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Research Material

Household structure in Ghana: Exploring dynamics over three decades

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Abstract

BACKGROUND
The nuclear convergence hypothesis proposes that development and urbanisation lead to increasing proportions of nuclear families. We explore this hypothesis in Ghana by charting household living arrangements as captured in censuses and surveys.

OBJECTIVE
To classify household structure in Ghana and track trends to test whether households converge towards nucleation during processes of development and urbanisation.

METHODS
We employ two methods of classification – manual and data-driven (latent class analysis) – to create household structures using Ghana's censuses (1984–2021) and Demographic and Health Surveys (1993–2022). We explore trends over time and compare urban and rural areas to track nuclear convergence while documenting the differences and similarities between data sources and methods of classification.

RESULTS
We find that though the manual and data-driven approaches produce similar results, the latter is vulnerable to possible misclassification. From the manual approach, we identify seven different typologies of household structure in Ghana and find that, on average, a substantial proportion are core nuclear (couple with children only), other extended (non-multigenerational), and single-member households. Overall, we find weak evidence for nuclear convergence. There has not been a significant shift in the average distribution of

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household types in Ghana, and in urban areas there is a growing proportion of multigenerational extended households, with region-based peculiarities. We also observe that the surveys provide more reliable evidence on trends than the censuses do.

CONTRIBUTION

There is no strong evidence to support nuclear convergence in Ghana. We make a methodological contribution, highlighting that the use of data-driven methods for household classification needs to be approached with caution.

1. Introduction

The study of families has been relevant in understanding the dynamics of demographic and health outcomes, including fertility, mortality, and maternal and child health (Madhavan et al. 2017; Odimegwu 2020; Weiss-Laxer et al. 2020), while facilitating the development and testing of established theories on family change. In Ghana, family living arrangements can be complex, but there is a paucity of the national-level longitudinal, linkable, and administrative data needed to examine the intricacies of family composition, relationships, and changes, as can be done in other contexts. Existing data sources such as censuses and surveys at best capture households rather than families. Thus to comprehend the changes occurring within Ghanaian families, the use of existing data sources necessitates adopting a perspective that teases out features of families from the household concept. This is what our paper seeks to achieve.

In Ghanaian censuses and surveys, a household is defined as "a person or group of persons living together in the same house or compound, sharing the same housekeeping arrangements, and being catered for as one unit" (Ghana Statistical Service 2021: 20; Ghana Statistical Service, Ghana Health Service, and ICF International 2015: 11). Members of the household may be related or unrelated, making a household distinctively different from a family, where members are bound by blood, marriage, or adoption in a defined social arrangement (van de Walle 2006). "Household" is a statistical and enumeration concept that was first adopted in Ghana in the 1984 census. Before this, in censuses soon after Ghana's independence (1960 and 1970), individuals were enumerated by housing units (houses or compounds) (Census Office 1973). The switch from housing units to households in 1984 might have been influenced by the desire to align with international standards and features of modern censuses as outlined in the United Nations Principles and Recommendations for National Population and Housing Censuses while allowing for comparisons with other contexts (Census Office 1982; Randall et al. 2015; United Nations 1958). Regarding housekeeping arrangements, shared catering is a key factor in dividing larger and more complex families into smaller units

(Ghana Statistical Service 2010, 2021). However, relying on shared catering arrangements to define households can lead to an overestimation of smaller families, rendering important family ties linked by production and reproduction invisible (Hanson 2004; Randall et al. 2015; van de Walle 2006). This limitation impacts the extent to which family living arrangements can be studied. Nonetheless, in the absence of other nationally representative data sources, we rely on the strengths of the censuses and surveys to study living arrangements in Ghana. Information on household members' relationships to the head allows computation of family households and non-family households. Family households comprise households in which members are related by blood, marriage, or adoption, while non-family households reflect the absence of related persons (Cuccaro-Alamin et al. 2021).

Our research explores change in household structures in Ghana, using census and survey data spanning three decades. First, we create typologies of household structure that are contextually relevant using information on members' relationships to the household head. Existing studies that use similar data sources document several forms of nuclear (couple with children, couple) and extended family households as well as non-family households (Cuccaro-Alamin et al. 2021; United Nations 2019; van de Walle 2006). The approach for classifying households is predominantly manual, involving different levels of data manipulation, and is informed by prior contextual assumptions about the population of interest (Cuccaro-Alamin et al. 2021; Hall and Mokomane 2018; Mutanda and Amoo 2020; United Nations 2019). However, in recent times, new data-driven approaches that rely on statistical processes and data patterns are gradually gaining ground in the study of household structure. They have been used to explore kinship foster among families in Illinois, living arrangement dynamics among older adults in Mexico, and household composition groupings in Malawi (Huffman, Regules-García, and Vargas Chanes 2019; McLean et al. 2024; Zinn 2010). Since the data-driven approach relies on data patterns, it has the potential to identify unique groups in the Ghanaian context that may not be apparent with the manual approach. Furthermore, little is known about the extent to which findings from the data-driven approach align with those from the manual approach. Our aim to create typologies of household structure from Ghana's existing data sources also includes a methodological contribution that compares the two approaches. The similarities and differences derived from this comparison are relevant for future research on household classifications, especially those that rely on African censuses and surveys.

Second, we describe changing patterns in household structure in Ghana and test the nuclear convergence hypothesis in this context. The nuclear convergence hypothesis predicts that as a society develops through industrialisation, urbanisation, and modernisation, families gradually become more nuclear (Cherlin 2012; Goode 1963). The origin of this hypothesis is found in Goode's *World Revolution and Family Patterns*

and aligns with functionalist perspectives that deem the nuclear conjugal family (man with spouse and children) as well suited for a developing society (Goode 1963; Murdock 1949; Parsons 1937). Goode (1963) proposed that the change in family structure is primarily driven by an expansion in the economic system through industrialisation, characterised by a market economy that allows workers to be hired and paid on the basis of merit (Cherlin 2012; Goode 1963). Individuals do not have to rely on property inheritance, a common practice that strengthened the influence and existence of extended family forms. Urbanisation further accelerates the process of convergence through mechanisms of migration (nuclear families are more mobile) and the associated demand for human capital. Over time, people become more independent, with little need for the functions of the extended family system (Cherlin 2012; Goode 1963; Pesando 2019). Other explanations relating to modernisation, increase in education, and democratisation have been made in support of the idea that nucleation inevitably accompanies economic development, reinforcing teleological notions of a directional change (Thornton 2001). Goode's hypothesis, however, has been heavily criticised and challenged, following empirical evidence from a variety of contexts (Cherlin 2012; Pesando 2019; Thornton 2001). Despite increasing global development, different contexts have varying levels of family change, and there is little evidence that all families will eventually become nuclear (Cherlin 2012; Esteve and Reher 2023; Pesando 2019; Thornton 2001).

There is growing interest from scholars to explore further the tenets of nuclear convergence, especially for countries where data might not have been adequately available when Goode proposed his hypothesis (Cherlin 2012; Pesando 2019; Pesando and GFC team 2019). Recent findings reveal several different patterns. On one hand, countries like Bangladesh, Egypt, and India have experienced an increase in nuclear households and a decline in extended ones (United Nations 2019), confirming the nuclear convergence hypothesis. On the other hand, household structure dynamics over time have varied considerably among other countries: The proportion of extended households in Pakistan, the Philippines, and Haiti has increased; both nuclear and extended households have declined in Botswana and Kenya; and in Ethiopia and Malawi the proportions of different household types have remained unchanged. These examples highlight diversity in household structure, with little or no trend toward nucleation (Mutanda and Amoo 2020; United Nations 2019).

Rural–urban differences have also been used to understand the impact of urbanisation on household structure. Urban areas are considered a hub of better social and industrial infrastructure, transportation, and health services, and thus they facilitate rural-to-urban migration (Ravenstein's hypothesis from the 1800s). Following the nuclear convergence hypothesis, urban areas would be expected to demonstrate more rapid nucleation with time than would rural areas. Thus, even if nuclear convergence is not apparent at the national level, it might be traceable in urban areas. Mutanda and Amoo

(2020) report mixed findings about rural–urban trends in household structure (Mutanda and Amoo 2020). While Cameroon and Egypt had a decline in extended family residence and an increase in nuclear (specifically two-parent) families in urban areas, Mali and South Africa experienced the opposite. In several countries, the predominant household structure in rural areas was not extended families but was two-parent nuclear families, contrary to expectations. These findings demonstrate diversity within and across countries. Furthermore, urbanisation does not always result in the decline of extended households. In this paper, we provide evidence on where Ghana sits in this varied international picture.

Ghana's development has been evident through various markers. These include its transition from a low-income country to a lower middle-income one in 2010, rapid urbanisation – from 23% in 1960 to 57% in 2021 – and improvement in the human development index between 1990 (0.460) and 2022 (0.668) (Ghana Statistical Service 2014b; Moss and Majerowicz 2012; UNDP 2022, 2024). The country also operates a market economy, where forces of demand and supply direct the production of goods and services, with progressive levels of industrialisation. However, the changes have not entirely replaced the property inheritance culture in Ghana, which from Goode's perspective strengthens the influence of extended family systems (Cherlin 2012; Kutsoati and Morck 2012). The combined forces of development and sociocultural dynamics of property inheritance, family norms, and values in Ghana imply that patterns of household structure could be unpredictable.

Evidence on household structure trends in Ghana from multi-country studies has been inconclusive. Using two rounds of census data (2000 and 2010), Mutanda and Amoo (2020) report a decline in extended households and an increase in nuclear ones (two-parent, couple-only, and single-parent) in both rural and urban areas. They also report a higher proportion of extended households in urban areas than in rural areas (Mutanda and Amoo 2020). A study by the United Nations (2019) drew insights from Demographic and Health Surveys (DHSs) from 1993 to 2014 and concluded that there has not been a major shift in the proportion of nuclear and extended households over time. We infer the different conclusions to be partly driven by the type of data source used. Ghana-specific studies that describe national estimates on changing household structure are rare, and the available research captures living arrangements only for children below age 5 (Annim, Awusabo-Asare, and Amo-Adjei 2015). The inconclusiveness on the trends in household structure in Ghana so far necessitates our current research based on multiple data sources.

Contributing to evidence on global family change, our study provides an updated and extensive descriptive analysis of household structure in Ghana across three decades. We explore two major nationally representative data sources to identify patterns over time and space and to examine the evidence for nucleation. We further make a

methodological contribution to the household literature by comparing the relative advantages of two classification approaches.

2. Data: Censuses and surveys

We extract information on household membership from two nationally representative data sources in Ghana – the Ghana Population and Housing Census (GPHC) and the Ghana Demographic and Health Survey (GDHS). We prioritise these two data sources because they capture about three decades' worth of household information needed to examine long-term national trends in household structure. Each data source adopts distinct enumeration procedures. Ghana's censuses adopt a de facto approach, enumerating people as members of households where they are located, regardless of their usual place of residence. Only usual residents (those who spent the prior six months in the household) and guests present in the household during the census night (before the day of the interview) are enumerated (Ghana Statistical Service 2021; Statistical Service 1999). Usual residents who are absent during the census night are not enumerated as part of that particular household in the household questionnaire (Statistical Service 1999). The approach is used to avoid double counting but risks omitting usual members of the household. In the Demographic and Health Surveys, however, all usual members of the household, irrespective of whether they are present or absent the night before the interview, and any guests who stayed in the household the night before the interview are captured in the household questionnaire (Ghana Statistical Service, Ghana Health Service, and ICF International 2015; Ghana Statistical Service and ICF International 2024). The surveys therefore capture both de jure (all usual residents) and de facto (enumerated where they are located, including guests) populations, likely risking double counting but useful in identifying eligible respondents (women aged 15–49 and men aged 15–59) for further interviews. The differences in enumeration procedures between the censuses and surveys potentially impact the observation of changing household structure and nucleation. We compare the two data sources for similarities and differences. Our comparison also allows us to assess the generalisability of the household structure typologies derived and the robustness of our results.

Six post-independence censuses have been conducted in Ghana since 1960, the most recent in 2021. We use data from the last four rounds of the censuses – 1984, 2000, 2010, and 2021 – which are publicly available. For each of these census rounds, a 10% sample is available for use. The sample covers 269,071, 370,590, 557,828, and 842,122 households in the 1984, 2000, 2010, and 2021 GPHCs, respectively. For this paper, we exclude floating populations (those who slept in outdoor places, such as bus terminals, border posts, corridors, and streets) and those in group quarters (institutions such as

boarding schools, university halls, and hotels), since technically they are not considered households (Ghana Statistical Service 2021). All together, they constitute 3.4% (n = 9,156), 0.2% (n = 640), 2.0% (n = 11,341), and 0.7% (n = 5,607) in the four respective censuses. The final sample for the study comprises 259,915, 369,950, 546,487, and 836,515 households for the 1984, 2000, 2010, and 2021 censuses, respectively.

The Ghana Demographic and Health Surveys are cross-sectional and nationally representative exercises conducted to collect up-to-date demographic and health information on a sample of the Ghanaian population. We rely on all six rounds of the surveys – 1993, 1998, 2003, 2008, 2014, and 2022 – to explore household structures and their trends in Ghana. The surveys follow a two-stage stratified sampling process, first selecting clusters and subsequently selecting households from clusters. The numbers of sampled households were 5,822, 6,003, 6,251, 11,778, 11,835, and 17,933 in the 1993, 1998, 2003, 2008, 2014, and 2022 GDHSs, respectively. In all surveys, less than 1.5% non-usual residents were living in households. (See Table A-1 in the appendix.) This shows that the population captured in GDHSs is mainly de jure. Non-usual residents were not excluded from the sample given their extremely small proportion.

Household structure typologies are computed using information on household members' relationships to the household head. The household head is defined as a person who is recognised and acknowledged as such by other members of the household (Ghana Statistical Service 2021). He or she has the primary responsibility for making major decisions about the household's living arrangements but may not necessarily be the oldest or the main income earner of the household (Ghana Statistical Service 2021). Tables A-2 and A-3 show the various relationships specified in the two data sources and their recodes. Members relate to the household head as spouses, children, sons- and daughters-in-law, parents and parents-in-law, grandchildren, other relatives, and non-relatives. Additional information on other family ties is particularly limited beyond those specified for the household head and only for selected individuals who meet a certain age requirement – for instance, parental coresidence and survivorship for children below age 18 in the surveys. As a result, such other family ties are not considered in the classification of household structures. Household structures are created from the perspective of the household head.

3. Analytical strategy

We explore two methods that are commonly used for creating typologies of household structures in family demography – manual and data-driven. The manual approach is the most conventional and relies on data manipulation processes to create mutually exclusive categories of household structure, based on assumptions about family structure in the context and using information on household membership. It involves creating new variables and/or categories based on information available from existing variables in a dataset. For household structure, this process includes selecting, filtering, combining, or excluding some characteristics of the household population to create subgroups. For the data-driven approach, statistical or machine learning methods are used to detect subgroups based on patterns in the data. Researchers can then label these subgroups based on their contextual understanding of the population. The data-driven method can help researchers identify unique groups that may not be apparent through the manual code and possibly avoid biases imposed by prior assumptions about the population. The manual and data-driven methods follow deductive and inductive processes, respectively. We compare both methods to assess the strengths and weaknesses of each to inform better classification of living arrangements in future studies.

First, we manually construct household structure by adapting IPUMS International's classification of households, as used elsewhere (Mutanda and Amoo 2020). Nuclear households comprising combinations of head, spouses, and children are first identified and classified. This is followed by capturing the presence of extended relatives and non-relatives.

Second, we rely on latent class analysis (LCA) as a data-driven approach to construct household structures as used in studies from other contexts (Chng et al. 2016; Lee et al. 2020; McLean et al. 2024). This method uses patterns of responses in the data sample to detect latent subgroups to which households can belong (Weller, Bowen, and Faubert 2020). For each latent item (relationship to household head), the probability of belonging to a latent household is estimated and used in differentiating groups. We compute a total of nine LCA models for the GPHCs and GDHSs, starting with a minimum of two classes and ending with a maximum of 11 classes. Several model fit statistics, in addition to interpretability of latent classes, guide the choice of the best model. Model statistics include the Bayesian Information Criterion (BIC), Akaike Information Criterion (AIC), entropy, log likelihood, the G^2 statistic for model fit, and the boot p-value for the G^2 statistic. The lower the AIC and BIC, the better the model. A boot p-value for G^2 greater than 0.05 shows the model is adequate.

We also conduct a multi-group analysis with year of survey as a group variable to confirm whether the underlying latent constructs are the same across years. This is relevant in adjusting for year-specific differences. Information on the model statistics of

all models and the class probabilities of the final model can be found in the appendix (Tables A-4 to A-16). Labels for latent classes are determined using the probability of membership in a class. The differences between the manually and latent class–constructed typologies of household structure are illustrated with Sankey diagrams.

To explore trends in household structure over time, we choose the classification approach that results in more consistent groupings across years. For the GDHSs, survey weights are applied. We examine the nuclear convergence hypothesis by inspecting changes over time, including differences between rural and urban areas. The analysis is performed in R v4.3.2 (R Core Team 2021), and the codes are available for replication.

4. Results

4.1 Composition of members in households

Overall, approximately six out of ten households are headed by men (Table 1). In about 40% of households, household heads reside with their spouses. Few households had multiple coresident wives (polygynous unions). The declining estimates for polygynous unions captured in the censuses and surveys do not provide a holistic picture of all forms of polygynous living arrangements since they do not include partners that live separately. Therefore the findings should be interpreted with caution. In about 60% of households, heads reside with their children, and less than 4% live with their sons- or daughters-in-law. Less than 6% of household heads coreside with their parents and/or parents-in-law. While this proportion decreases over time in the censuses, it increases in the surveys. There are coresident grandchildren in more than 10% of all households. The proportion of households including other relatives of the household head decreases over the three decades. Households with non-relatives are few, with no substantial changes over time in either the censuses or surveys.

Table 1: Sex of household head and the percentage of households with members related and unrelated to the household head, based on data from Ghana Population and Housing Censuses (1984–2021) and Demographic and Health Surveys (1993–2022)

	GPHC				GDHS					
	1984 %	2000 %	2010 %	2021 %	1993 %	1998 %	2003 %	2008 %	2014 %	2022 %
Sex of household head										
Male	68.6	65.6	65.3	64.6	62.9	63.4	66.2	66.3	66.2	63.4
Female	31.4	34.4	34.7	35.4	37.1	36.6	33.8	33.7	33.8	36.6
Relationship to household head										
Spouse	44.1	44.7	46.2	41.4	41.7	40.7	46.9	46.5	45.7	42.2
More than one wife (polygyny)	5.3	2.8	-	1.5	3.5	1.9	3.3	2.1	1.9	1.8
Child (son/daughter; adopted/foster; step)	65.7	64.4	65.3	55.8	62.7	60.2	65.1	62.7	59.3	61.0
Son/daughter-in-law	3.2	3.5	2.3	1.9	0.8	0.7	0.9	1.0	0.5	1.4
Parent/parent-in-law	4.6	3.7	4.0	3.4	2.3	2.6	4.5	5.0	4.0	5.3
Other relative	26.0	46.3	26.0	15.1	14.1	12.8	17.6	15.8	12.8	13.4
Grandchild	17.6	14.5	14.6	11.3	11.6	14.0	15.6	12.7	12.1	14.5
Not related	3.3	9.3	5.1	3.3	3.3	2.2	3.1	2.3	2.6	2.3
Total number of households	259,915	369,950	546,487	836,515	5,822	6,003	6,251	11,778	11,835	17,933

Note: For the surveys, percentages are weighted.

4.2 Household structure typologies in Ghana: Manual versus data-driven

We use the manual approach to classify households into seven major typologies (Table 2). Three revolve around the nucleus of the household head and comprise core nuclear, semi-nuclear, and couple-only households. We use "core" and "semi" as keywords to distinguish between households with children where heads have either a coresident spouse (core) or do not (semi). The absence of a coresident spouse implies two possibilities. Either the head of house is currently not married and therefore does not have a spouse or the head is married but is not living with the spouse, perhaps due to long-term migration or separate marital living arrangements. Therefore, rather than using the term "single parent" or "lone parent" to generally describe an adult living with a biological or adopted child, as found in other studies (Chavda and Nisarga 2023), we use "semi-nuclear," which provides a more appropriate picture to capture the nuances for this context. Two typologies show extended living arrangements and mainly capture multigenerational and other extended family households (Table 2); the rest comprise single-member and non-related households. An advantage of the manual approach is that it allows for consistent typologies to be created across data points of the censuses and surveys, ensuring comparability.

Table 2: Conventional (manual) typologies of household structure and their compositions using data on members' relationship to the household head

Typology	Composition
Core nuclear	Head, spouse(s), and child(ren) only
Semi-nuclear	Head and child(ren) only
Couple only	Head and spouse only
Multigenerational extended	More than two generations in household including the head, child(ren), parents/in-law, and/or grandchildren
Other extended	All other complex households that are not multigenerational, including those with non-related individuals
Single member	Head only
Non-related	Head and non-related individuals only

With latent class analysis, we rely on data patterns to construct typologies of household structures. We show the results for the surveys and provide additional discussions for the censuses in the appendix (Tables A-9 to A-15). We observe that different statistics point to different models as the best fit (Table 3), an inherent disadvantage with this data-driven method. Our decision on the best model is guided by the BIC, since some scholars believe it performs better than other statistics with large data samples (Weller, Bowen, and Faubert 2020). The five-class model is chosen as the best model because it has the lowest BIC (Table 3). Even though the bootstrapped p-value indicates that it is not the most appropriate model ($p < 0.001$), we find the classes to be a better representation than models where the p-values are greater than 0.05 (models with 8, 9, 10, and 11 classes).

We also conduct a multi-group analysis using year of survey as a group variable and test for measurement invariance. This is to confirm whether latent constructs that determine typologies of household structure are the same across all survey years. To do this, two additional models are run – (1) constrained multi-group LCA and (2) unconstrained multi-group LCA – and a chi-square test is performed to determine differences. In the constrained multi-group model, the year-specific variances are fixed, while for the unconstrained model, they are allowed to vary. The results in Table 4 show that measurement invariance was not met ($p < 0.001$), indicating inherent differences in latent constructs of household structure across years. For this reason, we use year-specific item-response probabilities to determine labels of household structure typologies for each year (see Table A-8). The magnitude of the item-response probability is a determining factor for labelling a class, with higher probabilities informing inclusion. We present the results for the 1998 and 2022 surveys as examples in Table 5.

Table 3: Nine latent class models with their associated model statistics to determine absolute model fit for the Demographic and Health Surveys

Class	Log likelihood	AIC	BIC	Entropy	G^2	Boot p-value
2	–145960.0	291950.0	292084.9	0.78	4419.73	0.000
3	–144688.2	289422.4	289629.3	0.88	1876.14	0.000
4	–144011.4	288084.7	288363.6	0.80	522.45	0.000
5	–143862.3	287802.7	288153.5	0.72	224.39	0.000
6	–143822.4	287738.8	288161.6	0.70	144.55	0.000
7	–143806.4	287722.9	288217.6	0.72	112.58	0.02
8	–143785.6	287697.3	288264.0	0.73	70.99	0.16
9	–143777.9	287697.8	288336.5	0.75	55.49	0.60
10	–143772.6	287703.1	288413.8	0.73	44.87	0.90
11	–143762.9	287699.8	288482.4	0.72	25.52	1.00

Table 4: Test for measurement invariance on basic, constrained multi-group, and unconstrained multi-group five-class models

Five-class models	AIC	BIC	Entropy	Deviance	Chi-square p-value
Basic model	287802.7	288192.5	0.72		-
Constrained multi-group model	287342.0	287872.8	0.72	500.65	0.000
Unconstrained multi-group model	287014.5	289119.5	0.71	677.53	0.000

From Table 5, we observe some similarities and differences in the item-response probabilities and use them for labelling respective classes. There is no defined rule of thumb that specifies a threshold for item-response probabilities when labelling classes. The labels, as described in Table 6, are based on researchers' understanding of the nature of the probabilities within and between classes and on the context, population, and dataset. Class 3 and Class 1 of the 1998 and 2022 GDHSs, respectively, have a high probability of having a coresident spouse and children of the head of house and therefore are labelled as nuclear (Table 5). Class 1 of the 1998 survey was distinct only for this survey and was not observable in the other surveys, showing a 1.000 probability of a coresident son- or daughter-in-law and a high proportion of coresident grandchildren as well. We distinguish two multigenerational households based on the highest probability for a coresident parent or parent-in-law in the household (the highest within-item-response probability). Multigenerational I shows the absence of a parent or parent-in-law of the household head, and Multigenerational II captures their presence. The composite extended household category (2022 survey) highlights a high probability of a coresident "other relative" of the household head, though this is not apparent in the 1998 survey. The last latent category (Class 5), labelled as "head-centred," shows low item-response probabilities for all relationships except those with the head of house. Similar

observations are made for the censuses (Table A-15). We notice that since not all classes are identified in all survey rounds (for example, "other" in 1998), it is inherently challenging to use latent-derived household structures to investigate trends.

Table 5: Survey year-specific item-response probabilities and labels for a multi-group five-class model for the 1998 and 2022 GDHS

Class	Head	Spouse	Child(ren)	Son/ daughter -in-law	Parent/ in-law	Grandchild	Other relative	Non- relative	Label	Model class prevalence (%)
1998 GDHS										
1	**1.0000**	0.6000	1.000	1.0000	0.0000	0.9357	0.0371	0.0000	Other (head, spouse, child, grandchild, son/daughter-in-law)	0.7
2	**1.0000**	0.1927	0.5665	0.0062	0.0206	0.9978	0.1521	0.0000	Multigenerational I (head, child, grandchild)	10.2
3	**1.0000**	1.0000	0.9822	0.0032	0.0274	0.0638	0.0992	0.0269	Nuclear (head, spouse, child)	33.4
4	**1.0000**	0.3010	0.5279	0.0140	0.2602	0.0653	0.7761	0.0883	Multigenerational II (head, child, parent/in-law, other relative)	5.2
5	**1.0000**	0.1359	0.3910	0.0008	0.0142	0.000	0.0703	0.0134	Head-centred	50.5
2022 GDHS										
1	**1.0000**	0.7455	1.0000	0.0025	0.0054	0.0003	0.0460	0.0157	Nuclear (head, spouse, child)	33.5
2	**1.0000**	0.1345	0.1766	0.0000	0.2198	0.0899	0.5831	0.0376	Composite extended (head, parent-in-law, other relative)	9.4
3	**1.0000**	0.4668	0.7992	0.1478	0.0381	0.9354	0.1528	0.0233	Multigenerational I (head, spouse, child, grandchild)	12.6
4	**1.0000**	0.6553	1.0000	0.0077	0.2517	0.0000	0.3926	0.0286	Multigenerational II (head, spouse, child, parent/in-law, other relative)	14.1
5	**1.0000**	0.1754	0.1487	0.0007	0.0000	0.0813	0.0000	0.0207	Head-centred	30.3

Note: Each household has a head of house. In the original modelling, this variable was not included in the analysis. It is shown here for reference.

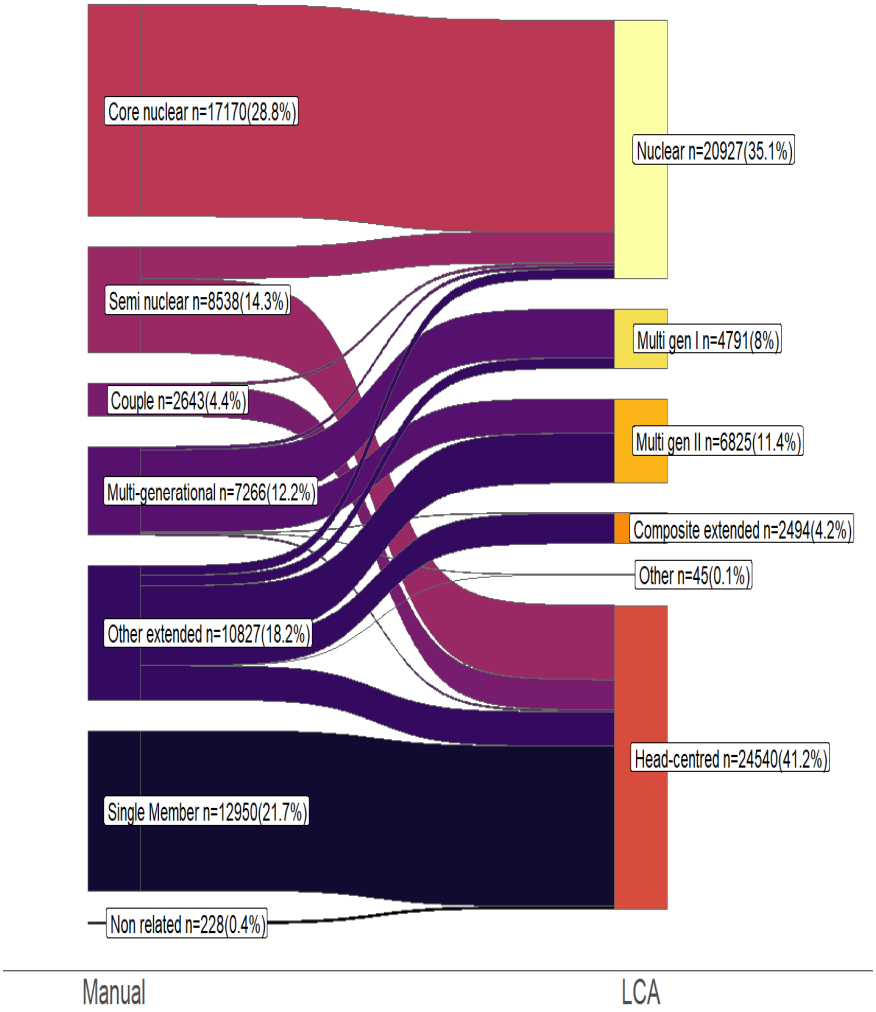
Table 6: Latent typologies of household structure and compositions based on the highest probability of membership

Latent household structure	Composition
Nuclear	Head, spouse, children
Multigenerational I	Head, with or without spouse, child(ren), grandchild; no parent/in-law
Multigenerational II	Head, with or without spouse, child(ren), parent/in-law; no grandchild
Composite extended	Head, other relative; small likelihood of parent/in-law or grandchild present
Head-centred	Head and little presence of other relationships
Other	Head, child, son/daughter-in-law, grandchild

We compare typologies from the manual approach to that of the latent class (data-driven) approach using a Sankey diagram (Figure 1) and data from all survey rounds. There exist some similarities and differences in classifications from the two approaches. The "core nuclear" households as defined by the manual coding are fully captured as part of the nuclear category of the LCA. The latter, however, also comprises a substantial proportion of semi-nuclear and a handful of extended households from the manual approach. The LCA's two multigenerational categories and composite extended household link appropriately to the manual's extended household typologies. The LCA's head-centred category captures the manual approach's single-member household and some proportions of semi-nuclear, couple, other extended, and non-related households. From the Sankey illustration, we notice that the LCA is vulnerable to possible misclassifications, perhaps due to its reliance on item-response probabilities.

The LCA identifies useful categories but has inherent limitations that make subsequent descriptive analysis of trends and rural–urban differences challenging. Since the LCA-driven categories were similar to the manually coded typologies, nothing is missed by using the manual approach. We conclude that the manual approach to classification is preferable to the LCA approach for exploring trends over time in this paper. Therefore all subsequent descriptive analyses on trends and rural–urban differences are examined using typologies derived from the manual approach to classification.

Figure 1: Sankey diagram showing the differences between household structure typologies derived from manual coding and those derived from latent class analysis using pooled data from the Ghana Demographic and Health Surveys



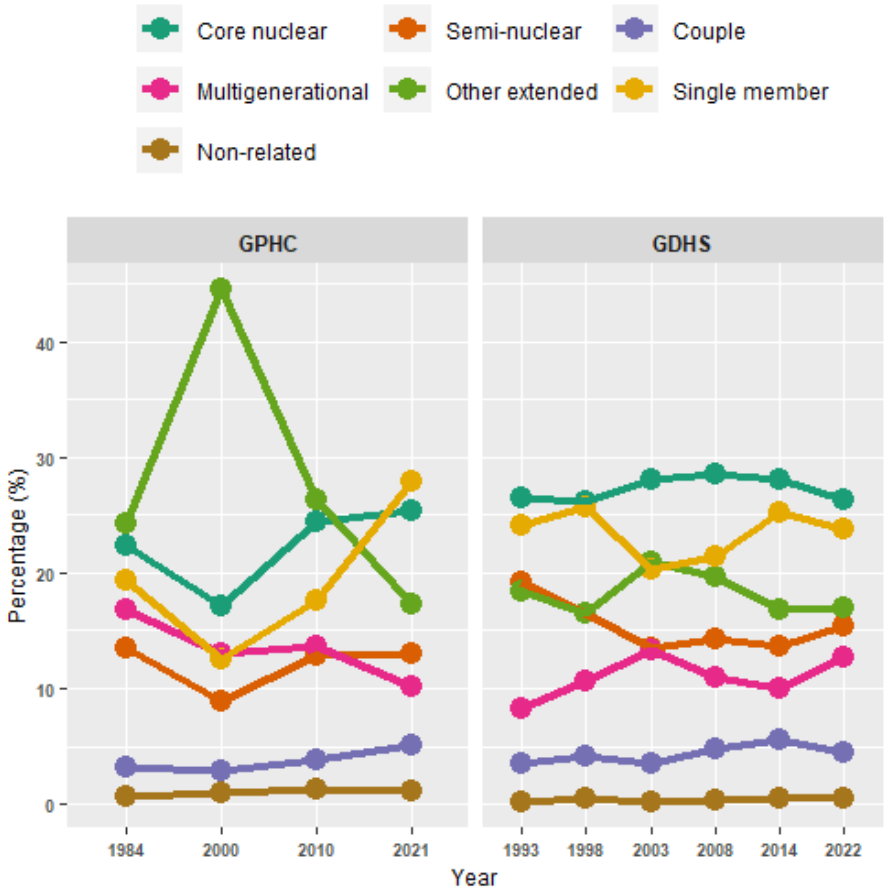
4.3 Household structure: Trends over time and rural–urban differences

Figure 2 illustrates the percentage distribution of household structure typologies from the censuses and surveys. In general, about a quarter of households are core nuclear (head, spouse, children). The censuses indicate a very small increase in core nuclear households between 1984 (22.4%) and 2021 (25.4%), while the surveys suggest no shift between 1993 (26.5%) and 2022 (26.2%). Both data sources illustrate a declining trend in semi-nuclear (head and children) households and a marginal increase in couple-only (head and spouse) households. Multigenerational households comprised 8.2% of all households in 1993, increasing to 12.6% in 2022, according to the surveys. The censuses, however, demonstrate a decline from 16.8% to 10.1%.

Other extended households (complex but not multigenerational) made up a considerable proportion of all households but declined after peaking in the early 2000s. The peak observed also corresponds with trends in the proportion of other relatives of the household head, as shown in Table 1, about 80% of whom were captured as part of other extended households (see Table A-17). Particularly for the censuses, additional investigation into the age distribution of other relatives revealed that there were more children below age 10 and more older adults in 2000 compared to the other census rounds (Figures A-1 and A-2). Single-member households comprise, on average, a quarter of all households. While the surveys report no substantial change over time in the proportion of single-member households (24.0% in 1993 and 23.8% in 2022), the censuses reveal an increase between 1984 (19.4%) and 2021 (28.0%). Non-related households, though few, have increased slightly over the last three decades. In both data sources, the predominant households are core nuclear, other extended, and single member.

To examine nuclear convergence in the Ghanaian context, we observe trends over time and rural–urban differences because it is hypothesised that urbanisation is associated with nucleation. We observe that generally, the evidence from the censuses and surveys does not lean strongly towards nuclear convergence. In the censuses, for instance, the decline observed for extended households is not necessarily accompanied by a substantial increase in nuclear households (core nuclear). Though there has been a rise in single-member households, the phenomenon falls outside Goode's hypothesis. The surveys also show no substantial shifts in core nuclear, couple, other extended, single-member, and non-related households. Semi-nuclear households declined, and multigenerational households increased in proportion.

Figure 2: Trends in household structure based on the Ghana Population and Housing Census (1984–2021) and the Demographic and Health Surveys (1993–2022)

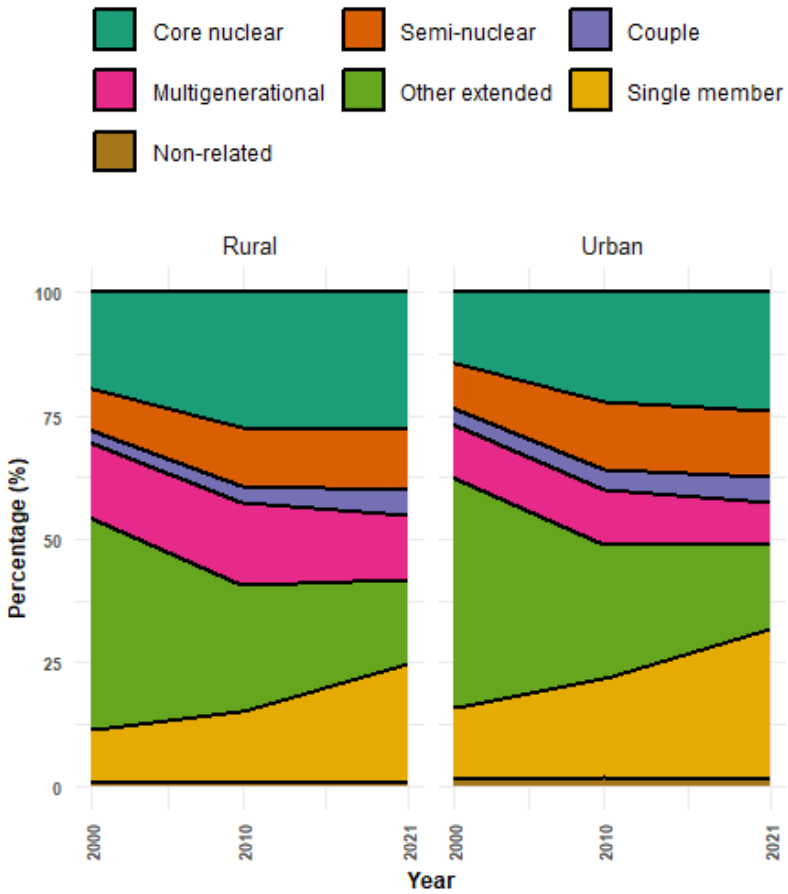


Note: See Table A-16 for additional information.

Trends over time segregated by place of residence show mixed patterns (Figures 3 and 4). Evidence from the census indicates that except in 2000, the most predominant household in rural areas has been core nuclear (head, spouse, children), with comparatively higher proportions than those in urban areas (Table 7). This pattern was also observed in the surveys, further showing no substantial shifts in the trends of core

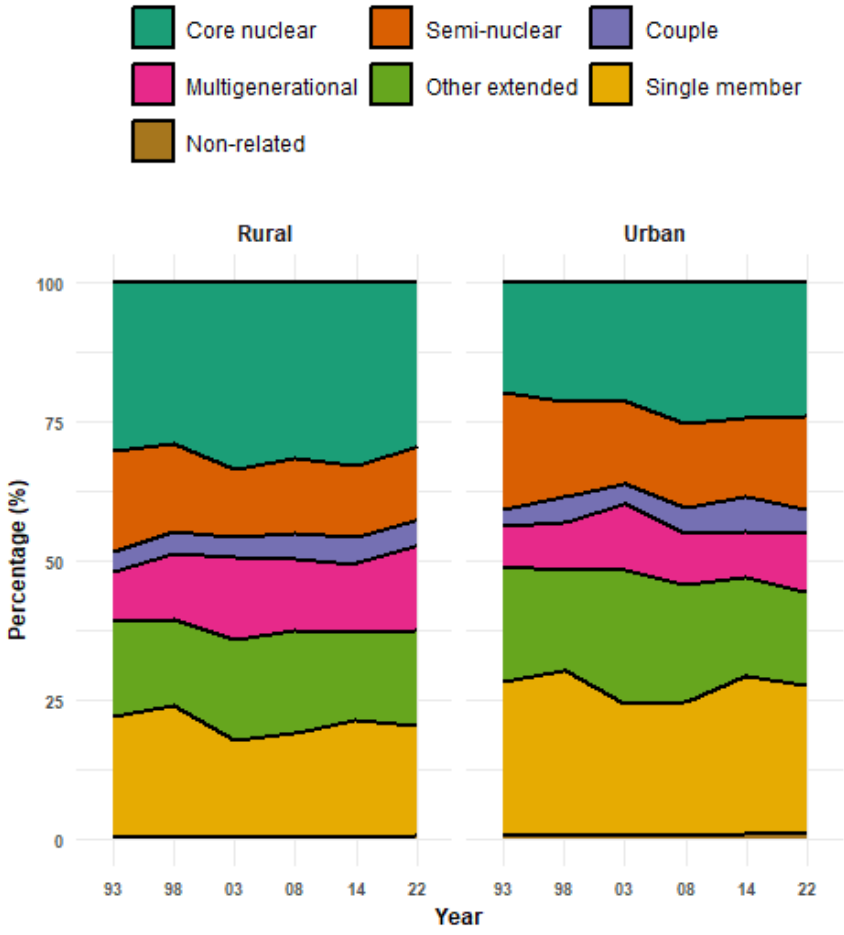
nuclear households in rural areas. Nonetheless, in urban areas the proportion of core nuclear households increases, but only marginally (Table 7, Figure 4). Semi-nuclear households are relatively more common in urban areas than in rural areas, having declined over time (Figures 3 and 4).

Figure 3: Trends in household structure by place of residence in the Ghana Population and Housing Census (2000–2021)



Note: There was no information on place of residence (rural or urban) in the available data from the 1984 census, and it was therefore not captured in the trends.

Figure 4: Trends in household structure by place of residence in the Ghana Demographic and Health Surveys (1993–2022)



Both data sources confirm that there is an increase in couple-only households in both rural and urban areas, but for multigenerational households, the censuses and surveys report different patterns. In both rural and urban areas, the censuses demonstrate a decline in multigenerational households, while the surveys show an increase. For other extended households, both data sources confirm a decrease in rural and urban areas. We also observe that the most predominant household type in urban areas is the single-member

household, with an estimated 9% increase in proportion between 2010 and 2021 (Figure 3). As shown in Figure 4, evidence from the surveys affirms the predominance of single-member households in urban areas. The trends have remained stable over time, and the same is true for rural areas.

Table 7: Trends in household structure by place of residence in the Ghana Population and Housing Census (2000–2021) and the Demographic and Health Surveys (1993–2022)

	GPHC			GDHS					
Household structure						Rural			
	2000 %	**2010 %**	**2021 %**	**1993 %**	**1998 %**	**2003 %**	**2008 %**	**2014 %**	**2022 %**
Core nuclear	19.4	27.2	27.5	30.2	28.8	33.7	31.5	32.9	29.4
Semi-nuclear	8.7	12.2	12.6	18.2	16.1	12.2	13.6	13.0	13.4
Couple only	2.6	3.3	4.9	3.7	3.9	3.6	4.7	4.6	4.4
Multigenerational extended	15.0	16.6	13.0	8.8	11.8	14.7	12.7	12.5	15.4
Other extended	42.7	25.7	17.3	17.2	15.6	18.3	18.4	15.6	17.2
Single member	10.8	14.3	23.9	21.9	23.4	17.4	18.9	21.1	19.8
Non-related	0.8	0.7	0.8	0.1	0.5	0.1	0.2	0.3	0.4
Total number of households	**195382**	**241560**	**328977**	**3733**	**4022**	**3734**	**6603**	**5896**	**9138**
						Urban			
Core nuclear	14.5	22.2	23.9	19.8	21.2	21.3	25.3	24.0	23.9
Semi-nuclear	9.2	13.5	13.3	20.9	17.4	15.0	15.1	14.2	16.9
Couple only	3.2	4.2	5.3	3.2	4.4	3.5	4.8	6.4	4.4
Multigenerational extended	10.7	11.3	8.2	7.3	8.6	11.8	9.1	8.1	10.6
Other extended	46.4	26.8	17.3	20.5	18.1	24.1	21.0	17.8	16.7
Single member	14.6	20.2	30.6	27.8	29.6	23.8	24.0	28.6	26.8
Non-related	1.3	1.9	1.4	0.4	0.6	0.4	0.6	0.8	0.7
Total number of households	**174568**	**304927**	**507538**	**2089**	**1981**	**2517**	**5175**	**5939**	**8795**

Note: There was no information on place of residence (rural or urban) in the available data from the 1984 census, and it was therefore not captured in the trends.

Ghana's urbanisation is not geographically uniform. Most regions in the coastal (Greater Accra, Central, Western, Volta) and middle (e.g., Ashanti, Brong Ahafo, Eastern) belts of the country are predominantly urban, with higher population density than the northern (Northern, Upper East, and Upper West) belt, where regions are mostly rural, sparsely populated, and burdened by negative net migration (see Table A-18). We therefore explore the distribution of household structure by place of residence across the various regional belts to ascertain conclusions on nuclear convergence.

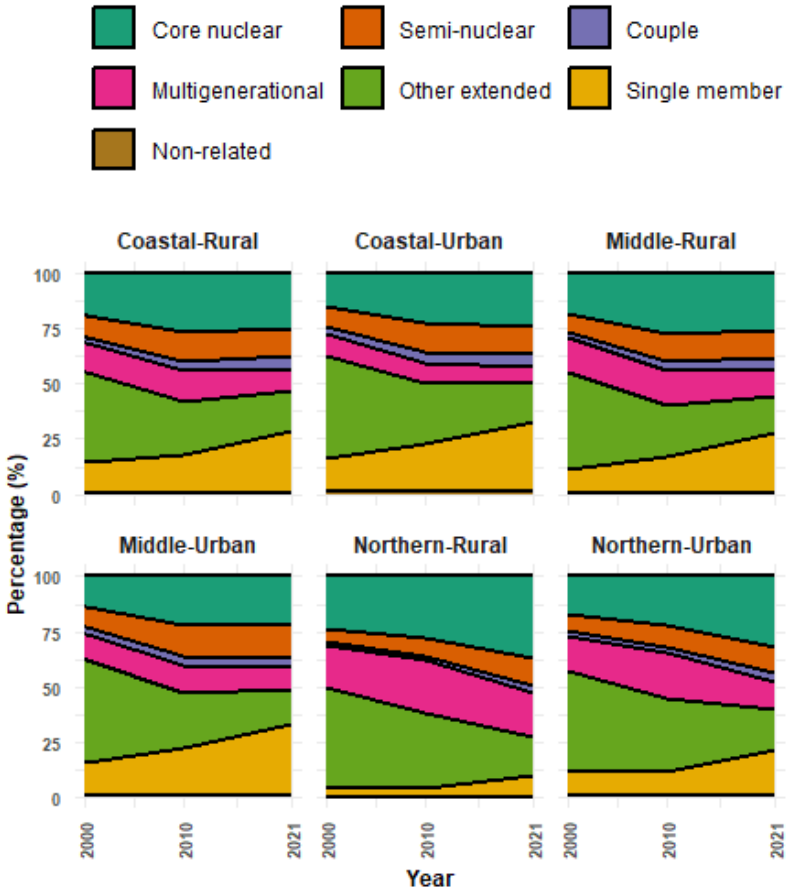
Our findings highlight regional variations in household structures (Figure 5 and 6). In the urban areas of the coastal belt, core nuclear households increased, while semi-nuclear and other extended households declined (Figure 6). Multigenerational households

remained stable despite fluctuations in some survey years (Figure 6). Single-member household trends reveal no major shifts in the surveys but showed long-term growth in censuses (Figures 5 and 6). A closer look into the Greater Accra region (the most urbanised region) shows a trend toward core nuclear and single-member households and a decline in other extended households (not multigenerational), especially in rural areas. For multigenerational households, substantial declines occur in rural areas of the Greater Accra region, but trends are stable in urban areas (see Table A-18 and Figure A-3).

Evidence from the surveys further demonstrates that the middle belt saw little change in core nuclear and single-member households but that multigenerational and other extended households increased in urban areas (Figure 6). Findings from the censuses show no major shifts in core nuclear households between 2010 and 2021 for this regional belt (Figure 5). The decline in extended households for this belt in the censuses was accompanied by a rise in single-member households (Figure 5). Particularly for the Ashanti region (the second most urban region in the country), further analysis from the surveys demonstrates that urban settings are characterised by stable core nuclear households, declining single-member households, and a rise in extended households (see Table A-18 and Figure A-3).

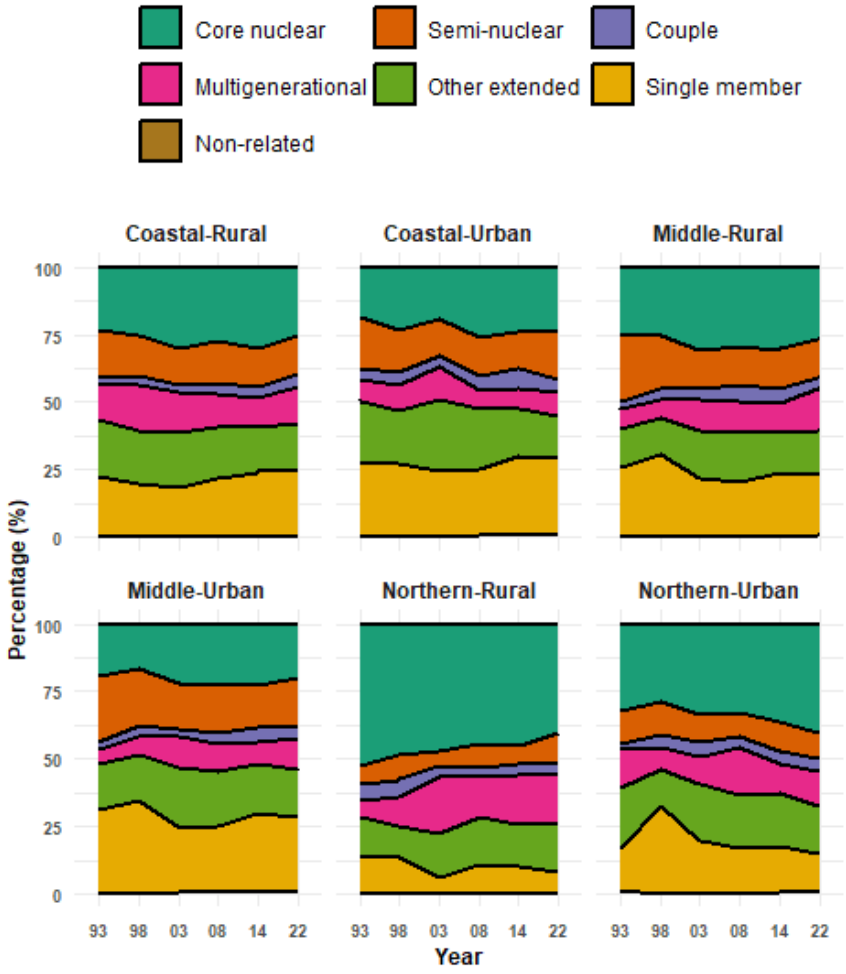
The predominant household in both rural and urban areas of the northern belt is core nuclear (Figure 5 and Figure 6). The proportion increased in urban areas and decreased in rural areas. This is accompanied by a downward shift in single-member households, in contrast to the trend in the coastal belt (Figure 6). Multigenerational extended households increased in both rural and urban areas for the northern belt, but the proportion of other extended households declined only in urban areas. For the Upper East region – the country's least urbanised region – the predominant core nuclear households are declining over time, accompanied by increasing extended households.

Figure 5: Trends in household structure by place of residence and regional zones in the Ghana Population and Housing Censuses (2000–2021)



Notes: The coastal belt captures the Greater Accra, Western, Central, and Volta regions. (For the 2021 census, we included the Oti region and Western North in this belt to ensure consistency across censuses.) The middle belt captures the Ashanti, Eastern, and Brong Ahafo regions (the Bono, Bono East and Ahafo regions in the 2021 census). The northern belt captures the Northern (Northern, Savannah, and North East in the 2021 census), Upper East, and Upper West regions. There was no information on place of residence (rural or urban) in the available data from the 1984 census, and it was therefore not captured in the trends. See Table A-19 for more information.

Figure 6: Trends in household structure by place of residence and regional zones in the Ghana Demographic and Health Surveys (1993–2022)



Notes: The coastal belt captures the Greater Accra, Western, Central, and Volta regions. (For the 2022 survey, we included Oti and Western North in this belt to ensure consistency across surveys.) The middle belt captures Ashanti, Eastern, and Brong Ahafo (Bono, Bono East, and Ahafo in the 2022 survey). The northern belt captures the Northern (Northern, Savannah, and North East in the 2022 survey), Upper East, and Upper West regions. See Table A-19 for more information.

5. Discussion

Our research explores dynamics in Ghanaian household structure over three decades using data from national censuses and Demographic and Health Surveys. First, we created typologies of household structure using information on household members' relationships to the household head and compared two methods of classification – manual and data-driven. We also examined trends in household structure, exploring whether households are becoming nucleated.

We make a methodological contribution by comparing two approaches to classifying household structure, given that such attempts are usually rare. The manual and data-driven (LCA) approaches have notable similarities and differences. Both are able to produce categories for nuclear and extended family households and rely on researchers' understanding of the context to assign labels. Particularly for extended family households, both methods identify similar categories – multigenerational and other extended (composite for the LCA) – confirming that these households indeed reflect Ghana's living arrangement not only via what we understand about the context but also based on how data patterns are structured in nationally representative data sources. The LCA, however, was not able to detect different forms of nuclear households as defined in the manual approach and also missed out on non-related households. Though by using the data-driven approach we aimed to identify possible unique categories that might have been missed with the manual approach, no additional unique group was identified.

With LCA, model statistics did not always agree on the best model, coupled with inconsistencies in groups across data points. It may be that the information we fed into the LCA models from the censuses and DHSs was insufficiently detailed to create new and unique groups beyond those defined by manual approaches. In contexts where data are available from longitudinal health and demographic surveillance systems (HDSS), the LCA approach could be more powerful, as it can make full use of the available complex information on biological and social relations in documenting living arrangements (McLean et al. 2024). Additionally, the manual approach may not necessarily be optimal when more sociodemographic variables, such as age, marital status, and socioeconomic status, are included, since combinations become more complex. For instance, in Huffman's study on the living arrangements of older people in Mexico, the LCA models were run on a set of nine household-level sociodemographic markers that captured age, education, and occupation (Huffman, Regules-García, and Vargas Chanes 2019). Using the manual approach would have been extremely complicated.

The comparison of the two approaches also draws out a potential weakness with the LCA as a data-driven method: misclassification. Hardly discussed in existing studies, misclassification is potentially a product of the modelling process, resulting from

estimated probabilities, marginal errors, or residuals. It is important that such limitations are acknowledged in research where this method is applied, and we recommend additional methodological research to help increase the precision of the LCA method. Interested in exploring trends over time to establish nucleation with consistent categories of household structure, we prefer the manual approach over the latent class approach for this paper. This does not necessarily mean that the LCA is an entirely worse approach. It can be advantageous for other research purposes, especially those that aim to identify whether unique categories of household living arrangements emanate at certain periods in history.

In Ghana, the predominant household types are core nuclear (head, spouse, children), other extended (non-multigenerational), and single-member households. Over the last three decades, there have been variations in these household structures, with the censuses and surveys reporting peculiar patterns. Census data reveal a substantial increase in single-member households alongside a decline in multigenerational and other extended households. However, the surveys show stable trends for all except multigenerational households, whose proportions increased. These differences result from distinctions in the enumeration approach or possibly from errors and classification inconsistencies. Regarding the enumeration approach, Ghana's census is strictly de facto, and usual residents who were absent during the census night are not recorded in the household questionnaire, potentially affecting estimates of household types (Ghana Statistical Service 2021). This observation aligns with a critique of the de facto approach: that it obscures the time dimension of households since it does not entirely portray the long-term structure of households (van de Walle 2006). The censuses therefore have an inherent bias for national estimates of household structure and its trends.

Ghanaian households are partly ethno-culturally rooted. Among some ethnic groups, such as the Gomoas (a Fante-speaking group in the Central region), coastal Fantes, and Gas, married women may not always live with their spouses (Awusabo-Asare 1988; Mensah and Fitzgibbon 2013). Where women live with their children separately from their husbands, living arrangements similar to semi-nuclear households could be common. Matrilocal and patrilocal residential patterns, characteristic of respective matrilineal and patrilineal lineages, also translate into varied forms of extended households (including multigenerational), where individuals live with maternal or affinal relatives, respectively. In some ethnic contexts, there exist women's and men's houses or compounds (Awusabo-Asare 1988; Mensah and Fitzgibbon 2013), showing unique forms of household membership segregated by sex, including those where members can belong to more than one household. Though such distinctions were not explored in this paper, we acknowledge that extended forms of living arrangements can be more complex than what we identified in this study and that multigenerational and other extended household classifications are broad categories.

We observe a peak for other extended households in the early 2000s. Most extreme in the censuses, the peak correlates during this period with an increase in coresident other relatives (Table 1), a majority of whom resided in other extended households. The specific socioeconomic and cultural factors underlying this peak remain uncertain. It is possible that the economic and political atmosphere during the period, coupled with migration trends, may have contributed to the prevalence of extended living arrangements. These arrangements could have served as a coping mechanism, promoting resource sharing and offering protection for vulnerable relatives, such as children and older adults. As shown in the trends (Figure 2), the proportions of single-member and nuclear households were at their lowest during this period. Alternatively, it is possible that there were classification differences or enumeration errors in the 2000 census, driving the extreme peak in other extended households.

We examine nuclear convergence using trends over time and consider rural–urban differences. We rely on findings from the Demographic and Health Surveys, since they capture information on all usual members of a household and provide a stable picture of household living arrangements compared to the censuses' de facto approach. Except for semi-nuclear (head, spouse) and multigenerational households, other family and non-family households have remained fairly stable for the last three decades. The proportion of semi-nuclear households declined, and multigenerational households increased. The general patterns differ from Goode's propositions on nuclear convergence, where with development, nuclear households are expected to increase while extended households decline (Cherlin 2012; Goode 1963). Therefore there is not enough evidence to support nuclear convergence in this context. The stable trends for other extended households and the increase in multigenerational households demonstrate the relevance of the extended family system in the Ghanaian context as one preferable form of living arrangement. This is also evident in other African contexts, such as South Africa and Cameroon (Mutanda and Amoo 2020), where extended family members provide support in varied forms (socially, economically, and emotionally).

We explore the potential impact of urbanisation via differences in rural–urban trends to unearth important dynamics that infer nuclear convergence. In urban areas, there is an increase in core nuclear (head, spouse, children) households and a decline in other extended (non-multigenerational) households, confirming patterns of nuclear convergence. However, evidence from the surveys indicates that until 2022, the proportion of other extended households was higher in urban areas compared to rural areas. Additionally, there are substantial proportions of core nuclear households in rural areas, higher than those found in urban areas. The evidence on nuclear convergence in urban areas is further complicated by the increasing trend in multigenerational households. This could potentially be an outcome of migration or perhaps the increasing demand for urban employment requiring child care support from grandparents.

Furthermore, even though other extended households are on the decline in urban areas, they still make up about one-fifth of all households. The phenomenon can be explained by rural–urban migration dynamics. First, urban areas are mostly at the receiving end of migration streams (Ghana Statistical Service 2014a), and having social networks (relatives) in destination areas is an essential enabling factor, especially for migrants seeking greener pastures (Zaami 2020). Having a strong and reliable social network, mostly kin, is advantageous for absorbing economic shocks. Kin also provide protection and serve as information resources in urban areas (Turolla and Hoffmann 2023; Zaami 2020). As migrants settle into already established families of related kin, the shape of household structure changes and become more extended. Having additional members in families at destination areas also increases household size, with implications for available resources. The peculiar trends for the various households in rural and urban areas suggest that the underlying factors of changing family dynamics are complex. Goode's nuclear convergence hypothesis and functionalist propositions miss out on such complexities in urban living arrangements, which for the Ghanaian context drives diversity in the patterns of household structure.

We acknowledge that some rural-to-urban migrants reside in non-familial living households. They are captured either as single-member households for those who live alone or as non-related households for those who live with non-relatives (friends, acquaintances, or strangers), a situation that is prominent in major urban destinations such as Accra and Kumasi, where slum and squatter living is common (Yeboah 2003). This corroborates our study's findings, showing a higher proportion of single-member households in the urban echelons of the coastal belt. Further research is needed to unravel how much of the changing household structure is attributable to migration, including immigration from neighbouring countries. With the exception of refugees camped at specific sites in Ghana (Buduburam and Agyeikrom in the Central region, Krisan in the Western region, and Fetentaa in the Bono region), immigrants from other countries have always integrated into the general population. So it is difficult to identify the effects of "migrant households" on living arrangements given the currently available data. At the moment, we can only speculate on the possible influence of migration on household structure.

The findings for the regional zones show mixed patterns. While some evidence for nucleation in the coastal belt and urban areas of the northern belt is observed, this is accompanied by stable multigenerational households in the former and increasing proportions in the latter, following patterns observed for urban areas discussed above. The middle belt, on the other hand, shows no substantial shift in core nuclear households but has had an increase in extended households in urban areas. Furthermore, the predominance of core nuclear households in the northern belt deviates from the development–nucleation tenets, given that the belt is mostly rural in nature.

We acknowledge the limitations on how urbanisation is measured in Ghana. For the censuses and surveys, urban areas are defined by a population of more than 5,000, and definitions do not take into consideration the presence of economic and social infrastructure and amenities as used in other contexts (Ghana Statistical Service 2014b). The distinction between rural and urban areas solely on population markers (a 5,000-person cutoff) could influence the overall picture on household trends. For instance, as populations in rural areas grow over time, those that meet the criteria are recategorised as urban areas while they carry with them their usual household structure characteristics. In a published report on urbanisation by the Ghana Statistical Service, the limitations of the urbanisation concept were acknowledged (Ghana Statistical Service 2014b), though little effort has been dedicated to adjusting the boundaries of this definition in recent data collection efforts. Improvements in the conceptualisation of urbanisation are needed to adequately understand its relationship with other demographic and health outcomes, including household compositions.

The use of households in family research has inherent limitations for how much we can learn about changes in family structure in Ghana, especially when dwelling units in Ghana's urban and rural areas are distinctively different in nature. As an enumeration concept, the reliance on catering arrangements to define households could be identifying more nuclear households in rural areas than there actually are, since communal living in compound houses is common and members could be bound by criteria beyond shared catering. Our findings also extend to other African contexts where the household concept captures a part of family living arrangements (van de Walle 2006). Some historical works on household size and composition share our observations on these limitations (Bender 1967; Burch 1979; Hammel and Laslett 1974; Yanagisako 1979). The household concept has been defined in various ways throughout history, bordering on one or more key elements – propinquity/common residence, economic cooperation, and socialisation of children – and resulting in different interpretations across cultures and contexts (Bender 1967). Not only does it not entirely capture families, but the variations in definitions underpin different tenets for classifying household structure, with nuclear and extended categories having different meanings over time and space (Bender 1967; Hammel and Laslett 1974; Yanagisako 1979).

Our classification of households in Ghana relies on how members relate to the household head and highlights the major generic households that can be found in this context. The trends show changes in the proportion of household structure over time and do not entirely depict compositional changes informed by economic, geographical, social, and religious influences. Our analysis makes us acknowledge how complex the tasks of collecting and analysing data on household and family structure are. The data sources don't always give a perfect picture of the fluidity of household structure and its changes over time, partly due to differences in data collection but also because

households are inherently challenging concepts. More enriched, longitudinal, and context-driven approaches to data collection are necessary to broaden the scope of family research in Ghana to inform theories and policies.

6. Ethical consideration

Ethical approval for this research is sought from the London School of Hygiene and Tropical Medicine's Research Ethics Committee (LSHTM ethics reference 27955). We also followed appropriate registration and data request procedures from the Ghana Statistical Service, IPUMS International, and the DHS program to access census and survey data, adhering to user agreement terms in not redistributing data downloaded from institutional websites. Three rounds of the census (2000–2021) were obtained from the Ghana Statistical Service website, www.statsghana.gov.gh. The 1984 census was retrieved from IPUMS International, https://international.ipums.org. The surveys were downloaded from the DHS database website, https://dhsprogram.com/data/available-datasets.cfm. All data are freely accessible from their respective websites upon request.

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Appendix

We provide additional information that informed our sample size, variable recode, and descriptive statistics for the manually coded and data-driven household structure typologies.

A.1 Extended data and methods

A.1.1 Maintaining non-usual residents in the surveys

Table A-1 shows the proportion of non-usual residents in households in the GDHS. They are at most below 1.5%. For this reason, they were not excluded from the surveys and are considered majorly de jure.

Table A-1: Proportion of household members who are usual residents in the 1993, 1998, 2003, 2008, 2014, and 2022 GDHSs

	Usual residence	
	No	Yes
	% (n)	% (n)
1993 GDHS	1.1 (239)	98.9 (21900)
1998 GDHS	1.0 (219	99.0 (22433)
2003 GDHS	1.1 (287)	98.9 (26307)
2008 GDHS	1.0 (468)	99.0 (46529)
2014 GDHS	1.4 (631)	98.6 (43944)
2022 GDHS	1.1 (797)	98.9 (68887)

A.1.2 Variable recoding

To allow for comparison across groups, we recoded some of the variables in the rounds of the censuses and surveys. As shown in Table A-2, we combine members who related to the household head as child, adopted child, foster child, or stepchild into one "child" category. Table A-3 provides additional information on the percentage of household members who related as such to the household head. The proportions are relatively small for adopted, foster, and stepchildren, and in some data sources, the differences were not captured. For the other relationship variables, the recodes are indicated in Table A-2.

Table A-2: Relationships to household head in the censuses and surveys

	Relations originally available in datasets										Recoding relationships	New categories
	GPHC				GDHS							
	1984	2000	2010	2021	1993	1998	2003	2008	2014	2022		
Head	***	***	***	***	***	***	***	***	***	***	Head = head + temporary head	Head
Temporary head		***										
Spouse/partner	***	***	***	***	***	***	***	***	***	***		Spouse
Co-spouse						*** (n–1)	*** (n = 5)				Recoded as other relative	Other relative
Child or son/daughter	***	***	***	***	***	***	***	***	***	***	Child = son/daughter + adopted/foster child + stepchild	Child
Stepchild			***	***						***		
Adopted/foster			***		***	***	***	***	***	***		
Adopted				***								
Foster				***								
Grandchild	***	***	***	***	***	***	***	***	***	***	Grandchild = grandchild + great-grandchild	Grandchild
Great-grandchild				***								
Parent/in-law		***	***								Parent/in-law = parent + parent-in-law	Parent/in-law
Parent	***			***	***	***	***	***	***	***		
Parent-in-law	***			***	***	***	***	***	***	***		
Son/daughter-in-law	***	***	***		***	***	***	***	***	***	Son/daughter-in-law = son-in-law + daughter-in-law	Son/daughter-in-law
Son-in-law				***								
Daughter-in-law				***								
Brother/sister	***	***	***	***	***	***	***	***	***	***	Other relative = brother/sister + aunt/uncle + nephew/niece + cousin + other relative	Other relative
Aunt/uncle	***											
Nephew/niece	***							***		***		
Cousin	***											
Other relative	***	***	***	***	***	***	***	***	***	***		
Group quarters	***		***	***							Non-relative = house help + non-relative + other relative or non-relative. The last group, found in the 1984 census, was added because it was unclear what this category emphasised; it could be a relative or a non-relative. Moreover, the sample was very small.	Non-relative
House help				***								
Floating				***								
Non-relative	***	***	***	***	***	***	***	***	***	***		
Other relative or non-relative	***											

*** Information available in data source.
Note: Group quarters and floating were excluded from the dataset.

Table A-3: Percentage distribution of household members who are son/daughter, adopted, foster, or stepchildren to the household head by data source and year

	GPHC				GDHS					
	1984	2000	2010	2021	1993	1998	2003	2008	2014	2022
Child	43.6	37.4								
Son/daughter			41.4	40.7	46.6	44.9	44.4	43.7	43.3	42.7
Adopted/foster child	-	-	0.4		0.1	1.0	1.0	1.0	1.2	1.2
Adopted	-	-		0.1						
Foster	-	-		0.3						
Step	-	-	0.8	0.5	-	-				

A.2 Extended results

A.2.1 LCA results for GDHS

A.2.1.1 Checking for the best model

There is no defined rule of thumb that specifies a threshold for item-response probabilities. The labels are based on the researchers' understanding of the nature of the probabilities within and between classes and on the context, population, and dataset. The five-class model identifies a nuclear household, two multigenerational families, a composite extended household, and a head-centred household. The predominant households are nuclear and head-centred, based on the model class prevalence. Generally, some latent items (household memberships) such as parent (or parent-in-law) and son- or daughter-in-law are a handful in the dataset itself. As a result, they tend to have very small item-response probability estimates. To recognise these relations for household labels, their presence is highlighted for classes where their probabilities are comparatively highest. For instance, for classes that have the highest parent/parent-in-law probability estimates, we give the presence of this kin a priority in the labelling, as shown in the distinctions for multigenerational households (Tables A-4 to A-7).

In the six-class model (Table A-5), nuclear and head-centred households remained as the most common households, but an additional multigenerational household was identified (class 6). This household is similar to class 1; the only difference lies in the probability of having a spouse, which tends to be lower for class 6 than for class 1. The difference isn't substantial, and the additional class does not make a five-class model less preferrable. Similar observations were made for the seven-class (Table A-6) and eight-class (Table A-7) models. There are more subcategories of the multigenerational and other extended categories, but the nuclear and head-centred households remain the same.

The addition of more classes does not yield any substantial benefit. Therefore the five-class model is adequate and captures relevant latent household typologies in the surveys.

Table A-4: Item-response probabilities, labels, and model class prevalence for five-class model for the surveys

Class	Head	Spouse	Child(ren)	Son/ daughter -in-law	Parent/ in-law	Grandchild	Other relative	Non-relative	Label	Model class prevalence (%)
1	1.0000	0.4852	0.7972	0.1119	0.0295	0.9741	0.1509	0.0283	Multigenerational I (head, spouse, child, son/daughter-in-law, grandchild)	9.7
2	1.0000	0.0000	0.3906	0.0017	0.1720	0.0892	0.5339	0.0390	Multigenerational II (head, child, parent/in-law, other relative)	11.2
3	1.0000	0.1263	0.1860	0.0004	0.0000	0.0961	0.0085	0.0137	Head-centred (head)	30.0
4	1.0000	0.7689	0.9418	0.0039	0.0453	0.0044	0.0154	0.0222	Nuclear (head, spouse, child)	42.5
5	1.0000	0.9004	0.8699	0.0057	0.1632	0.0196	0.9834	0.0492	Composite extended (head, spouse, child, other relative)	6.6

Note: Each household has a head of house. In the original modelling, this variable was not included in the analysis. It is shown here for reference.

Table A-5: Item-response probabilities, labels, and model class prevalence for six-class model for the surveys

Class	Head	Spouse	Child(ren)	Son/ daughter -in-law	Parent/ in-law	Grandchild	Other relative	Non-relative	Label	Model class prevalence (%)
1	1.0000	0.5699	0.9740	0.1769	0.0646	0.9466	0.2268	0.0489	Multigenerational I (head, spouse, child, grandchild)	4.3
2	1.0000	0.7383	0.9579	0.0050	0.1608	0.0000	0.3777	0.0358	Composite extended (head, parent/in-law, other relatives)	19.0
3	1.0000	0.1348	0.2307	0.0011	0.1686	0.0627	0.9353	0.0516	Multigenerational II (head, spouse, child, parent/in-law, other relative)	5.9
4	1.0000	0.0342	0.3524	0.0000	0.0215	0.0299	0.0002	0.0158	Head-centred (head)	36.1
5	1.0000	1.0000	0.8681	0.0026	0.0000	0.0324	0.0076	0.0198	Nuclear (head, spouse, child)	26.3
6	1.0000	0.2687	0.4887	0.0461	0.0129	0.8716	0.1167	0.0119	Multigenerational III (head, child, grandchild)	8.3

Note: Each household has a head of house. In the original modelling, this variable was not included in the analysis. It is shown here for reference.

Table A-6: Item-response probabilities, labels, and model class prevalence for seven-class model for the surveys

Class	Head	Spouse	Child(ren)	Son/ daughter -in-law	Parent/ in-law	Grandchild	Other relative	Non- relative	Label	Model class prevalence (%)
1	1.0000	0.6399	0.9113	0.0034	0.0387	0.0000	0.0000	0.0169	Nuclear (head, spouse, child)	39.3
2	1.0000	0.0004	0.0450	0.0005	0.0221	0.0352	0.0320	0.0172	Head-centred (Head).	24.0
3	1.0000	1.0000	0.6757	0.0047	0.0000	0.2433	0.0802	0.0323	Other	10.7
4	1.0000	0.6084	0.9339	0.2468	0.0636	1.0000	0.1995	0.0528	Multigenerational I (head, spouse, child, son/daughter-in-law, grandchild)	3.0
5	1.0000	0.6683	1.0000	0.0055	0.1632	0.0249	0.6241	0.0419	Composite extended (head, spouse, child, other relatives)	12.2
6	1.0000	0.1708	0.1235	0.0024	0.2014	0.0592	0.9999	0.0568	Multigenerational II (head, spouse, child, parent/in-law, other relative)	4.2
7	1.0000	0.0813	0.5707	0.0446	0.0219	1.0000	0.1281	0.0090	Multigenerational III (head, child, grandchild)	6.6

Table A-7: Item-response probabilities, labels, and model class prevalence for eight-class model for the surveys

Class	Head	Spouse	Child(ren)	Son/ daughter -in-law	Parent/ in-law	Grandchild	Other relative	Non- relative	Label	Model class prevalence (%)
1	1.0000	0.2984	0.5766	0.0585	0.0027	0.8578	0.1406	0.0084	Multigenerational I (head, child, grandchild)	8.8
2	1.0000	0.1217	0.3079	0.0000	0.0201	0.0503	0.0000	0.0165	Head-centred (head)	38.1
3	1.0000	0.0000	0.8292	0.0068	1.0000	0.2156	0.0368	0.0405	Multigenerational II (head, child, parent/in-law)	0.6
4	1.0000	0.8590	0.9494	0.0035	0.0000	0.0412	0.0992	0.0201	Nuclear	36.2
5	1.0000	0.6241	1.0000	0.3168	0.0695	1.0000	0.2031	0.0478	Multigenerational III (head, spouse, child, son/daughter-in-law, grandchild)	1.9
6	1.0000	0.1354	0.3629	0.0009	0.1715	0.0618	1.0000	0.0424	Composite extended (head, child, other relative)	6.7
7	1.0000	0.8184	0.7400	0.0107	0.0401	0.2550	0.5372	1.0000	Other extended (head, spouse, child, other relative, non-relative)	0.3
8	1.0000	0.8659	0.9800	0.0074	0.3506	0.0198	0.3700	0.0227	Multigenerational IV (head, spouse, child, parent/in-law, other relative)	7.2

A.2.1.2 Survey year-specific item response probabilities

Table A-8: Survey year-specific item-response probabilities and labels for a multi-group five-class model

Classes	Head	Spouse	Child(ren)	Son/ daughter -in-law	Parent/ in-law	Grandchild	Other relative	Non-relative	Label	Model class prevalence (%)
1993 GDHS										
1	1.0000	0.4347	0.7361	0.0792	0.0339	1.0000	0.1148	0.0402	Multigenerational I (head, spouse, child, grandchild)	5.0
2	1.0000	0.7507	0.9089	0.0068	0.0076	0.0223	0.0000	0.0359	Nuclear (head, spouse, child)	38.0
3	1.0000	0.0263	0.3078	0.0005	0.0000	0.1013	0.0324	0.0037	Head-centred (head)	37.8
4	1.0000	1.0000	0.8044	0.0057	0.0650	0.0712	0.6638	0.1018	Composite extended (head, spouse, child, other relative, non-relative)	10.0
5	1.0000	0.0000	0.5163	0.0026	0.1277	0.1268	0.6195	0.0605	Multigenerational II (head, child, parent/in-law, other relative)	9.2
1998 GDHS										
1	1.0000	0.6000	1.000	1.0000	0.0000	0.9357	0.0371	0.0000	Other (head, spouse, child, son/daughter-in-law, grandchild)	0.7
2	1.0000	0.1927	0.5665	0.0062	0.0206	0.9978	0.1521	0.0000	Multigenerational I (head, child, grandchild)	10.2
3	1.0000	1.0000	0.9822	0.0032	0.0274	0.0638	0.0992	0.0269	Nuclear (head, spouse, child)	33.4
4	1.0000	0.3010	0.5279	0.0140	0.2602	0.0653	0.7761	0.0883	Multigenerational II (head, child, parent/in-law, grandchild, other relative)	5.2
5	1.0000	0.1359	0.3910	0.0008	0.0142	0.0000	0.0703	0.0134	Head-centred (head)	50.5
2003 GDHS										
1	1.0000	0.5581	0.8856	0.1291	0.0204	0.9967	0.2118	0.0494	Multigenerational I (head, spouse, child, grandchild)	9.1
2	1.0000	0.7966	0.8964	0.0078	0.1604	0.0075	0.5760	0.0463	Multigenerational II (head, spouse, child, parent/in-law, other relative)	18.5
3	1.0000	1.0000	1.0000	0.0012	0.0313	0.0000	0.0024	0.0243	Nuclear (head, spouse, child)	25.0
4	1.0000	0.0000	0.2504	0.0000	0.1176	0.1321	0.9588	0.0716	Composite extended (head, other relative)	6.0
5	1.0000	0.1454	0.3898	0.0000	0.0238	0.1220	0.0000	0.0131	Head-centred (head)	41.5
2008 GDHS										
1	1.0000	0.7206	1.0000	0.0039	0.1766	0.0263	0.5965	0.0402	Multigenerational II (head, spouse, child, parent/in-law, other relative)	15.1
2	1.0000	1.0000	0.9671	0.0058	0.0257	0.0318	0.0000	0.0174	Nuclear (head, spouse, child)	26.7
3	1.0000	0.1678	0.0000	0.0039	0.2024	0.0565	1.0000	0.0510	Composite extended (head, other relative)	3.9
4	1.0000	0.4566	0.7861	0.1407	0.0368	0.9275	0.2124	0.0217	Multigenerational I (head, spouse, child, grandchild)	6.8
5	1.0000	0.1605	0.3755	0.0002	0.0319	0.1028	0.0488	0.0170	Head-centred (head)	47.5

Table A-8: (Continued)

Classes	Head	Spouse	Child(ren)	Son/ daughter -in-law	Parent/ in-law	Grandchild	Other relative	Non- relative	Label	Model class prevalence (%)
2014 GDHS										
1	1.0000	0.4645	0.7533	0.0985	0.0265	1.0000	0.1671	0.0430	Multigenerational I (head, spouse, child, grandchild)	6.3
2	1.0000	1.0000	0.9344	0.0019	0.0000	0.0426	0.0744	0.0202	Nuclear (head, spouse, child)	27.7
3	1.0000	0.1378	0.3110	0.0007	0.0207	0.1029	0.0535	0.0152	Head-centred (head)	47.7
4	1.0000	0.6574	1.0000	0.0015	0.2145	0.0225	0.3164	0.0329	Multigenerational II (head, spouse, child, parent/in-law, other relative)	12.5
5	1.0000	0.1691	0.1053	0.0028	0.2476	0.0761	0.9683	0.0859	Composite extended (head, other relative)	2.8
2022 GDHS										
1	1.0000	0.7455	1.0000	0.0025	0.0054	0.0003	0.0460	0.0157	Nuclear (head, spouse, child)	33.5
2	1.0000	0.1345	0.1766	0.0000	0.2198	0.0899	0.5831	0.0376	Composite extended (head, parent-in-law, other relative)	9.4
3	1.0000	0.4668	0.7992	0.1478	0.0381	0.9354	0.1528	0.0233	Multigenerational I (head, spouse, child, grandchild)	12.6
4	1.0000	0.6553	1.0000	0.0077	0.2517	0.0000	0.3926	0.0286	Multigenerational II (head, spouse, child, parent/in-law, other relative)	14.1
5	1.0000	0.1754	0.1487	0.0007	0.0000	0.0813	0.0000	0.0207	Head-centred (head)	30.3

A.2.2 LCA results for GPHC

Table A-9 shows the model statistics for all LCA models for censuses. None of the model statistics pointed to a single model as an adequate fit. The AIC and BIC kept decreasing until the ninth model and the bootstrapped p-value indicated that none of the models was an adequate fit. For the censuses, the model statistics are not helpful in determining an adequate model. For this reason, the choice of the best model strongly depended on the interpretability and relevance of classes in the various models. To align with those found for the GDHS, the results for five-class, six-class, seven-class, and eight-class models are inspected (Tables A-10 to A-13). Similar to the surveys, the censuses also show the two most common households to be nuclear and head-centred. Beyond the five-class model, any additional classes show different variations of multigenerational and other extended households. Therefore, for the censuses as well, a five-class model is adjudged an adequate fit.

Table A-9: Model statistics to determine absolute model fit for the Ghana Population and Housing Censuses

Class	Log likelihood	AIC	BIC	Entropy	G2	Boot p-value
2	-5379341	10758711	10758899	0.84	167842.72	0.0000
3	-5326925	10653896	10654184	0.74	63011.82	0.0000
4	-5306322	10612705	10613093	0.82	21804.85	0.0000
5	-5299107	10598292	10598780	0.71	7375.74	0.0000
6	-5297244	10594582	10595170	0.62	3649.74	0.0000
7	-5296369	10592848	10593536	0.68	1899.09	0.0000
8	-5295880	10591885	10592674	0.70	920.60	0.0000
9	-5295735	10591612	10592501	0.66	631.76	0.0000
10	-5278854	10557866	10558854	0.55	455.10	0.0000
11	-5278784	10557742	10558831	0.56	315.61	0.0000

Using multi-group analysis and testing for measurement invariance, we find that the latent construct of household structure from the censuses also differed across years (Table A-14). As with the surveys, we rely on year-specific item-response probabilities to label the various household structures for the four rounds of the censuses, as shown in Table A-15. The nomenclature across years was similar. A unique distinction was observed for 1984 for a household labelled "other." The item probabilities indicated the presence of children and grandchildren (class 1), similar to multigeneration I (Class 4). In the 2000 census, head-centred households also comprised about 0.30 probability of a child being present, as found in the surveys, indicating that this household group is likely to capture living arrangements where heads live with their children. The item probabilities for composite extended households also varied across years, but common was the moderate to high probability of other relatives being present.

Table A-10: Item-response probabilities, labels, and model class prevalence for five-class model for the censuses

Class	Head	Spouse	Child(ren)	Son/ daughter -in-law	Parent/ in-law	Grandchild	Other relative	Non- relative	Label	Model class prevalence (%)
1	1.0000	0.6907	0.9606	0.0073	0.0279	0.0000	0.1280	0.0275	Nuclear (head, spouse, child)	41.6
2	1.0000	0.1369	0.0719	0.0009	0.0031	0.0670	0.1070	0.0435	Head-centred (head)	30.8
3	1.0000	0.4088	0.8862	0.1483	0.0283	0.9443	0.2490	0.0550	Multigenerational I (head, spouse, child, grandchild)	11.0
4	1.0000	0.7542	0.8687	0.0403	0.1555	0.0643	0.9243	0.1223	Multigenerational II (head, spouse, child, parent/in-law, other relative)	8.2
5	1.0000	0.0005	0.2618	0.0163	0.1122	0.0655	0.7447	0.0949	Composite extended (head, spouse, child, other relative)	8.4

Note: Each household has a head of house. In the original modelling, this variable was not included in the analysis. It is shown here for reference.

Table A-11: Item-response probabilities, labels, and model class prevalence for six-class model for the censuses

Classes	Head	Spouse	Child(ren)	Son/ daughter -in-law	Parent/ in-law	Grandchild	Other relative	Non-relative	Label	Model class prevalence (%)
1	1.0000	0.1213	0.0511	0.0000	0.0000	0.0398	0.1010	0.0494	Head-centred (head)	25.5
2	1.0000	0.4760	0.8880	0.2174	0.0339	0.9054	0.3474	0.0830	Multigenerational I (head, spouse, child, grandchild)	7.9
3	1.0000	0.7820	0.9549	0.0066	0.0270	0.0103	0.0809	0.0299	Nuclear (head, spouse, child)	33.3
4	1.0000	0.2416	0.6903	0.0050	0.0140	0.3208	0.0005	0.0000	Other	11.4
5	1.0000	0.0000	0.4545	0.0173	0.1035	0.0844	0.7110	0.0869	Composite extended (head, child, other relative)	13.9
6	1.0000	1.0000	0.8759	0.0274	0.1279	0.0381	0.9147	0.0965	Multigenerational II (head, spouse, child, parent/in-law, other relative)	8.0

Note: Each household has a head of house. In the original modelling, this variable was not included in the analysis. It is shown here for reference.

Table A-12: Item-response probabilities, labels, and model class prevalence for seven-class model for the censuses

Class	Head	Spouse	Child(ren)	Son/ daughter -in-law	Parent/ in-law	Grandchild	Other relative	Non-relative	Label	Model class prevalence (%)
1	1.0000	0.6408	0.9532	0.0130	0.1130	0.0364	0.4883	0.0383	Multigenerational II (head, spouse, child, parent/in-law, other relative)	20.5
2	1.0000	0.0225	0.0000	0.0016	0.0104	0.0290	0.0002	0.0507	Head-centred (head)	21.6
3	1.0000	0.6602	0.8399	0.0039	0.0000	0.0585	0.0413	0.0257	Nuclear (head, spouse, child)	36.6
4	1.0000	0.6489	0.9757	0.4991	0.0401	0.8969	0.3698	0.0719	Multigenerational I (head, spouse, child, son/daughter-in-law, other relative, grandchild)	2.2
5	1.0000	0.5982	0.8610	0.0627	0.0937	0.2140	0.8788	0.2469	Composite extended (head, spouse, child, other relative)	4.2
6	1.0000	0.0796	0.0199	0.0103	0.0757	0.0322	0.9995	0.0753	Other extended (head, other relative)	7.6
7	1.0000	0.1760	0.6920	0.0757	0.0258	0.9532	0.2139	0.0419	Multigenerational III (head, child, grandchild)	7.3

Table A-13: Item-response probabilities, labels, and model class prevalence for eight-class model for the censuses

Class	Head	Spouse	Child(ren)	Son/ daughter -in-law	Parent/ in-law	Grandchild	Other relative	Non- relative	Label	Model class prevalence (%)
1	1.0000	0.0000	0.4402	0.0089	0.1002	0.0519	0.7629	0.0688	Composite extended (head, child, other relative)	12.5
2	1.0000	0.8375	1.0000	0.3454	0.0443	1.0000	0.4187	0.0733	Multigenerational III (head, spouse, child, son/daughter-in-law, grandchild, other relative)	1.7
3	1.0000	0.6689	1.0000	0.0076	0.0232	0.0221	0.0345	0.0264	Nuclear (head, spouse, child)	36.6
4	1.0000	0.1908	0.0284	0.0019	0.0060	0.0671	0.0463	0.0000	Head-centred (head)	19.3
5	1.0000	1.0000	0.8914	0.0200	0.1125	0.0243	0.8190	0.0805	Multigenerational II (head, spouse, child, parent/in-law, other relative)	10.0
6	1.0000	0.1095	0.0000	0.0004	0.0000	0.0276	0.1373	0.1333	Other	9.9
7	1.0000	0.2740	0.8190	0.1059	0.0213	0.9873	0.1585	0.0387	Multigenerational I (head, child, grandchild)	7.4
8	1.0000	0.3573	0.7472	0.1697	0.0802	0.5016	0.7863	0.2011	Multigenerational IV (head, spouse, child, grandchild, other relative)	2.6

Table A-14: Test for measurement invariance on basic, constrained multi-group and unconstrained multi-group five-class models for the censuses

5-class models	AIC	BIC	Entropy	Deviance	Chi-square p-value
Basic model	10598292	10598780	0.71		–
Constrained multi-group model	10452064	10452702	0.74	146252.71	0.000
Unconstrained multi-group model	10418741	10420693	0.73	33533.03	0.000

Table A-15: Census year-specific item-response probabilities and labels for a multi-group five-class model

Class	Head	Spouse	Child(ren)	Son/ daughter -in-law	Parent/ in-law	Grandchild	Other relative	Non-relative	Label	Model class prevalence (%)
1984 GPHC										
1	1.0000	0.2759	1.0000	0.0017	0.0261	0.3642	0.1715	0.0137	Other (head, child grandchild, other relative, spouse)	17.3
2	1.0000	0.9039	1.0000	0.0117	0.0336	0.0000	0.2619	0.0337	Nuclear (head, spouse, child)	30.4
3	1.0000	0.5235	0.6585	0.0135	0.8714	0.0723	1.0000	0.0396	Multigenerational II (head, spouse, child, parent/in-law, other relative)	2.6
4	1.0000	0.6043	0.9380	0.3527	0.0350	0.9241	0.3996	0.0613	Multigenerational I (head, child, grandchild, other relative)	7.6
5	1.0000	0.1403	0.2192	0.0019	0.0151	0.0980	0.2260	0.0351	Head-centred (head)	42.1
2000 GPHC										
1	1.0000	0.5920	1.0000	0.0607	0.1145	0.1027	0.8810	0.1984	Composite extended (head, spouse, child, other relative)	13.3
2	1.0000	0.3997	0.8750	0.1640	0.0264	0.8102	0.4420	0.0922	Multigenerational I (head, spouse, child, grandchild)	10.7
3	1.0000	0.1381	0.3950	0.0090	0.0156	0.0822	0.3789	0.0657	Other (head, child, other relative)	46.2
4	1.0000	0.2527	0.0000	0.0776	0.1342	0.0819	0.9908	0.2299	Multigenerational II (head, child, parent/in-law, other relative)	5.0
5	1.0000	1.0000	0.9458	0.0052	0.0224	0.0116	0.2977	0.0595	Nuclear (head, spouse, child)	24.9
2010 GPHC										
1	1.0000	0.6836	0.9371	0.0060	0.0271	0.0000	0.1284	0.0315	Nuclear (head, spouse, child)	46.0
2	1.0000	0.0000	0.4143	0.0130	0.1529	0.0496	0.7166	0.0708	Composite extended (head, child, other relative)	8.7
3	1.0000	0.9326	0.9266	0.0333	0.1507	0.0625	0.9459	0.0712	Multigenerational II (head, spouse, child, parent/in-law, other relative)	7.2
4	1.0000	0.4079	0.8676	0.1322	0.0283	0.9592	0.2488	0.0705	Multigenerational I (head, spouse, child, grandchild, other relative)	12.3
5	1.0000	0.1167	0.0497	0.0006	0.0000	0.0726	0.1571	0.0651	Head-centred (head)	25.8
2021 GPHC										
1	1.0000	0.1385	0.0125	0.0003	0.0000	0.0574	0.0000	0.0332	Head-centred (head)	32.0
2	1.0000	0.6718	0.9670	0.0071	0.0242	0.0000	0.0623	0.0173	Nuclear (head, spouse, child)	42.5
3	1.0000	0.4048	0.8664	0.1499	0.0275	0.9759	0.1360	0.0325	Multigenerational I (head, spouse, child, son/daughter-in-law, grandchild)	8.9
4	1.0000	0.0787	0.1108	0.0032	0.0819	0.0417	0.6232	0.0635	Composite extended (head, other relative)	10.9
5	1.0000	0.6959	0.9576	0.0323	0.2179	0.0584	0.7734	0.0889	Multigenerational II (head, spouse, child, parent/in-law, other relative)	5.7

A.2.3 Manual approach: Household structure

Table A-16: Household structure and trends in the censuses (1984–2021) and Demographic and Health Surveys (1993–2022)

Combinations/description	GPHC				GDHS					
	1984 %(n)	2000 %(n)	2010 %(n)	2021 %(n)	1993 %(n)	1998 %(n)	2003 %(n)	2008 %(n)	2014 %(n)	2022 %(n)
Core nuclear Head, spouse, and child only	22.3 (58194)	17.1 (63333)	24.4 (133569)	25.4 (212118)	26.5 (1540)	26.1 (1723)	28.0 (1872)	28.5 (3490)	28.1 (3469)	26.2 (5076)
Semi-nuclear Head and child only	13.6 (35128)	8.9 (33075)	13.0 (70520)	13.0 (108828)	19.2 (1116)	16.6 (942)	13.5 (794)	14.3 (1599)	13.7 (1563)	15.4 (2524)
Couple Head and spouse	3.2 (8218)	2.9 (10628)	3.8 (20779)	5.1 (42986)	3.5 (203)	4.1 (262)	3.6 (226)	4.8 (548)	5.6 (625)	4.4 (779)
Multigenerational Three or more generations and coresidence of child of household head and parent/in-law and/or grandchild	16.8 (43537)	13.0 (47985)	13.7 (74600)	10.1 (84546)	8.2 (480)	10.6 (643)	13.4 (893)	11.0 (1389)	10.1 (1341)	12.6 (2520)
Other extended Complex living arrangements that are not multigenerational households but have other relatives and non-relatives	24.2 (62967)	44.5 (164501)	26.3 (143892)	17.3 (144688)	18.4 (1071)	16.5 (956)	20.9 (1283)	19.6 (2320)	16.8 (2043)	16.9 (3154)
Single member	19.3 (50197) [a]	12.6 (46607)	17.6 (96207)	28.0 (233830)	24.0 (1399)	25.6 (1454)	20.4 (1169)	21.4 (2388)	25.2 (2743)	23.8 (3797)
Non-related Households comprising head and non-related individuals	0.6 (1674)	1.0 (3821)	1.3 (6920)	1.1 (9519)	0.2 (13)	0.4 (23)	0.3 (14)	0.4 (44)	0.6 (51)	0.6 (83)
Total	259915	369950	546487	836515	5822	6003	6251	11778	11835	17933

Notes: For the 1984 census, 1,289 households had no head of house but rather only one member based on the variable "number of household members." They were added to single-member households. Percentages for the surveys are weighted.

A.2.4 Coresident other relatives

Table A-17: Percentage of coresident other relatives in extended households in the censuses and surveys

	GPHC %					GDHS %						
	1984*	2000	2010	2021	Total	1993	1998	2003	2008	2014	2022	Total
Multigenerational	22.4	14.3	17.4	15.0	16.5	13.9	16.5	19.5	17.7	16.3	21.2	18.3
Other extended	77.0	85.7	82.6	85.0	83.5	86.1	83.5	80.5	82.3	83.6	78.7	81.7

Note: For the 1984 census, the percentages do not add up to 100 because about 0.6% of other relatives were recaptured as single-member households.

Figure A-1: Percentage distribution of the ages of other relatives by year of census

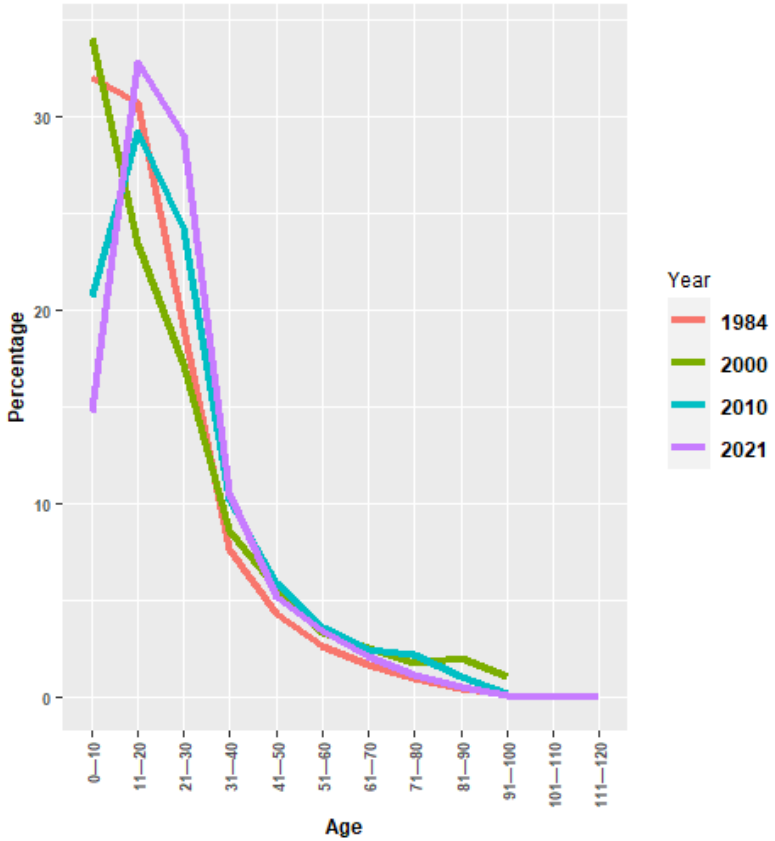

Figure A-2: Percentage distribution of the ages of other relatives by sex and year of census

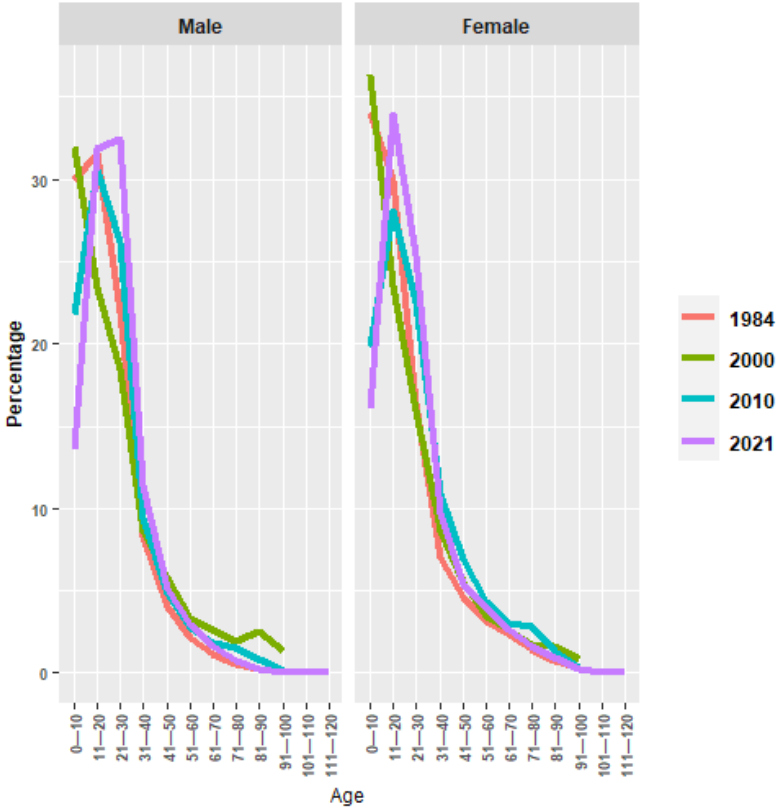

Table A-18: 2021 estimates for population density, percentage urban, net migration, and religion for all regions in Ghana

Regions	Population density (per km^2)	Percentage urban	Net migration rate (per 1,000)	Religion (%)				
				Christian	Islam	Trad.	Other	None
Coastal								
Greater Accra	1681.3	91.7	259.9	84.3	11.6	0.3	2.8	0.9
Central	291.0	57.9	–20.0	84.1	9.1	0.3	5.2	1.3
Volta	174.6	42.1	–211.2	78.6	4.7	9.7	6.0	1.0
Oti region (formerly part of Volta region)	67.5	32.6	–45.2	63.7	13.2	12.7	8.9	1.5
Western	148.4	51.6	57.6	83.0	9.4	0.3	6.3	0.9
Western North (formerly part of Western region)	87.4	29.8	67.4	79.2	12.0	0.3	6.5	2.0
Middle								
Ashanti	223.1	61.6	39.9	78.1	16.0	0.4	4.6	0.9
Eastern	151.4	51.5	–77.3	86.1	6.7	0.6	5.3	1.4
Bono (formerly part of Brong Ahafo region)	108.8	58.6	–18.5	81.3	12.8	0.6	4.0	1.2
Bono East (formerly part of Brong Ahafo region)	51.8	52.6	60.8	62.7	24.1	3.8	7.5	1.9
Ahafo region(formerly part of Brong Ahafo region)	108.7	48.7	35.8	75.0	16.5	0.3	5.1	3.1
Northern								
Northern	87.1	47.4	–72.1	18.2	66.4	11.5	3.5	0.4
Savannah (formerly part of Northern region)	18.8	29.6	–47.8	28.1	64.1	4.4	2.7	0.7
North East (formerly part of Northern region)	72.7	32.6	–110.7	30.8	61.2	6.1	1.6	0.3
Upper East	147.2	25.4	–184.0	49.4	29.7	17.5	2.4	1.0
Upper West	48.8	26.4	–176.0	46.0	45.2	6.2	2.2	0.4

Sources: (1) Ghana Statistical Service (2024). *Population Projections 2021–2050*. Accra, Ghana Statistical Service (2) Ghana Statistical Service (2023). *Thematic Report – Migration*. Accra, Ghana Statistical Service (3) Ghana Statistical Service (2021). *Ghana 2021 Population and housing census – General report Volume 3C: Background characteristics*. Accra, Ghana Statistical Service

Table A-19: Trends in household structure by place of residence and regional zones in the Ghana Population and Housing Census (GPHC) (2000–2021) and the Demographic and Health Surveys (GDHS) (1993–2022)

Household structure	GPHC			GDHS					
	Coastal Rural								
	2000 %	2010 %	2021 %	1993 %	1998 %	2003 %	2008 %	2014 %	2022 %
Core nuclear	18.7	26.7	25.0	23.3	25.4	30.2	27.2	29.8	26.4
Semi-nuclear	9.9	13.4	12.7	17.5	14.8	13.0	15.4	14.2	13.4
Couple only	3.1	3.9	5.2	3.0	3.2	3.2	4.2	4.5	4.9
Multigenerational extended	12.9	14.0	10.5	12.4	16.9	14.9	12.2	11.0	13.6
Other extended	40.6	24.3	17.6	21.3	19.7	20.1	19.3	16.3	17.5
Single member	13.8	17.1	28.1	22.5	19.4	18.4	21.3	23.7	23.7
Non-related	0.9	0.8	0.9	0.0	0.6	0.2	0.3	0.5	0.4
Total number of households	79350	97694	131397	1402	1372	1140	2244	2182	3207

Table A-19: (Continued)

Household structure	GPHC			GDHS					
	2000 %	2010 %	2021 %	1993 %	1998 %	2003 %	2008 %	2014 %	2022 %
Coastal Urban									
Core nuclear	14.8	22.5	23.8	18.3	23.2	18.9	26.0	24.2	23.9
Semi-nuclear	9.3	13.2	12.9	19.1	15.7	13.8	14.2	13.3	17.0
Couple only	3.5	4.6	5.7	4.0	4.5	3.8	5.3	7.2	4.8
Multigenerational extended	9.5	9.8	6.8	8.0	9.8	12.4	7.1	7.6	9.0
Other extended	46.5	27.3	17.9	23.6	19.6	26.3	22.1	17.4	16.1
Single member	14.9	20.7	31.3	26.8	26.1	24.4	24.8	29.2	28.4
Non-related	1.5	1.9	1.6	0.3	1.1	0.4	0.6	1.0	0.7
Total number of households	95396	163412	275353	1030	1048	1253	2586	2801	3618
Middle Rural									
Core nuclear	18.2	27.4	25.4	24.9	25.2	30.5	29.0	30.3	25.7
Semi-nuclear	8.8	12.8	12.5	24.7	19.8	14.6	14.4	14.6	15.1
Couple only	2.5	3.6	5.2	3.1	3.8	3.6	5.9	5.1	4.2
Multigenerational extended	15.4	15.9	12.1	6.9	7.3	11.8	12.0	11.3	15.5
Other extended	43.5	23.5	16.6	14.8	13.1	17.4	17.9	14.9	16.2
Single member	10.8	15.9	27.3	25.4	30.5	21.9	20.6	23.5	22.8
Non-related	0.8	0.9	0.9	0.2	0.3	0.1	0.1	0.2	0.6
Total number of households	80512	100361	129611	1528	1488	1427	2277	1848	2665
Middle Urban									
Core nuclear	13.7	21.9	22.2	19.5	16.8	21.7	22.9	22.4	19.9
Semi-nuclear	9.5	14.4	14.3	24.4	20.8	17.2	17.5	16.0	18.4
Couple only	2.9	3.8	4.8	2.4	4.3	2.8	4.3	5.3	3.9
Multigenerational extended	11.6	12.1	9.3	5.5	6.8	11.4	10.2	8.4	12.1
Other extended	46.5	25.4	16.2	16.8	16.5	22.5	19.9	17.9	17.3
Single member	14.8	20.9	31.9	30.9	34.8	24.0	24.5	29.4	27.7
Non-related	1.1	1.5	1.2	0.5	0.0	0.5	0.8	0.5	0.7
Total number of households	67686	124466	186785	910	700	1003	1921	2096	3094
Northern Rural									
Core nuclear	23.9	28.0	36.5	52.4	48.4	46.8	44.4	44.9	40.5
Semi-nuclear	5.7	8.1	12.4	7.0	9.1	5.4	8.6	7.2	10.5
Couple only	1.7	1.5	3.8	5.9	6.5	4.3	3.6	4.0	4.1
Multigenerational extended	18.9	24.0	19.7	6.0	10.6	20.8	15.0	18.3	18.2
Other extended	45.7	33.9	17.8	14.4	11.6	16.6	17.4	15.4	18.2
Single member	3.9	4.2	9.5	14.3	13.7	5.9	11.0	10.2	8.3
Non-related	0.3	0.3	0.3	0.0	0.0	0.1	0.01	0.0	0.1
Total number of households	35520	43505	67969	803	1162	1167	2082	1866	3266
Northern Urban									
Core nuclear	17.1	21.9	32.0	32.2	28.7	33.3	33.0	36.5	40.0
Semi-nuclear	6.9	9.8	11.3	12.1	12.5	10.1	8.9	10.3	9.8
Couple only	2.7	2.7	4.6	2.0	4.5	5.5	4.1	5.3	4.8
Multigenerational extended	15.6	20.3	12.2	14.1	8.3	10.4	17.4	10.4	13.0
Other extended	45.5	33.1	18.3	22.8	13.6	21.3	19.4	20.1	17.6
Single member	11.4	11.0	20.9	15.4	32.5	19.4	17.2	17.0	14.3
Non-related	0.7	1.2	0.7	1.3	0.0	0.0	0.0	0.4	0.5
Total number of households	11486	17049	45400	149	233	261	668	1042	2083

Figure A-3: Trends in household structure by place of residence for Greater Accra, Ashanti, and Upper East regions using data from the Ghana Demographic and Health Surveys