National Bureau of Statistics
Ministry of Finance & Treasury
Male', Maldives

TECHNICAL REPORT

Household Income & Expenditure Survey 2016

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Household Income and Expenditure Survey (HIES)
Technical Report
2016

National Bureau of Statistics
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SAMPLING METHODOLOGY

1 BACKGROUND

Sample design was done by National Bureau of Statistics (NBS) in collaboration with a technical expert funded by World Bank (WB) during the first half of 2015. The survey was designed in such a way that the results would be representative at the individual Atoll level and the capital Male'. The sampling frame covers the households in the administrative islands of each atoll. HIES covered 48 enumeration block from capital Male' and 282 enumeration blocks randomly selected from all the 20 Atolls.

Initially it was planned to conduct the data collection for the HIES over a 12-month period, in order to represent seasonality in expenditures and income throughout a full year. However, because of resource constraints it was decided to complete the data collection during a period of 6 months, with each atoll enumerated during one month, except for Male', where the sample was spread across the 6 months' period.

The geographic domains of analysis for the HIES was capital Male' and 20 administrative atolls, as well as the national level. There was also interest in obtaining HIES results at the national level for the following administrative island size groups: (1) less than 500 population; (2) 501 to 1000 population; (3) 1001 to 2000 population; and (4) greater than 2000 population.

There was also interest in obtaining HIES results for resort as well as industrial islands and a sampling plan was developed which was representative at the national level. However, because of resource constraints it was decided not to carry out the resort and industrial island component.

The data from the 2009/2010 HIES was used for tabulating the sampling errors and design effects for the estimates of average household expenditure and average household income. These results were useful in determining the most effective sampling strategy for the 2016 HIES.

SAMPLING FRAME AND STRATIFICATION FOR 2016 MALDIVES HIES 2

The sampling frame for the 2016 HIES is based on the summary data and cartography from the 2014 Maldives Population and Housing Census. The survey covers all of the household-based population in the administrative islands of each atoll of the Maldives, but excludes the institutional population (for example, persons in prisons, hospitals, military barracks and school dormitories). Table 1 shows the distribution of the population by atoll and type of island based on the preliminary data from the 2014 Maldives Census.

Table 1: Distribution of population by atoll and type of island, 2014 Maldives Census preliminary data

Atoll	Administrative islands		Resort islands		Industrial islands		Total population
	Population	%	Population	%	Population	%	
Male'	153,379	100.0%	0	0.0%	0	0.0%	153,379
HA	13,412	92.7%	1,008	7.0%	44	0.3%	14,464
HDh	19,207	99.4%	0	0.0%	107	0.6%	19,314
Sh	12,669	96.5%	200	1.5%	260	2.0%	13,129
N	11,242	87.6%	1,120	8.7%	475	3.7%	12,837
R	15,813	94.5%	326	1.9%	594	3.5%	16,733
B	9,549	71.0%	2,572	19.1%	1,328	9.9%	13,449
Lh	8,380	78.6%	1,803	16.9%	477	4.5%	10,660
K	12,978	49.3%	10,608	40.3%	2,719	10.3%	26,305
AA	6,054	66.0%	2,357	25.7%	767	8.4%	9,178
ADh	9,029	70.6%	3,739	29.2%	23	0.2%	12,791
V	1,749	88.3%	221	11.2%	10	0.5%	1,980
M	5,018	91.8%	432	7.9%	19	0.3%	5,469
F	4,254	94.2%	254	5.6%	8	0.2%	4,516
Dh	5,833	77.9%	1,092	14.6%	564	7.5%	7,489
Th	9,683	97.6%	237	2.4%	0	0.0%	9,920
L	12,626	92.0%	328	2.4%	766	5.6%	13,720
GA	9,295	84.9%	813	7.4%	839	7.7%	10,947
GDh	12,715	96.7%	274	2.1%	163	1.2%	13,152
Gn	8,579	100.0%	0	0.0%	0	0.0%	8,579
S	21,396	97.6%	384	1.8%	148	0.7%	21,928
Total	**362,860**	**90.7%**	**27,768**	**6.9%**	**9,311**	**2.3%**	**399,939**

A stratified two-stage sample design was used for the HIES. The primary sampling units (PSUs) selected at the first stage for the administrative islands are the enumeration blocks

(EBs), which are small operational areas defined on maps for the 2014 Census enumeration. The average number of households per EB is 65. Table 2 shows the distribution of the EBs and households in the 2014 Maldives Census frame for the administrative islands by atoll. It can be seen that the percent of households varies by atoll from 0.5% for Vaavu (V) atoll to 39.3% for Male'. Table 2 also shows the average number of households per EB by atoll. It can be seen in this table that the average number of households per EB varies from 58 for Vaavu (V) atoll to 81 for Gaafu Dhaal (GDh).

Table 2: Distribution of EBs and households in 2014 Maldives Census frame for Administrative Islands by atoll

Atoll	No. EBs in frame	No. households in frame	Percent of households by atoll	Average no. households per EB
Male'	436	25,735	39.3%	59
HA	42	2,748	4.2%	65
HDh	53	3,584	5.5%	68
Sh	32	2,546	3.9%	80
N	31	2,195	3.3%	71
R	50	3,178	4.8%	64
B	28	1,874	2.9%	67
Lh	25	1,665	2.5%	67
K	25	1,987	3.0%	79
AA	15	1,117	1.7%	74
ADh	22	1,434	2.2%	65
V	6	350	0.5%	58
M	14	963	1.5%	69
F	11	758	1.2%	69
Dh	13	965	1.5%	74
Th	29	1,955	3.0%	67
L	33	2,510	3.8%	76
GA	23	1,768	2.7%	77
GDh	32	2,596	4.0%	81
Gn	27	1,611	2.5%	60
S	54	4,000	6.1%	74
Maldives	**1,001**	**65,539**	**100.0%**	**65**

Since the four administrative island size groups also domains for tabulating the HIES results, it is also important to examine the distribution of the frame by size group. Table 3 shows the distribution of the EBs and households in the 2014 Census frame for the administrative islands by atoll and island population size group. It can be seen in Table 3 that the distribution of the EBs in the frame by island size group varies considerably by atoll, and some atolls do not have any islands in the smallest size group as well as some other groups. Therefore, the frame cannot be stratified by island size at the atoll level. For this reason, the island size domains can only be established at the national level. The island group with a population of 500 or less only has 59 EBs and 3,872 households in the frame. If the sample in each atoll is allocated to the island size groups in proportion to the number of households, the smallest island size group would not have a sufficient number of sample households to make reliable estimates. Therefore, a special strategy was used for increasing the probability of selection for the EBs in the smallest island group, as described later in this chapter.

Table 3: Distribution of EBs and households in 2014 Maldives Census frame for administrative islands by atoll and island population size

Atoll	500 or less population		501-1000 population		1001-2000 population		More than 2000 population	
	No. EBs	No. hhs.	No. EBs	No. hhs.	No. EBs	No. hhs.	No. EBs	No. hhs.
Male'	0	0	0	0	0	0	436	25,735
HA	6	520	5	393	14	929	17	906
HDh	4	357	9	751	14	1,184	26	1,292
Sh	5	368	9	737	14	1,046	4	395
N	4	302	9	711	12	809	6	373
R	4	306	6	550	30	1,724	10	598
B	7	481	7	596	6	312	8	485
Lh	0	0	1	113	3	271	21	1,281
K	0	0	2	123	20	1,582	3	282
AA	3	191	6	456	6	470	0	0
ADh	4	282	7	534	0	0	11	618
V	3	127	3	223	0	0	0	0
M	4	238	7	497	3	228	0	0
F	1	65	6	431	4	262	0	0
Dh	1	64	8	524	0	0	4	377
Th	9	413	10	850	10	692	0	0
L	3	97	14	1,055	4	304	12	1,054
GA	1	61	6	570	9	673	7	464
GDh	0	0	9	801	11	823	12	972
Gn	0	0	0	0	0	0	27	1,611
S	0	0	0	0	12	938	42	3,062
Total	**59**	**3,872**	**124**	**9,915**	**172**	**12,247**	**646**	**39,505**

Following the selection of sample EBs for the administrative islands at the first sampling stage, a new listing of households in each sample EB was done for the second stage of selection.

3 SAMPLING ERRORS AND DESIGN EFFECTS FOR ESTIMATES FROM 2009/10 MALDIVES HIES DATA

In order to study the sample size requirements and the corresponding expected level of precision for estimates of key indicators by domain for the 2016 HIES, it was useful to examine the sampling errors and design effects from the 2009/10 HIES. Although the geographic domains for the previous survey were the 8 regions, these results were useful for studying the sample size and precision for key estimates at the atoll level for the 2016 HIES.

The Complex Samples module of the SPSS software was used for calculating the standard errors, coefficients of variation, 95% confidence intervals and the design effects for the estimates of average household expenditures and average household income at the national and regional level from the 2009/10 HIES data. This software uses a linearized Taylor series variance estimator, which was described later in the section on the Calculation of Sampling Errors. This variance estimator takes into account the stratification and clustering in the sample design. The design effect was defined as the ratio between the variance of survey estimate based on the actual complex sample design and the corresponding variance based on a simple random sample of the same size. It was a measure of the relative efficiency of the sample design, so it was useful to examine the previous design effects for determining the sample size and estimating the expected level of precision.

In order to calculate the sampling errors from the 2009/10 HIES, it was first necessary to understand the sample design for 2009/10 HIES. The sampling frame for the 2009/10 HIES was based on the 2006 population Census. This frame was stratified by 8 regions, which are groups of atolls; Male' was an individual region. The PSUs selected at the first sampling stage were the census EBs. At the second stage 15 households were selected in each sample EB in Male', and 20 households were selected in each sample EB for the remaining regions. Table 4 shows the distribution of the sample EBs and households for the 2009/10 HIES by region.

Table 4. Distribution of sample EBs and sample households (with completed interviews) by region for 2009/10 Maldives HIES

Region	Sample EBs	Sample households	Average no. sample hhs./EB
1	14	269	19.2
2	14	268	19.1
3	8	156	19.5
4	6	115	19.2
5	7	135	19.3
6	6	115	19.2
7	18	333	18.5
8	42	526	12.5
Total	115	1917	16.7

Given that the percentage of EBs in the 2009/10 HIES sample for most regions was greater than 10%, it is important to include a finite population correction factor in the calculation of the standard errors, as shown later in the section on the Calculation of Sampling Errors. In order to estimate the average first stage sampling rate for each region, the distribution of the frame of EBs from the 2014 Census was used. Table 5 shows the distribution of the EBs in the Census frame and the 2009/10 HIES sample by region, with the corresponding average first stage sampling fraction for each region. These sampling fractions were used in the SPSS Complex Samples application to apply a finite population correction factor in calculating the variances and corresponding standard errors.

Table 5. Distribution of EBs in 2014 Census frame and 2009/10 HIES sample by region, and corresponding average first stage sampling fractions

Region	No. EBs in Census frame	No. EBs in 2009/10 HIES sample	Average 1st stage sampling fraction
1	127	14	0.1102
2	134	14	0.1045
3	68	8	0.1176
4	38	6	0.1579
5	62	7	0.1129
6	55	6	0.1091
7	81	18	0.2222
8	436	42	0.0963

Tables 6 and 7 show the results of the tabulation of measures of precision using the SPSS Complex Samples software. The coefficient of variation (CV) was a useful relative measure of precision for evaluating these results; it was defined as the standard error of an estimate divided by the value of the estimate. It can be seen in Table 6 that the CV for average household expenditure was greater than 10% for Regions 3 and 5, which have a relatively small number of sample households (156 and 135, respectively). In the case of the estimates of average household income in Table 7, five of the regions have CVs greater than 10%, and most of these regions also have a relatively small sample size. The design effect for average household expenditure was 3.06 at the national level, and the corresponding design effect for average household income was 2.96. Such relatively high design effects were similar to the results for other countries, given the intra-class correlation within clusters for socioeconomic characteristics. The design effect also increases with the number of households selected per cluster, as discussed in the next section.

Table 6. Estimates of average household expenditure by region from 2009/2010 Maldives HIES data: value of estimates, standard errors, coefficients of variation, 95% confidence intervals, design effects and number of sample households

Domain	Estimate	SE	CV	95% confidence interval		DEFF	No. sample households
				Lower	Upper		
Maldives	13,283	556.5	0.042	12,180	14,386	3.06	1,917
Region							
1	9,420	500.5	0.053	8,427	10,412	1.66	269
2	8,280	689.2	0.083	6,914	9,646	3.01	268
3	16,367	3012.5	0.184	10,395	22,339	3.45	156
4	12,048	609.6	0.051	10,839	13,256	0.58	115
5	9,268	1147.4	0.124	6,994	11,543	2.30	135
6	10,233	922.7	0.090	8,403	12,062	1.55	115
7	11,023	506.3	0.046	10,019	12,026	0.67	333
8	19,456	985.2	0.051	17,503	21,409	1.74	526

Table 7. Estimates of average household income by region from 2009/2010 Maldives HIES Data: value of estimates, standard errors, coefficients of variation, 95% confidence intervals, design effects and number of sample households

Domain	Estimate	SE	CV	95% confidence interval		DEFF	No. sample households
				Lower	Upper		
Maldives	15,767	729.4	0.046	14,321	17,213	2.96	1,917
Region							
1	9,371	248.7	0.027	8,878	9,864	0.30	269
2	9,673	1049.2	0.108	7,593	11,753	1.71	268
3	18,214	2433.1	0.134	13,391	23,038	2.36	156
4	15,396	1604.9	0.104	12,215	18,578	1.43	115
5	10,004	1315.0	0.131	7,397	12,611	2.52	135
6	8,865	1065.5	0.120	6,753	10,977	3.17	115
7	12,029	633.6	0.053	10,773	13,285	0.52	333
8	25,593	1092.1	0.043	23,428	27,758	1.17	526

4 SAMPLE SIZE AND ALLOCATION FOR 2016 HIES

The sample size for a particular survey is determined by the accuracy required for the survey estimates for each domain, as well as by the resource and operational constraints. The accuracy of the survey results depends on both the sampling error, which can be measured through variance estimation, and the non-sampling error, which can only be partially measured through re-interview or validation studies. The sampling error is inversely proportional to the square root of the sample size. On the other hand, the non-sampling error may increase with the sample size, since it is more difficult to control the quality of a larger survey operation. It is therefore important that the overall sample size be manageable for quality and operational control purposes. The sample size also depends on cost considerations and logistical issues related to the organization of the teams of enumerators and the workload for the data collection each month.

15 households per sample EB for all atolls were selected. This slightly decreased the design effects and sampling errors compared to the 2009/10 HIES, where 20 households were selected per EB for all atolls except for Male'. In order to examine the effect of the number of sample households per cluster on the variance of the survey estimates, we can examine the following expression for the design effect due to clustering:

$$DEFF = 1 + \rho_x \times \left(\bar{n} - 1\right),$$

Where:

DEFF = design effect for estimate (such as average household expenditure)

ρ_x = intra-class correlation coefficient (measure of similarity of households within EB)

For the characteristic being measured (such as household expenditures)

$\bar{n}$ = average number of households selected per cluster

It can be seen that the design effect depends on the number of households selected in each EB, as well as the correlation of households within the EB.

For the HIES the number of geographic domains of analysis was the main determinant of the overall sample size and allocation, since a minimum level of precision was needed each atoll. If the samples EBs are allocated to the atolls proportionally to the number of households, the smaller atolls would not have a sufficient sample size to produce reliable results. Therefore, initially a total sample of 320 samples EBs was allocated to the atolls proportionally to the square root of the number of households. This approach increases the number of sample EBs for the smaller atolls and reduces the number of sample EBs for the larger atolls compared to strictly proportional allocation. However, the number of EBs allocated to the smaller atolls was then increased to a minimum of 12 (or all EBs if the frame for the atoll has less than 12), in order to ensure a sufficient level of precision for the survey estimates for these atolls. This increased the total number of sample EBs to 330.

Based on a review of the results of the sampling errors for the 2009/10 HIES estimates of average household expenditure and average household income, it was recommended to select a minimum of 180 sample households for the smaller atolls, which ensure that the CVs for the estimates of average household income and expenditure by atoll was within 10%. It was expected that most of the design effects will be lower than those shown in the results from the 2009/10 HIES, given the selection of 15 households per cluster. The relatively high first stage sampling rates for the atolls reduce the sampling errors with the corresponding finite population correction factors. Some of the smaller atolls have a sample of 12 sample EBs with 15 sample households each, for a minimum of 180 sample households.

Table 8 shows the proposed allocation of the sample EBs and households for the 2016 HIES by atoll. In the case of Vaavu (V) atoll, which only has 6 EBs in the frame, and Faafu (F) atoll, which has a total of 11 EBs, all of the EBs was selected with certainty. At the second stage 20 households per EB for Vaavu (V) atoll, and 20 households in the largest EB for Faafu (F) atoll was selected.

Table 8: Proposed allocation of sample EBs and households in administrative islands by atoll for 2016 HIES

Atoll	No. EBs in frame	No. sample EBs	No. sample households
Male'	436	48	720
HA	42	16	240
HDh	53	19	285
Sh	32	16	240
N	31	15	225
R	50	18	270
B	28	14	210
Lh	25	13	195
K	25	14	210
AA	15	12	180
ADh	22	12	180
V	6	6	120
M	14	12	180
F	11	11	170
Dh	13	12	180
Th	29	14	210
L	33	16	240
GA	23	13	195
GDh	32	16	240
Gn	27	13	195
S	54	20	300
Maldives	**1,001**	**330**	**4,985**

It was important to consider how to assign the sample EBs to the different months for the data collection. In order for the sample to represent seasonality geographically, it would be ideal to assign the sample EBs within each atoll equally across the different months. However, this was not possible due to resource and logistical constraints. The data collection for the 2016 HIES was conducted over a 6-month period. In the case of the 48 sample EBs for Male', a systematic subsample of 8 EBs was enumerated each month in order to cover the seasonality over the 6-month period. However, for the other atolls it was only possible to enumerate each atoll during a particular month for logistical reasons. Based on the logistical considerations, the HIES team decided to make the monthly data collection assignments according to the scheme shown in Table 9.

Table 9: Assignment of the HIES sample EBs by atoll and month

Atoll	Number of sample EBs by month					
	1	2	3	4	5	6
Male'	8	8	8	8	8	8
HA	16					
HDh				19		
Sh						16
N					15	
R			18			
B					14	
Lh	13					
K						14
AA				12		
ADh		12				
V					6	
M			12			
F	11					
Dh						12
Th				14		
L		16				
GA					13	
GDh			16			
Gn		13				
S						20
Maldives	**48**	**49**	**54**	**53**	**56**	**70**

5 SAMPLE SELECTION PROCEDURES

The sample selection methodology for the 2016 HIES was based on a stratified two-stage sample design. As described previously, separate sampling frames were developed for the administrative islands. The procedures used for each sampling stage are described separately here.

5.1 First Stage Selection of Sample EBs for the Administrative Islands

At the first sampling stage the sample EBs in the administrative islands for the 2016 HIES were selected within each atoll systematically with PPS from the ordered list of EBs in the sampling frame. Within each atoll the EBs were ordered by island number and EA number in order to provide additional implicit geographic stratification. The measure of size for each EB was based on the number of households in the 2014 Census sampling frame. However, in the case of the EBs in the small islands with a population of 500 or less, the measure of size was equal to 2 times the number of households in order to increase the probability of selection for the small islands, as described previously.

Within each atoll the following first stage sample selection procedures were used:

(1) Cumulate the measures of size down the ordered list of EBs within the stratum (atoll). The final cumulated measure of size for the stratum was Mh.

(2) To obtain the sampling interval for stratum h (Ih), divided Mh by the total number of EBs to be selected in stratum h (nh): Ih = Mh/nh.

(3) Selected a random number (Rh) between 0 and Ih. The sample EBs in stratum h was identified by the following selection numbers:

$S_{hi} = R_h + [I_h \times (i - 1)]$, Rounded up,

Where i = 1, 2, ..., nh

The i-th selected EB was the one with a cumulated measure of size closest to Shi but not less than Shi.

There were some atolls that had EBs with a measure of size that was larger than the sampling interval. In this case such EBs were selected with a probability of 1 and separated as self-representing (SR) PSUs. Then it was necessary to cumulate the measures of size of the remaining EBs in the frame for the atoll and calculate a new sampling interval in order to select the remaining (non-self-representing) sample EBs with PPS. Some of the SR sample EBs was from the small island group, given that the measure of size for these EBs is equal to the number of households times 2. The purpose of this procedure was to increase the probability of selection of the EBs in the small islands.

An Excel file was used for selecting the sample EBs in each atoll for the 2016 HIES following these procedures, based on the final allocation of the sample EBs shown in Table 8. The Excel file has a separate spreadsheet for each atoll. The columns of the spreadsheet include all the relevant sampling frame information for each EB. Each spreadsheet documents the first stage systematic selection of sample EBs with PPS for the corresponding atoll. The file includes a summary spreadsheet with the frame information for all 330 samples EBs. A copy of this spreadsheet with the sample EBs can be adapted later to include formulas for calculating the probabilities and weights based on the information in the frame. The number of households listed in each sample EB will have to be added to this weighting spreadsheet when this information becomes available.

5.2 Listing of Households in Sample EBs and Islands

A new listing of households in each sample EB prior to the 2016 HIES data collection was carried out to select the sample households. The supervisor verified the boundaries of the sample EB in order to ensure good coverage of the listed households. The number of households listed in each sample EB was compared to the corresponding number from the Census frame, and any large differences was investigated.

5.3 Second Stage Selection of Sample Households within a Sample EB or Island

A random systematic sample of 15 households were selected from the listing for each sample EB. The sample of households for each EB was selected using the following procedures:

(1) All the households in valid (occupied) housing units in the EB was assigned a serial number from 1 to M’hi, the total number of households listed in the EB.

(2) To obtain the sampling interval for the selection of households within the sample EB (Ihi), divide M’hi by 15, and maintain at least 2 decimal places.

(3) Selected a random number (Rhi) between 0.01 and Ihi, with at least 2 decimal places. The sample households within the sample EB was identified by the Following selection numbers:

$$S_{hij} = R_{hi} + [I_{hi} \times (j-1)]$$

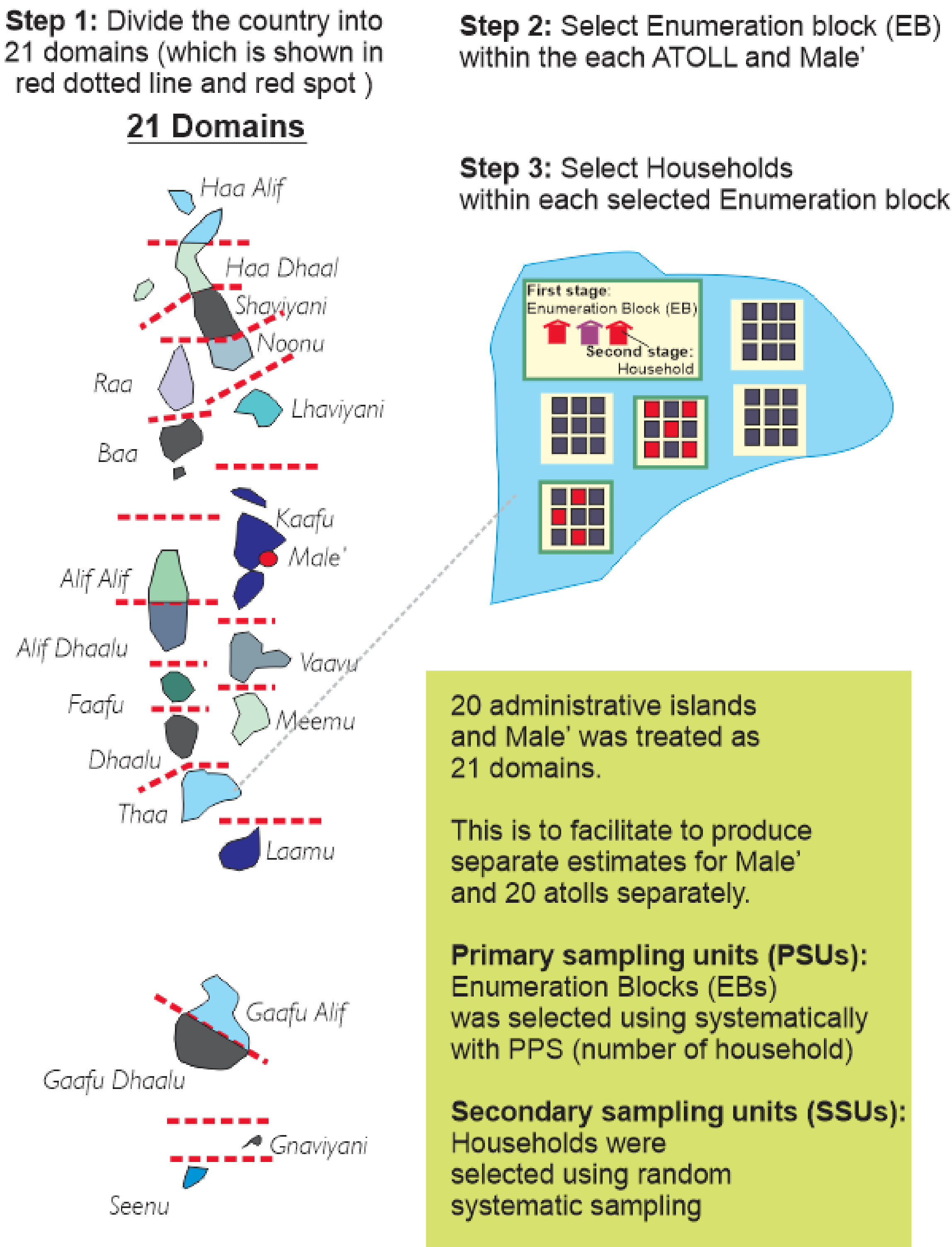
, rounded up,

where j = 1, 2, 3,..., 15

The j-th selected household was the one with a serial number equal to Shij.

Due to time constraint, sample households for each sample EB were selected in the field using the household selection table. Using the table, the supervisor only has to look up the total number of households listed, and a specific systematic sample of households were identified in the corresponding row of the table. An Excel spreadsheet was developed for generating this table, using the random number function and the formulas specified above.

Figure 1: Sample design



6 ESTIMATION PROCEDURES

6.1 Weighting Procedures

In order for the sample estimates from the 2016 HIES to be representative of the population, it is necessary to multiply the data by a sampling weight, or expansion factor. The basic weight for each sample household would be equal to the inverse of its probability of selection (calculated by multiplying the probabilities at each sampling stage). Since all survey data was processed by computer, it was easy to attach a weight to each sample household record in the data files.

Based on the stratified two-stage sample design, the overall probability of selection for sample households in the 2016 HIES can be expressed as follows:

Where: $$p_{hi} = \frac{n_h \times M_{hi}}{M_h} \times \frac{m_{hi}}{M'_{hi}},$$

phi = probability of selection for the sample households in the i-th sample EB in stratum (atoll) h

nh = number of sample EBs selected in stratum h for the 2016 HIES

Mh = cumulated measure of size for stratum h, based on the 2014 Census sampling frame

Mhi = total number of households in the frame for the i-th sample EB in stratum h; in the case of the EBs in islands with a population of 500 or less, Mhi is equal to 2 times the number of households in the frame

mhi = number of sample households selected in the i-th sample EB in stratum h (generally equal to 15)

M’hi = total number of households listed in the i-th sample EB in stratum h

The two components of this probability of selection correspond to the individual sampling stages.

$$W_{hi} = \frac{M_h \times M'_h}{n_h \times M_h \times m_h},$$

The basic sampling weight, or expansion factor, is calculated as the inverse of this probability of selection. Based on the previous expression for the probability, the weight can be simplified as follows:

Where:

Whi = basic weight for the sample households in the i-th sample EB in stratum h

In the case of self-representing (SR) sample EBs selected with a probability of 1, the basic weight simplifies as follows:

$$W_{hi} = \frac{M'_h}{m_h}$$

It is also important to adjust the weights to take into account the non-interview households in each sample EB. Since the weights is calculated at the level of the sample EB, it is advantageous to adjust the weights at this level. The weight (W'hi) after adjusting for the non-interview households in the i-th sample EB in stratum h can be expressed as follows:

Where: $$W'_{hi} = W_h \times \frac{m_h}{m'_h},$$

mhi = number of sample households selected in the i-th sample EA in stratum h

m'hi = number of sample households with completed interviews in the i-th sample EB in stratum h

In order to make all sets of individual weights consistent with the population estimates based on 2014 Census, it was necessary to calculate weight adjustment factors using population projection.

The weight adjustment factor in the i-th sample EB in stratum h can be expressed as follows:

Where: $$A_h = \frac{\widehat{P_h}}{\sum_{i \varepsilon h} \sum_j \sum_k W_{hijk}}$$

Ah = adjustment factor for the sample households selected in the i-th sample EA in stratum h

P_h= estimate of population for stratum h based on projections using Census 2014

$\sum_{i \varepsilon h} \sum_j \sum_k W_{hijk}$ = Sum of weights for all sample individuals in stratum h from 2016 HIES

The final weight (W''hi) for the sample households in the i-th sample EB in stratum h can be expressed as follows:

Where: $$W''_{hi} = W'_h \times A_h$$

Ah = population adjustment factor for the sample households selected in the i-th sample EA in stratum h

Whi = Weight after adjusting for the non-interview households

The sampling probabilities at each stage of selection was maintained in an Excel spreadsheet with information from the sampling frame for each sample EB or island so that the overall probability and corresponding weight can be calculated.

Refer to annex 1 to see the design weight and final weight.

6.2 Survey Estimates

$$\hat{Y} = \sum_{h=1}^{L} \sum_{i=1}^{n_h} \sum_{j=1}^{m_h} W'_h \; y_{hij} \;,$$

The most common survey estimates to be calculated from the 2016 HIES data was in the form of totals and ratios. The survey estimate of a total can be expressed as follows:

Where:

L = number of strata

yhij = value of variable y for the j-th sample household in the i-th sample EB in stratum h

The survey estimate of a ratio is defined as follows:

$$\hat{R} = \frac{\hat{Y}}{\hat{X}},$$

Where $\hat{Y}$ and $\hat{X}$ are estimates of totals for variables y and x, respectively, calculated as specified previously.

In the case of a stratified two-stage sample design, means and proportions are special types of ratios. In the case of the mean, the variable X, in the denominator of the ratio, is defined to equal 1 for each unit so that the denominator is the sum of the weights. For a proportion, the variable X in the denominator is also defined to equal 1 for all units; the variable Y in the numerator is binomial and is defined to equal either 0 or 1, depending on the absence or presence, respectively, of a specified characteristic for the unit.

7 SAMPLING ERRORS AND PRECISION FROM SURVEY

The standard error, or square root of the variance, is used to measure the sampling error, although it may also include a small variable part of the non-sampling error. The variance estimator takes into account the different aspects of the sample design, such as the stratification and clustering.

The Complex Samples module of SPSS was used for producing the results in Tables 6 and 7 from the 2009/10 HIES data. These tables show the measures of precision for estimates of the average household expenditure and average household income by region. For each estimate, the tables show the standard error, coefficient of variation (CV), 95 percent confidence interval, the design effect (DEFF) and the number of observations.

The variance estimator for a total used by Stata and the Complex Samples module of SPSS can be expressed as follows:

Variance Estimator of a Total

$$V(\hat{Y}) = \sum_{h=1}^{L}\left[(1-f_h)\times\frac{n_h}{n_h-1}\sum_{i=1}^{n_h}\left(\hat{Y}_{hi}-\frac{\hat{Y}_h}{n_h}\right)^2\right],$$

Where:

$f_h = \frac{n_h}{N_h}$	=	average first stage sampling fraction for stratum h
nh	=	number of sample EBs selected in stratum h
Nh	=	total number of EBs in sampling frame for stratum h

$$\hat{Y}_{hi} = \sum_{j=1}^{m_{hi}} W'_{hij}\, y_{hij}$$

$$\hat{Y}_h = \sum_{i=1}^{n_h} \hat{Y}_{hi}$$

The expression (1-fh) is the finite population correction factor, which reduces the variance based on the first stage sampling fraction.

The variance estimator for a ratio used by these statistical software packages can be expressed as follows:

Variance Estimator of a Ratio

$$V(\hat{R}) = \frac{1}{\hat{X}^2}\left[V(\hat{Y}) + \hat{R}^2 V(\hat{X}) - 2\,\hat{R}\,COV(\hat{X},\hat{Y})\right]$$

Where:

$$COV(\hat{X},\hat{Y}) = \sum_{h=1}^{L}\left[(1-f_h)\times\frac{n_h}{n_h-1}\sum_{i=1}^{n_h}\left(\hat{X}_{hi} - \frac{\hat{X}_h}{n_h}\right)\left(\hat{Y}_{hi} - \frac{\hat{Y}_h}{n_h}\right)\right]$$

$V(\hat{Y})$ and $V(\hat{X})$ are calculated according to the formula for the variance of a total.

7.1 Results on sampling errors for selected attributes in HIES 2016

Reliability of statistics for some selected estimates is given below to build confidence among advanced data users and to support future sample design activities of similar type of surveys.

Table 10: Estimation, standard error, coefficient of variation and 95% confidence internal of mean selected indicators, 2016

Location	Mean	Std. Err.	Relative standard error (RSE)	[95% Conf.	Interval]	DEFF
Monthly Household Income						
Male'	37,035	1,276	3.4	34,524	39,545	1.27
Haa Alif (HA)	18,778	1,196	6.4	16,425	21,132	1.34
Haa Dhaal (HDh) Atoll	17,097	1,413	8.3	14,316	19,878	1.49
Shaviyani (Sh) Atoll	18,617	1,699	9.1	15,273	21,961	1.20
Noonu (N) Atoll	15,831	938	5.9	13,987	17,676	1.19
Raa (R) Atoll	14,132	769	5.4	12,618	15,646	0.61
Baa (B) Atoll	16,249	1,161	7.1	13,965	18,533	1.44
Lhaviyani (Lh) Atoll	16,384	1,307	8.0	13,812	18,955	1.93
Kaafu (K) Atoll	23,269	2,401	10.3	18,545	27,993	4.05
Alif Alifu (AA)	19,194	1,420	7.4	16,399	21,988	1.26
Alifu Dhaal (Adh)	24,959	1,042	4.2	22,909	27,010	0.49
Vaavu (V)	20,579	2,959	14.4	14,757	26,400	2.98
Meemu (M)	18,398	1,577	8.6	15,296	21,501	2.07
Faafu (F) Atoll	26,523	2,294	8.6	22,010	31,036	2.26
Dhaal (Dh) Atoll	20,772	1,130	5.4	18,549	22,995	1.13
Thaa (T) Atoll	16,990	1,617	9.5	13,808	20,171	2.91
Laamu (L) Atoll	21,219	2,230	10.5	16,832	25,606	3.29
Gaafu Alif (GA) Atoll	14,537	1,374	9.5	11,833	17,241	2.68
Gaafu Dhaal (Gdh) Atoll	17,422	1,060	6.1	15,336	19,508	1.01
Gnaviyani (Gn) Atoll	17,672	1,524	8.6	14,672	20,671	1.86
Seenu (S) Atoll	18,953	1,519	8.0	15,963	21,942	2.12
Maldives	**26,395**	**729**	**2.8**	**24,961**	**27,829**	**3.99**

Location	Mean	Std. Err.	Relative standard error (RSE)	[95% Conf.	Interval]	DEFF
Monthly Household Expenditure						
Male'	34,341	1,074	3.1	32,227	36,455	1.67
Haa Alif (HA)	18,552	1,346	7.3	15,904	21,200	1.57
Haa Dhaal (HDh) Atoll	15,809	1,089	6.9	13,667	17,951	2.09
Shaviyani (Sh) Atoll	18,522	1,431	7.7	15,706	21,339	2.87
Noonu (N) Atoll	16,788	1,191	7.1	14,443	19,132	1.72
Raa (R) Atoll	18,753	779	4.2	17,221	20,286	0.88
Baa (B) Atoll	14,657	1,572	10.7	11,565	17,750	4.62
Lhaviyani (Lh) Atoll	19,307	1,560	8.1	16,238	22,376	1.87
Kaafu (K) Atoll	17,521	2,119	12.1	13,353	21,690	5.73
Alif Alifu (AA)	18,137	1,463	8.1	15,258	21,016	1.86
Alifu Dhaal (Adh)	21,740	1,088	5.0	19,599	23,881	0.94
Vaavu (V)	16,566	1,871	11.3	12,885	20,247	2.66
Meemu (M)	16,454	1,227	7.5	14,039	18,869	1.27
Faafu (F) Atoll	19,852	1,093	5.5	17,702	22,002	1.04
Dhaal (Dh) Atoll	19,648	1,821	9.3	16,065	23,231	3.31
Thaa (T) Atoll	17,805	1,147	6.4	15,548	20,062	2.04
Laamu (L) Atoll	21,303	1,545	7.3	18,264	24,343	1.71
Gaafu Alif (GA) Atoll	19,331	1,373	7.1	16,629	22,033	2.22
Gaafu Dhaal (Gdh) Atoll	20,381	1,571	7.7	17,290	23,472	2.09
Gnaviyani (Gn) Atoll	22,043	1,513	6.9	19,066	25,020	1.71
Seenu (S) Atoll	18,726	1,151	6.1	16,460	20,991	2.69
Maldives	**25,119**	**535**	**2.1**	**24,066**	**26,172**	**3.74**

Annex1: Weights for estimation, 2016

Atoll Code	Atoll name	Island Code	Island name	Block	Survey Month	Weight
10	MALE	1001	Henveiru	10	8	37.483719
10	MALE	1001	Henveiru	20	9	45.580202
10	MALE	1001	Henveiru	31	10	36.846741
10	MALE	1001	Henveiru	40	3	50.224491
10	MALE	1001	Henveiru	49	4	40.851821
10	MALE	1001	Henveiru	58	5	37.697912
10	MALE	1001	Henveiru	68	8	61.691954
10	MALE	1001	Henveiru	77	9	44.908031
10	MALE	1001	Henveiru	86	11	34.868576
10	MALE	1001	Henveiru	95	3	44.266487
10	MALE	1002	Galolhu	4	5	36.518096
10	MALE	1002	Galolhu	13	5	38.713344
10	MALE	1002	Galolhu	23	8	43.834781
10	MALE	1002	Galolhu	33	9	44.56995
10	MALE	1002	Galolhu	43	11	140.62215
10	MALE	1002	Galolhu	52	3	41.090024
10	MALE	1002	Galolhu	62	5	41.520427
10	MALE	1002	Galolhu	71	5	42.922533
10	MALE	1003	Machchangolhi	1	8	34.505561
10	MALE	1003	Machchangolhi	10	9	40.507734
10	MALE	1003	Machchangolhi	17	11	35.540119
10	MALE	1003	Machchangolhi	27	4	58.491078
10	MALE	1003	Machchangolhi	37	5	43.429412
10	MALE	1003	Machchangolhi	45	5	30.272565
10	MALE	1003	Machchangolhi	52	8	30.671609
10	MALE	1003	Machchangolhi	61	9	35.341792
10	MALE	1003	Machchangolhi	70	10	28.759438
10	MALE	1004	Maafannu	12	3	41.664878
10	MALE	1004	Maafannu	21	4	48.312349
10	MALE	1004	Maafannu	31	5	33.957853
10	MALE	1004	Maafannu	40	8	39.394654
10	MALE	1004	Maafannu	47	10	48.475186
10	MALE	1004	Maafannu	56	10	46.359512
10	MALE	1004	Maafannu	66	4	77.860918
10	MALE	1004	Maafannu	74	5	41.808764
10	MALE	1004	Maafannu	83	5	46.854649

10	MALE	1004	Maafannu	91	8	40.579389
10	MALE	1004	Maafannu	100	10	29.460888
10	MALE	1004	Maafannu	108	10	25.206443
10	MALE	1004	Maafannu	117	3	33.001539
10	MALE	1005	Villigili	3	5	43.237034
10	MALE	1005	Villigili	11	5	45.373551
10	MALE	1009	HulhuMale	2	8	49.789695
10	MALE	1009	HulhuMale	7	9	56.597146
10	MALE	1009	HulhuMale	13	11	38.925401
10	MALE	1009	HulhuMale	21	3	50.747189
10	MALE	1009	HulhuMale	32	4	36.846741
10	MALE	1009	HulhuMale	41	5	41.981765
20	HA	2001	Thurakunu	1	3	7.5817869
20	HA	2002	Uligamu	1	4	7.9264136
20	HA	2006	Hoarafushi	1	3	15.163574
20	HA	2006	Hoarafushi	4	3	12.487649
20	HA	2007	Ihavandhoo	1	4	16.77672
20	HA	2007	Ihavandhoo	5	4	13.227798
20	HA	2008	Kelaa	1	4	14.463717
20	HA	2008	Kelaa	4	4	14.608809
20	HA	2009	Vashafaru	1	3	6.9295902
20	HA	2010	Dhidhdhoo	4	4	14.930288
20	HA	2010	Dhidhdhoo	7	4	13.940705
20	HA	2011	Filladhoo	2	3	13.97892
20	HA	2013	Thakandhoo	1	3	6.9920333
20	HA	2014	Utheemu	1	3	14.897546
20	HA	2015	Muraidhoo	1	4	8.3309333
20	HA	2016	Baarah	2	4	16.246686
21	HDH	2103	Hanimaadhoo	2	8	17.245462
21	HDH	2103	Hanimaadhoo	3	8	11.234186
21	HDH	2104	Finey	1	8	12.248384
21	HDH	2106	Hirimaradhoo	1	8	6.4670481
21	HDH	2107	Nolhivaranfaru	1	8	12.170369
21	HDH	2108	Nellaidhoo	1	8	8.8140558
21	HDH	2109	Nolhivaramu	1	8	14.474817
21	HDH	2109	Nolhivaramu	4	8	13.025144
21	HDH	2110	Kuribi	1	8	6.0605479
21	HDH	2112	Kulhudhuffushi	2	8	14.332274
21	HDH	2112	Kulhudhuffushi	6	8	12.766121
21	HDH	2112	Kulhudhuffushi	10	8	17.904485
21	HDH	2112	Kulhudhuffushi	16	8	15.166152

21	HDH	2112	Kulhudhuffushi	22	8	13.502628
21	HDH	2112	Kulhudhuffushi	25	8	15.675609
21	HDH	2113	Kumundhoo	2	8	11.332732
21	HDH	2114	Neykurendhoo	2	8	27.397097
21	HDH	2115	Vaikaradhoo	3	8	32.704786
21	HDH	2117	Makunudhoo	2	8	8.6011739
22	SH	2201	Kaditheemu	3	10	11.005539
22	SH	2202	Noomaraa	1	10	6.4133524
22	SH	2204	Feydhoo	1	10	12.497815
22	SH	2205	Feevah	1	10	11.36165
22	SH	2206	Bilehffahi	1	10	6.364201
22	SH	2207	Foakaidhoo	2	10	12.497815
22	SH	2208	Narudhoo	1	10	7.1190085
22	SH	2210	Maroshi	1	10	3.7691823
22	SH	2211	Lhaimagu	1	10	12.088051
22	SH	2213	Komandoo	2	11	8.2677853
22	SH	2214	Maaugoodhoo	1	11	13.071109
22	SH	2215	Funadhoo	1	10	12.173196
22	SH	2215	Funadhoo	2	10	12.057751
22	SH	2215	Funadhoo	4	10	12.778665
22	SH	2216	Milandhoo	2	10	11.342555
22	SH	2216	Milandhoo	3	10	10.604207
23	N	2302	Hebadhoo	1	8	9.7225177
23	N	2303	Kedhikolhudhoo	1	8	13.799559
23	N	2303	Kedhikolhudhoo	3	8	12.767256
23	N	2305	Maalhendhoo	1	9	12.499411
23	N	2306	Kudafari	1	9	8.2711119
23	N	2308	Maafaru	1	9	13.588541
23	N	2309	Lhohi	1	9	14.122792
23	N	2310	Miladhoo	1	8	10.903626
23	N	2311	Magoodhoo	1	8	7.0253682
23	N	2312	Manadhoo	3	9	3.2646864
23	N	2313	Holhudhoo	1	8	11.821533
23	N	2313	Holhudhoo	4	8	14.609784
23	N	2314	Fodhdhoo	1	8	6.2147488
23	N	2315	Velidhoo	3	8	10.945163
23	N	2315	Velidhoo	5	8	10.852555
24	R	2401	Alifushi	2	5	11.952032
24	R	2401	Alifushi	6	5	12.515345
24	R	2402	Vaadhoo	1	5	7.1516255
24	R	2404	Agolhitheemu	1	5	10.269001

24	R	2407	Ugoofaaru	2	5	12.083781
24	R	2407	Ugoofaaru	5	5	13.323576
24	R	2410	Rasmaadhoo	1	5	12.310175
24	R	2411	Innamaadhoo	2	5	12.912657
24	R	2412	Maduvvari	3	5	14.303251
24	R	2413	Iguraidhoo	1	5	14.867853
24	R	2413	Iguraidhoo	4	5	11.621391
24	R	2416	Meedhoo	2	3	10.065251
24	R	2416	Meedhoo	5	3	11.207771
24	R	2417	Kinolhas	1	5	6.7498488
24	R	2418	Hulhudhuffaaru	3	5	13.911381
24	R	2419	Dhuvaafaru	2	5	13.537005
24	R	2419	Dhuvaafaru	5	5	11.749099
24	R	2419	Dhuvaafaru	9	5	13.643101
25	B	2501	Kudarikilu	1	10	5.8870575
25	B	2502	Kamadhoo	1	10	4.9999667
25	B	2503	Kendhoo	2	10	10.828016
25	B	2506	Kihaadhoo	1	9	6.7766925
25	B	2507	Dhonfanu	1	10	6.9787383
25	B	2508	Dharavandhoo	2	9	9.8550969
25	B	2509	Maalhos	1	9	7.2580161
25	B	2510	Eydhafushi	2	9	15.695154
25	B	2510	Eydhafushi	5	9	9.9345153
25	B	2510	Eydhafushi	8	9	12.331907
25	B	2512	Thulhaadhoo	4	10	15.270961
25	B	2513	Hithaadhoo	1	10	9.027664
25	B	2514	Fulhadhoo	1	10	4.971757
25	B	2516	Goidhoo	1	10	11.006991
26	Lh	2601	Hinnavaru	2	4	8.6329077
26	Lh	2601	Hinnavaru	4	4	8.6968551
26	Lh	2601	Hinnavaru	7	4	8.7540713
26	Lh	2601	Hinnavaru	9	4	8.0050598
26	Lh	2602	Naifaru	2	4	7.3780697
26	Lh	2602	Naifaru	4	4	9.2248785
26	Lh	2602	Naifaru	6	4	10.160268
26	Lh	2602	Naifaru	8	4	9.6235692
26	Lh	2602	Naifaru	10	4	9.6441911
26	Lh	2602	Naifaru	12	4	7.8855813
26	Lh	2603	Kurendhoo	2	4	6.8752165
26	Lh	2603	Kurendhoo	3	4	8.2027156
26	Lh	2604	Olhuvelifushi	1	4	9.9571295

27	K	2701	Kaashidhoo	2	10	12.381498
27	K	2701	Kaashidhoo	4	10	9.89771
27	K	2702	Gaafaru	1	10	13.646275
27	K	2702	Gaafaru	2	10	14.603179
27	K	2703	Dhiffushi	2	10	10.983587
27	K	2704	Thulusdhoo	1	10	12.858145
27	K	2705	Huraa	1	10	11.707995
27	K	2705	Huraa	2	10	11.522108
27	K	2706	Himmafushi	1	10	11.330527
27	K	2711	Gulhi	1	10	10.227142
27	K	2712	Maafushi	2	11	7.1183953
27	K	2712	Maafushi	3	11	7.3223916
27	K	2713	Guraidhoo	2	10	14.913885
27	K	2713	Guraidhoo	4	10	15.576724
28	AA	2801	Thoddoo	1	8	14.137686
28	AA	2801	Thoddoo	2	8	5.2561519
28	AA	2802	Rasdhoo	1	8	10.684702
28	AA	2802	Rasdhoo	2	8	6.5387536
28	AA	2804	Ukulhas	1	8	8.3164772
28	AA	2804	Ukulhas	2	8	6.9771195
28	AA	2805	Mathiveri	1	8	8.8575894
28	AA	2806	Bodufolhudhoo	1	8	6.8748823
28	AA	2807	Feridhoo	1	10	3.0176418
28	AA	2807	Feridhoo	2	8	2.8545261
28	AA	2808	Maalhos	1	8	6.6061889
28	AA	2809	Himandhoo	2	8	6.9320265
29	Adh	2901	Hangnameedhoo	1	4	5.0646713
29	Adh	2902	Omadhoo	2	5	13.427313
29	Adh	2903	Kuburudhoo	1	4	4.9038881
29	Adh	2904	Mahibadhoo	2	4	9.2744929
29	Adh	2904	Mahibadhoo	5	4	10.378599
29	Adh	2905	Mandhoo	1	4	3.698014
29	Adh	2906	Dhagethi	1	4	9.4704717
29	Adh	2907	Dhigurah	1	5	10.633879
29	Adh	2908	Fenfushi	2	4	8.5524912
29	Adh	2910	Maamigili	2	4	8.8794682
29	Adh	2910	Maamigili	4	5	9.2209862
29	Adh	2910	Maamigili	5	5	7.697461
30	V	3001	Fulidhoo	1	9	4.272236
30	V	3002	Thinadhoo	1	9	2.6458292
30	V	3003	Felidhoo	1	9	5.0426392

30	V	3004	Keyodhoo	1	10	3.2917228
30	V	3004	Keyodhoo	2	10	3.0963574
30	V	3005	Rakeedhoo	1	10	1.6808797
31	M	3101	Raimandhoo	1	5	3.6560832
31	M	3103	Veyvah	1	5	4.5422221
31	M	3104	Mulah	2	5	6.4997035
31	M	3104	Mulah	3	5	5.6777776
31	M	3105	Muli	1	5	6.0984872
31	M	3105	Muli	2	5	6.2619095
31	M	3106	Naalaafushi	1	5	5.5263702
31	M	3107	Kolhufushi	1	5	6.7376294
31	M	3107	Kolhufushi	2	5	6.2431363
31	M	3108	Dhiggaru	1	5	6.018244
31	M	3108	Dhiggaru	3	5	5.793214
31	M	3109	Maduvvari	1	5	7.4946664
32	F	3201	Feeali	1	4	5.0139321
32	F	3201	Feeali	2	4	6.1904199
32	F	3203	Biledhdhoo	1	4	2.6424777
32	F	3203	Biledhdhoo	2	4	5.2994746
32	F	3203	Biledhdhoo	3	4	3.9298387
32	F	3204	Magoodhoo	1	4	6.9110956
32	F	3205	Dharaboodhoo	1	4	3.4555478
32	F	3206	Nilandhoo	1	4	4.4041295
32	F	3206	Nilandhoo	2	4	6.7513854
32	F	3206	Nilandhoo	3	4	2.9135011
32	F	3206	Nilandhoo	4	4	4.3363737
33	Dh	3301	Meedhoo	1	10	5.6854605
33	Dh	3301	Meedhoo	2	10	5.0004652
33	Dh	3302	Badidhoo	1	10	3.1654253
33	Dh	3302	Badidhoo	2	10	4.8360664
33	Dh	3303	Ribudhoo	1	10	4.452469
33	Dh	3304	Hulhudheli	1	10	5.6672653
33	Dh	3307	Maaeboodhoo	1	10	4.1690227
33	Dh	3307	Maaeboodhoo	2	10	4.3603877
33	Dh	3308	Kudahuvadhoo	1	10	10.685926
33	Dh	3308	Kudahuvadhoo	2	10	4.7949667
33	Dh	3308	Kudahuvadhoo	3	10	6.4389552
33	Dh	3308	Kudahuvadhoo	4	10	6.1649571
34	Th	3401	Buruni	2	8	4.9119241
34	Th	3402	Vilufushi	1	8	11.446537
34	Th	3402	Vilufushi	3	8	13.37907

34	Th	3403	Madifushi	2	8	11.798574
34	Th	3405	Guraidhoo	1	8	6.1210131
34	Th	3405	Guraidhoo	3	8	7.7105785
34	Th	3406	Kadoodhoo	1	8	6.0842029
34	Th	3408	Hirilandhoo	1	8	7.9994192
34	Th	3408	Hirilandhoo	2	8	7.3278433
34	Th	3410	Thimarafushi	1	8	9.7667328
34	Th	3410	Thimarafushi	3	8	10.457645
34	Th	3411	Veymandoo	2	8	12.157012
34	Th	3412	Kibidhoo	1	8	11.277377
34	Th	3413	Omadhoo	1	8	6.6310975
35	L	3501	Isdhoo	1	5	10.077746
35	L	3502	Dhabidhoo	1	5	10.561007
35	L	3503	Maabaidhoo	1	5	9.9234459
35	L	3504	Mundhoo	2	5	4.2326535
35	L	3506	Gamu	2	5	11.641594
35	L	3506	Gamu	3	5	11.319677
35	L	3506	Gamu	4	5	10.693019
35	L	3506	Gamu	7	5	6.4836404
35	L	3507	Maavah	2	5	9.8655833
35	L	3507	Maavah	4	5	8.741656
35	L	3508	Fonadhoo	3	5	10.483352
35	L	3508	Fonadhoo	5	5	9.2974772
35	L	3510	Maamendhoo	1	5	9.2821348
35	L	3510	Maamendhoo	3	5	10.240291
35	L	3511	Hithadhoo	2	5	10.603054
35	L	3512	Kunahandhoo	2	5	9.8603661
36	GA	3601	Kolamaafushi	2	9	7.7893908
36	GA	3602	Villingili	1	8	14.472881
36	GA	3602	Villingili	4	8	12.405326
36	GA	3602	Villingili	5	8	11.026957
36	GA	3603	Maamendhoo	1	9	11.277569
36	GA	3603	Maamendhoo	3	8	11.821546
36	GA	3604	Nilandhoo	1	8	9.8760849
36	GA	3605	Dhaandhoo	2	8	12.005154
36	GA	3606	Dhevvadhoo	1	8	8.0492574
36	GA	3607	Kodey	1	8	5.0841501
36	GA	3609	Gemanafushi	1	8	11.49317
36	GA	3609	Gemanafushi	3	8	10.655857
36	GA	3610	Kanduhulhudhoo	1	8	11.734768
37	GDh	3701	Madeveli	2	5	10.026707

37	GDh	3701	Madeveli	3	5	10.252624
37	GDh	3702	Hoadedhdhoo	2	5	9.4779817
37	GDh	3703	Nadallaa	2	5	10.04246
37	GDh	3704	Gadhdhoo	3	3	10.085267
37	GDh	3704	Gadhdhoo	5	3	12.899139
37	GDh	3705	Rathafandhoo	1	5	10.831481
37	GDh	3706	Vaadhoo	2	5	11.691589
37	GDh	3707	Fiyoari	2	5	12.257708
37	GDh	3710	Thinadhoo	2	5	12.845159
37	GDh	3710	Thinadhoo	4	5	9.6367039
37	GDh	3710	Thinadhoo	5	5	11.134847
37	GDh	3710	Thinadhoo	7	5	12.150672
37	GDh	3710	Thinadhoo	10	5	13.842842
37	GDh	3710	Thinadhoo	12	5	13.09458
37	GDh	3711	Fares-Maathodaa	2	3	9.6205078
38	Gn	3801	Fuvahmulah	1	5	9.1175741
38	Gn	3801	Fuvahmulah	2	5	8.7528712
38	Gn	3801	Fuvahmulah	4	5	9.0197571
38	Gn	3801	Fuvahmulah	6	5	7.6679923
38	Gn	3801	Fuvahmulah	8	5	9.0043123
38	Gn	3801	Fuvahmulah	11	5	9.1003386
38	Gn	3801	Fuvahmulah	13	5	8.8653092
38	Gn	3801	Fuvahmulah	15	5	8.9118391
38	Gn	3801	Fuvahmulah	17	5	8.1102869
38	Gn	3801	Fuvahmulah	19	5	8.2239578
38	Gn	3801	Fuvahmulah	22	5	8.0189348
38	Gn	3801	Fuvahmulah	23	5	9.6780247
38	Gn	3801	Fuvahmulah	26	5	7.0587671
39	S	3901	Meedhoo	1	10	15.000531
39	S	3901	Meedhoo	4	10	15.012266
39	S	3902	Hithadhoo	2	10	16.55207
39	S	3902	Hithadhoo	4	10	16.082179
39	S	3902	Hithadhoo	6	10	15.581665
39	S	3902	Hithadhoo	8	10	12.857598
39	S	3902	Hithadhoo	11	10	15.018653
39	S	3902	Hithadhoo	14	10	14.857668
39	S	3902	Hithadhoo	17	10	13.885399
39	S	3902	Hithadhoo	19	10	13.736861
39	S	3902	Hithadhoo	21	10	10.345765
39	S	3902	Hithadhoo	25	10	12.467974
39	S	3903	Maradhoo	2	10	16.016713

39	S	3903	Maradhoo	4	10	15.557137
39	S	3904	Feydhoo	1	10	16.169403
39	S	3904	Feydhoo	4	10	14.480268
39	S	3904	Feydhoo	7	10	14.720488
39	S	3905	Maradhoo-Feydhoo	1	10	13.131778
39	S	3905	Maradhoo-Feydhoo	3	10	15.981309
39	S	3906	Hulhudhoo	2	10	16.312647

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