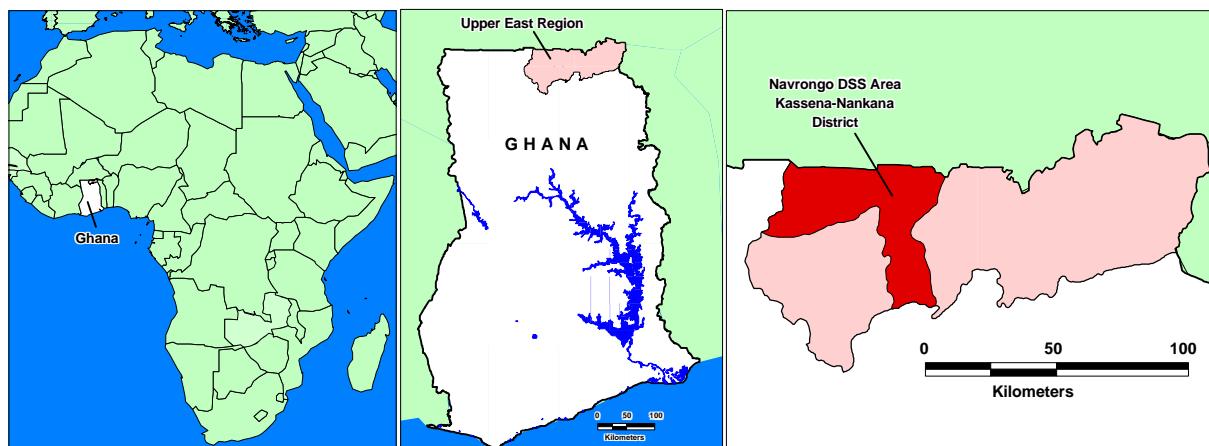


NAVRONGO DSS GHANA

**MINISTRY OF HEALTH
NAVRONGO HEALTH RESEARCH CENTRE**



LOCATION OF NAVRONGO DSS SITE, GHANA: Monitored Population 140,000

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1. NAVRONGO DSS SITE DESCRIPTION

1.1 Physical Geography of the Navrongo DSS Area

The Navrongo Demographic Survey System (NDSS) is sited in the Kassena-Nankana District of the Upper East region of Ghana. The district lies between latitudes 10°30' and 11°00' north of the equator and between longitudes 1°00' and 1°30' west of the zero meridian and covers an area of 1,675 square kilometers along the Ghana-Burkina Faso border (see map). It measures roughly 50 km long and 55 km wide and has an altitude of 200m - 400m above sea level. The land is relatively flat and passing through it from Burkina Faso is the White Volta River, which feeds Lake Volta (the world's largest artificial lake) in the Volta region, south of Ghana.

Located in the Guinea Savannah belt, the district's ecology is typically Sahelian (hot and dry), with the vegetation consisting mostly of semi-arid grassland interspersed with short trees. There are two main climatic seasons, the wet and dry seasons. The wet season extends from April to October, with the heaviest rainfall mainly occurring between June and October. The mean annual rainfall is 1365 mm but the highest level is recorded in August. Similarly, the dry season is subdivided into the *Harmattan* (November to mid February) and the dry hot (mid February to April) seasons. Monthly temperatures range from 20°C to 40°C, with the mean minimum and maximum temperatures for 1999 estimated at 22.8°C and 34.4°C respectively.

1.2 Population Characteristics of the Navrongo DSS Area

The population of the Kassena-Nankana district as at 1st July 1999 was 140,881, which is slightly less than 1% of Ghana's population and about 15% of the total population of the Upper East region. The population density is 84 persons per sq. km. The district is largely rural, with only 9.5% living in urban quarters. The population consists of two distinct ethno-linguistic groups: the *Kassena* form 49% of the district's population, while the *Nankani* constitute about 46%. The *Builsa* and migrants belonging to other ethnic groups make up the remaining 5%. The main languages spoken are *Kassim* and *Nankam*, with *Buili* being spoken by most of the minority tribe. Despite the linguistic distinction, the population is, in many respects, a homogenous group with a common culture. The district has ten traditional paramount chiefdoms and is characterized by traditional forms of village organization, leadership and governance. At both the village and family levels, there is a strong traditional social structure which influences economic and social behaviour. Male dominance is strong, constraining the autonomy of women and limiting their health decisions. For example, curative and preventive health care may not be sought without the permission of the male spouse or, in his absence, the head of the compound (Binka et al, 1994).

The main religious faith is animism but Christianity is gradually becoming more prominent, especially among women (Debpur et al, 2000). Presently, about a third of the people are Christian, 5% are Muslim and the rest profess the traditional religion. However, the dominant animist faith guides daily life, economic decisions, health beliefs and practices. This reliance on traditional medicine hampers the utilization of health services.

Lack of communication systems, road network and electricity within the district also impacts adversely on the health of the population. Subsistence agriculture is the mainstay of the district's economy, complemented to some extent by retail trading. About 90% of the people are farmers. The major

agricultural products are groundnuts, millet, guinea corn, rice, sorghum, sweet potatoes, beans and tomatoes. Rearing of cattle, goats, sheep, pigs, fowls and guinea fowls also form part of the agricultural activities. Unfortunately, the rainfall pattern limits food cultivation to a single growing season and even though the Tono irrigation dam and a few dugout wells supply water for dry season farming, the major crop grown during this time is tomato. Weather conditions in the district can be very severe, resulting in either occasional floods or droughts and, therefore, poor harvests. This situation has culminated in the net annual out-migration of the population for some time now. Nutritional problems are thus common, aggravating the mortality impact of infectious disease morbidity. Poverty and economic isolation complicate efforts to improve health conditions in the district (Binka et al, 1999).

The district has 77 primary schools, 35 junior secondary schools, 5 senior secondary schools, 1 training college and 2 vocational institutions. The district also accommodates the third faculty of the University for Development Studies, which focuses on intergrated science. There is also an orphanage managed by the Catholic mission.

About 89% of the houses in the district are mud huts with thatched roofs. The rest, which are built with cement blocks, are mostly found in the urban area. Almost two-thirds (65%) of the roofs are constructed with straw. Zinc sheets are used for the remaining 35%. The main sources of water supply in the Kassena-Nankana district are streams, wells and boreholes. In a few urban houses, however, pipelines have been installed to provide treated water. Similarly, only 7% of the compounds have access to properly constructed toilet facilities, suggesting that as high as 93% of the houses use the bushes in their immediate surroundings. For those compounds with toilet facilities, two-thirds use either Kumasi Ventilated Improved Pit Latrines (KVIPs), pan or pit latrines, while the rest use water closets.

The district has a hospital, four health centres and four clinics located in selected communities. These static health delivery points are complemented by community-based service delivery in all but the eastern part of the district, which serves as an experimental control cell. As part of the Ghana Ministry of Heath policy, free health services are available to all under fives and those aged 70 years and above. The district's immunization coverage for children aged 12-23 months in 1999 was 80% for BCG, 72% for Polio3, 70% for DPT3, and 63% for measles. The major causes of morbidity in the district are malaria, gastro-enteritis and acute respiratory infections. There is also a high prevalence of cerebro-spinal meningitis, with the peak season occurring between March and April. Although improved delivery of family planning services is one of the objectives of the Navrongo Community Health and Family Planning project (CHFP), only 10% of married women in the district utilize the service.

2. NAVRONGO DSS PROCEDURES

2.1 Introduction to the Navrongo DSS Site

The NDSS is a longitudinal household registration system, which was set up in July 1993 by the Navrongo Health Research Centre (NHRC) to support research into the determinants of morbidity, mortality and fertility in an area typically representing Ghana's rural savannah zone. The NDSS routinely updates vital events (births, deaths, migration, marriages and pregnancies) in all the approximately 14,200 compounds within the study area. Where a death has occurred, the compound is revisited to obtain information on the circumstances leading to the death. These verbal postmortems are

conducted using different schedules for children and adults. In addition to the vital events, there is an annual monitoring of educational attainment and vaccination coverage within the population.

The DSS started with a baseline census of the rural district in 1993, followed by compound visits at 90-day cycles to monitor demographic events. The baseline survey included a socio-economic module, which lists compound possessions as well as the materials used in constructing the building. In the last quarter of 1995, DSS activities were extended to include Navrongo town, the only urban area in the district. To qualify as a compound member, a person should have been resident in the compound for at least three months, except for a newborn baby whose mother is already a compound member. The initial DSS covered approximately 125,000 people but with the addition of the urban area, the population has increased to over 140,000. Detailed information on fertility and child health is obtained through the annual panel survey of a sample of DSS compounds. The Household Registration System (HRS) is the computing software used for processing and analyzing the NDSS database. The initial DOS version of the software (HRS1) has been upgraded to HRS2, which operates in Windows. The HRS system allows for data entry, editing, validation, and calculation of age-sex specific demographic rates and life tables.

The field and data processing operations of the NDSS is managed by a team consisting of a Demographer, two Research Assistants, two Principal Field Supervisors, a Data Manager and a Data Assistant. The team co-ordinates the activities of the 26 fieldworkers and 12 field supervisors who are responsible for field data collection as well as the two filing clerks and three data entry clerks who receive and process the field instruments. The fieldworkers are expected to visit and interview all compounds within their work area. The 12 field supervisors, on the other hand, are responsible for conducting verbal autopsies, carrying out quality checks, resolving queries and pairing migrants. Training, planning, supervision and co-ordination of field activities is undertaken by the 2 principal supervisors, 2 research assistants and the demographer.

The NDSS field data collection and processing is mainly supported by funds from the Rockefeller Foundation, with technical assistance from the Population Council. Data from the NDSS are used to compile reports designed to inform the Ghana Ministry of Health, which is the major consumer of the Navrongo DSS data. Lessons learned from the Navrongo CHFP project through the DSS and the Panel surveys have, for example, activated a process of extending the new health delivery approach, implemented in this district, countrywide. Other institutions that have also benefited from the NDSS database are the universities, and other educational and research institutions.

2.2 Navrongo DSS Data Collection and Processing

The Navrongo DSS evolved from an earlier study of the Kassena-Nanakana district in 1989 by the Department of Community Health of the University of Science and Technology and the London School of Hygiene and Tropical Medicine, with support from the Ghana Ministry of Health and the British Development Administration. This study, popularly called the Ghana Vitamin A Supplementation Trial (VAST), included continuous demographic and health surveys of resident members of the study compounds as part of its activities with the aim of helping to evaluate the effect of vitamin A supplementation to under fives. When the VAST project came to an end in 1992, the NHRC was established to shed more light on the health problems in northern Ghana and to help find practical solutions to them. The NHRC thus utilized and built on existing VAST resources. In 1993, the DSS was re-organized with respect to its coverage and content and formally set up as the NDSS to serve as a basis for assessing the mortality effects of impregnated bednets. The bednet study was concurrent with

the factorial experiment on the fertility and mortality impact of the NHRC's Community Health and Family Planning project, which has been in operation to date.

2.2.1 Field Procedures

a) Initial Census

For DSS purposes, the Kassena-Nankana district is divided into 5 zones. These are further sub-divided into 21 sub-zones and 244 clusters. On average, nine contiguous clusters are assigned to each of the 26 fieldworkers to enhance fieldwork and to reduce costs. Each field worker is expected to visit and update demographic information on 15 compounds every day. The main data collection instruments used for the routine recording and updating of vital events are compound registration books (CRBs) and event forms. The CRBs are field registers, which contain basic demographic information on all compounds in one cluster. Where a cluster has more than 99 compounds, an additional CRB is used. An event form is also filled out for each recorded event. Apart from the event updates, the first quarter of each year is devoted to updating information on education while the last quarter of the year is used to collect data on children's vaccination status.

b) Regular update rounds

All vital demographic events occurring within the district are updated through regular visits to each compound every 90 days. Thus, during these compound visits, new events such as births, deaths, marriages, in- and out-migration and obvious pregnancies are registered. Pregnancies recorded earlier are also monitored during these quarterly visits until they are terminated. This is to help improve on birth and death reporting, by capturing neonatal deaths in particular. For every vital event that is recorded, detailed information is collected using the appropriate event registration form. Information on the vaccination status of children aged two years, as well as the educational attainment of those aged 7 years and above, are updated once every year.

c) Continuous surveys

Vital demographic events including in- and out-migration, marriages, pregnancies, births and deaths are continuously monitored through quarterly updates. Verbal autopsies on deaths that occur to all those who are registered into the NDSS are also conducted to obtain information on the circumstances leading to the death. Trained field supervisors visit each of the compounds where a death has been reported and administer the appropriate verbal autopsy questionnaire to the closest relative of the deceased. Three medical doctors code these questionnaires independently to determine the probable cause of death. Where at least two of the doctors agree on one diagnosis, it is accepted as the cause of death. When there are disagreements, the case is coded as undetermined and is set aside for further discussions.

In addition to the routine collection of data by fieldworkers, the NDSS has recruited a number of voluntary community key informants (CKIs) to record all pregnancies, births, and child deaths that occur in their localities during the interval between interviewer visits to compounds. Presently, there are 170 CKIs working within the district. Two field supervisors are assigned to visit the CKIs in their homes every two weeks to collect the information they have gathered over the period. These data supplement what the regular NDSS fieldworkers collect during their regular visits to the compounds every 90 days.

d) Field supervision and quality control

For each round of data collection, quality assurance is achieved through re-interviewing a 3% random sample of compounds by a quality control supervisor. Other field checks include the re-interviewing of some of the compounds already completed by the fieldworker, random spot checks to review samples of compound registration books and event forms for inconsistencies and omissions, and observation of field interviews. Procedures employed at the office level include the assessment of the work progress of field staff at weekly meetings and a week's re-training of interviewers at the end of each round of data collection.

The NDSS also has a mechanism for pairing internal migrants to avoid double counting and to minimize loss to follow up. This process of pairing migrants is aided by issuing out identity cards to all compound members. The identity cards are meant to improve on the reporting of event dates and to facilitate the linking of migrants to their previous records. In order to avoid familiarity with the respondents and to forestall any attempts at data manipulation, the field staff do not work in the same clusters for more than two consecutive rounds. Improvement in event capture is also achieved through the voluntary activities of Community Key Informants who record births, deaths and pregnancies occurring in their communities during the interval between interviewer visits for a token fee.

2.2.2 Data Management

Every fortnight, each field worker submits all completed CRBs and event forms to the filing clerks. These are then carefully documented and sent to the data entry clerks for updating the database using the HRS data entry system.

A data manager, a data assistant and three data entry clerks carry out the data processing operations of the NDSS. Each of these personnel has a different level of access to operate the database. A successful entry into the system allows for data to be added, edited or deleted. Other forms of data manipulation such as validation and report generation can also be carried out depending on the level of access. Until July 2000, the DOS-based HRS1 software was used to process and analyze the NDSS data. Presently, data processing is done using HRS2, an upgrade of HRS1. This software operates in Windows (using Visual Fox Pro) and has a number of improved features including its flexibility in specifying constraints on the legal values for a data entry field, database triggers that help to make the appropriate changes in other related tables to maintain consistency, and the use of one ID specification for referencing all data entry forms, thus making data management easier (Ngom et al, 1999).

The functional components of the HRS2 software consist of data entry, validation, reports and output, visit register, and utilities. While the data entry option permits the entry, deleting and editing of both baseline compound information and longitudinal data, the validation procedure allows for logical consistency checks on subsets of compounds and their members. The reports and output option is used to generate key demographic rates, population distribution and life tables. The visit register procedure is used to print the compound registration books (CRBs), which are used for recording information during field visits. Finally, the utilities function is used by the data manager to add new user IDs, set interview round information, and generate reconciliation reports to help follow up unreported pregnancy outcomes and unmatched internal migrants, among others.

When CRBs and event forms are logged to the computer center at the weekly zonal meetings for fieldworkers, it takes one to two days to have them sorted and distributed to the data entry clerks. Data entry and validation takes approximately one week to complete.

The HRS system has in-built validation rules, which help to maintain consistency in the database. Computer operations are organized to correspond to the interviewing cycle so that information from compounds that fail the HRS logical checks are printed with the relevant error messages for field reconciliation. On the other hand, records that pass the logical tests are archived into the database. Thus, each round generates fully edited and cleaned data before a new cycle begins. The updated information is used to generate new compound registration books for the next round's compound visits while the old ones are archived by the filing clerks for future reference.

Analysis of the data is achieved using Fox Pro and Stata software. Most of the output from the NDSS is compiled as reports and circulated to the Ghana Ministry of Health, the sponsors and other interested bodies. Regular dissemination seminars are also organized for visitors to the Centre and for institutions making specific requests. Occasionally, *durbars* are organised to share the findings with the chiefs and subjects of the various paramoundancies within the district.

3. NAVRONGO DSS BASIC OUTPUTS

3.1 Demographic Indicators Generated by the Navrongo DSS Site

In 1999, the Kassena-Nankana district registered a population of 140,881. The population is quite young, with about 41% below 15 years (see Figure 1). The broad age distribution is as follows: 0-4 years - 13.1%, 5-9 years - 28.0%, 15-64 – 54.2% and 65+ - 4.7%, implying an age dependency ratio of 84%. Females constitute 53% of the population, giving a sex ratio of 89 males per 100 females. Educational attainment in the district is quite low. In general, about two-thirds (65.5%) of the population aged 15 years and above have received no formal education and only 8.2% have attained senior secondary or higher levels of education. The distribution by sex indicates that more females (74.6%) tend to be uneducated than males (54.4%). Similarly, current school attendance among the 6-25 age group is lower for girls (48%) than for boys (54%). Overall, about 55% of all the population aged 6 years and over have never been to school.

In the NDSS, the compound is the unit of observation and has an average of 10 members. Males dominate headship of these compounds, with females heading only 10.2%. In 1999, the population recorded a crude death rate of 14.1 per 1000 person years and a crude birth rate of 28.0 per 1000, suggesting a rate of natural increase of 1.39%. The total fertility rate for the same year was 4.1 per woman.

Mortality in the Kassena-Nankana district is very high. The infant mortality and under five mortality rates for 1999 are estimated at 90 per 1000 live births and 150 per 1000 children under five respectively. Expectation of life at birth in the district is 52.6 years. Generally, males in the district have a shorter life span (49.9 years) than females (54.8 years). For the period 1997/99, the crude death rate was 17.0 per 1000 person years for males and 14.0 per 1000 person years for females (see Table 1). The age pattern of mortality for each of the three-year periods is, as expected, curvilinear, with children and adults being the most vulnerable. At all ages, males generally have higher mortality rates than females but the differentials are much higher for ages 35 and over.

A trend assessment indicates that between 1994/96 and 1997/99, the age-standardized death rate declined from a level of 20.8 per 1000 to 19.6 per 1000 for males and 19.7 per 1000 to 16.5 per 1000 for females. Infant mortality rate for the period 1997/99 is estimated to be 106.1 per 1000 live births for males and 99.7 per 1000 live births for females, having fallen from a level of 124.5 per 1000 for male infants and 125.7 per 1000 for female infants within the period 1994/96. Although these figures are far above those recorded at the national level, the registered improvements in survival may have resulted from the participatory approach to health service delivery launched within the district by the Navrongo Health Research Center, as well as the various health interventions which have been put in place as part of the research activities of the Center. It is obvious that females recorded the highest mortality decline in the period under consideration.

Similarly, the fertility rate has declined from 4.7 births to 4.2 births per woman between 1994/96 and 1997/99 (Table 2). Migration figures for the district show that the population is highly mobile. For the period 1997/99, there was a net out-migration of 12.0 per 1000 person years. Migration is concentrated among young adults within the age group 15-29 years (see Tables 3 and 4).

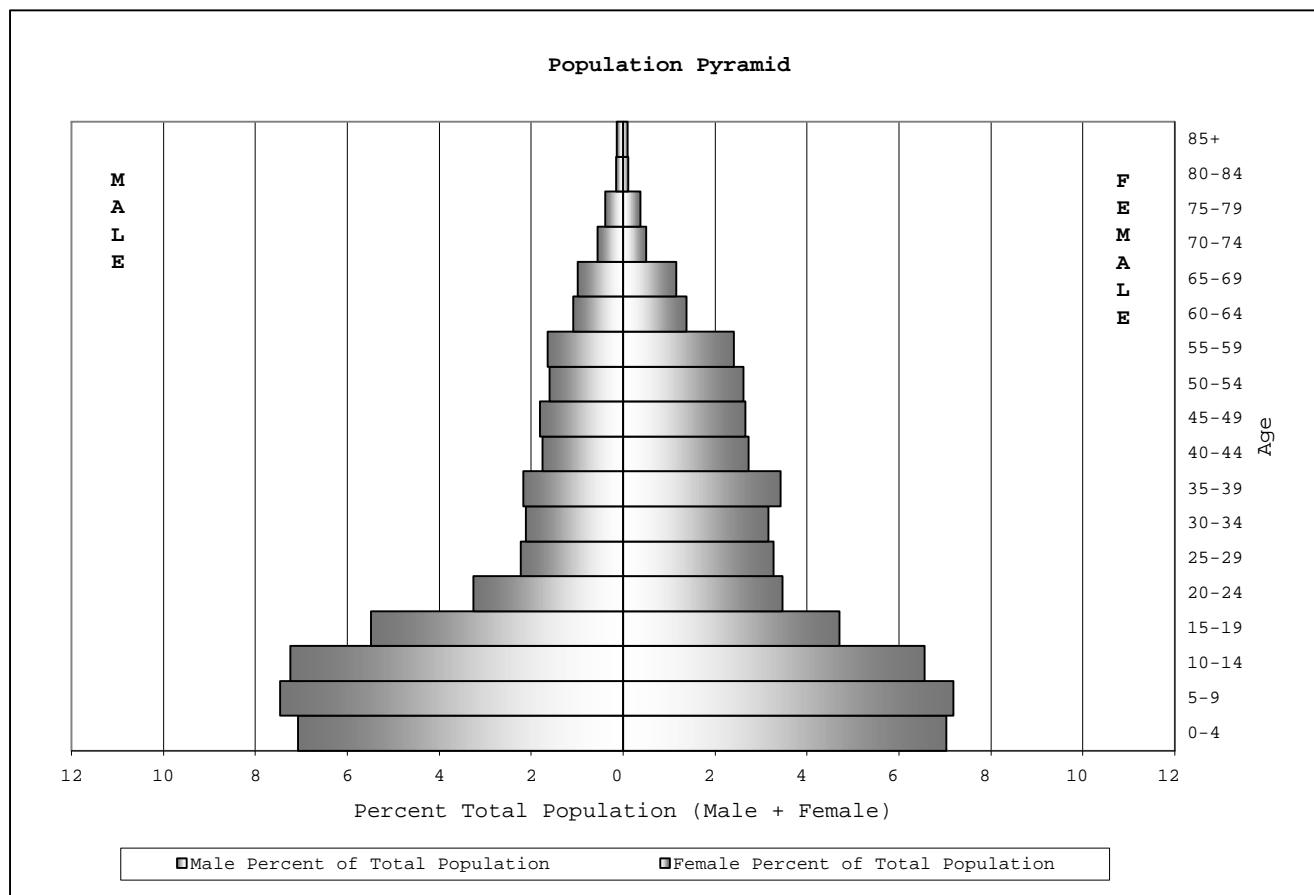


Figure 1. Population pyramid for person-years observed in the Navrongo DSS Site, 1995-1999.

Table 1. Age and sex specific mortality in the Navrongo DSS Site, 1995-1999

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TABLE 2: Age Specific Fertility Rates, Kassena-Nankana District, 1994-1999

Age Group	Age-specific fertility rates	
	1994-1996	1997-1999
15-19	80.2	68.3
20-24	210.4	176.8
25-29	212.9	191.5
30-34	194.3	174.3
35-39	142.5	125.9
40-44	76.1	68.1
45-49	27.6	26.5
TFR	4.7	4.2

TABLE 3: In-Migration Rates by Age, Kassena-Nankana District, 1994-1999

Age Group	In-Migration Rates by Age	
	1994-1996	1997-1999
0-4	80.7	89.9
5-9	66.8	75.3
10-14	67.9	75.8
15-19	128.9	139.9
20-24	176.9	187.1
25-29	146.3	156.9
30-34	86.2	110.3
35-39	60.3	70.3
40-44	43.7	55.9
45-49	31.4	40.4
50-54	25.3	26.8
55-59	18.5	20.2
60-64	17.3	21.3
65+	25.6	34.0
All	76.8	87.2

TABLE 4: Out Migration Rates by Age, Kassena-Nankana District, 1994-1999

Age Group	Out Migration Rates by Age	
	1994-1996	1997-1999
0-4	75.2	94.3
5-9	74.5	76.0
10-14	96.5	91.5
15-19	187.4	199.5
20-24	217.9	218.9
25-29	158.2	171.9
30-34	97.6	109.8
35-39	61.9	71.9
40-44	46.5	51.9
45-49	30.7	37.1
50-54	19.8	29.3
55-59	16.9	21.9
60-64	15.8	22.2
65+	20.9	27.5
All	90.1	99.2

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