
mx[1:81] <- Modeledmx2018
mx[82:162] <- Modeledmx2019
mx[163:243] <- Modeledmx2020
mx[244:324] <- Modeledmx2021
mx[325:405] <- Modeledmx2022

#ax for dataframe
ax <- c[1:405]
mx[1]
```

```
mx[82]
mx[163]
mx[244]
mx[325]
ax[1] <- 0.14903 - 2.05527 * mx[1]
ax[82] <- 0.14903 - 2.05527 * mx[82]
ax[163] <- 0.14903 - 2.05527 * mx[163]
ax[244] <- 0.14903 - 2.05527 * mx[244]
ax[325] <- 0.14903 - 2.05527 * mx[325]
ax[2:81] <- c(0.5)
ax[83:162] <- c(0.5)
ax[164:243] <- c(0.5)
ax[245:324] <- c(0.5)
ax[326:405] <- c(0.5)
#qx for dataframe
qx <- c[1:405]
qx <- mx / (1 + (1 - ax) * mx)
#px for dataframe
px <- c[1:405]
px <- (1 - qx)
#lx for dataframe
lx <- c[1:405]
lx[1] <- 100000
lx[82] <- 100000
lx[163] <- 100000
lx[244] <- 100000
lx[325] <- 100000

i <- 2
while (i <= 81) {
  lx[i] = lx[i-1] * px[i-1]
  i = i + 1
}

i <- 83
while (i <= 162) {
  lx[i] = lx[i-1] * px[i-1]
  i = i + 1
}

i <- 164
while (i <= 243) {
  lx[i] = lx[i-1] * px[i-1]
  i = i + 1
}

i <- 245
while (i <= 324) {
  lx[i] = lx[i-1] * px[i-1]
  i = i + 1
}

i <- 326
while (i <= 405) {
```

```
  lx[i] = lx[i-1] * px[i-1]
  i = i + 1
}
#dx for dataframe
dx <- c[1:405]
dx <- lx * qx
#Lx for dataframe
Lx <- c[1:405]
Lx <- lx - (1 - ax) * dx
#Tx for dataframe
Tx <- c[1:405]
Tx[1:405] <- 0

i <- 81
while (i >= 1) {
  Tx[i] = Tx[i+1] + Lx[i]
  i = i - 1
}

i <- 162
while (i >= 82) {
  Tx[i] = Tx[i+1] + Lx[i]
  i = i - 1
}

i <- 243
while (i >= 163) {
  Tx[i] = Tx[i+1] + Lx[i]
  i = i - 1
}

i <- 324
while (i >= 244) {
  Tx[i] = Tx[i+1] + Lx[i]
  i = i - 1
}

Tx[405] = Lx[405]
i <- 404
while (i >= 325) {
  Tx[i] = Tx[i+1] + Lx[i]
  i = i - 1
}
Tx[1:81] <- Tx[1:81] + lx[81] * px[81] * ax[81]
Tx[82:162] <- Tx[82:162] + lx[162] * px[162] * ax[162]
Tx[163:243] <- Tx[163:243] + lx[243] * px[243] * ax[243]
Tx[244:324] <- Tx[244:324] + lx[324] * px[324] * ax[324]
Tx[325:405] <- Tx[325:405] + lx[405] * px[405] * ax[405]

#ex for dataframe
ex <- c[1:405]
ex = Tx / lx

MortalityTableFemale <- data.frame(Year, Age, mx, qx, ax, px, lx, dx, Lx, Tx, ex)
```

# References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