

Developing a Census Tabulation Plan

*Select Topics in International Censuses*¹

By Britta Schumacher

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INTRODUCTION

The main objective of any population and housing census (PHC) is to provide a “reliable basis for an accurate count of the population (and its characteristics) of a country at a point in time” (United Nations Statistics Division, 2017). To accomplish this, national statistical offices (NSOs) must identify the expected outputs from their census, choose topics to cover, and concurrently build a census tabulation plan.²

A tabulation plan (TP) is the program of statistical data and metadata that defines the model tables (i.e., tabulations) to be built from an NSOs PHC data. TP development should begin early in the census timeline so that subject-matter specialists have time to solicit feedback from data users regarding topics and tabulations of priority. Equipped with this information, NSOs develop a TP that provides guidance to questionnaire developers and data processors about the major findings that should be presented in census reports and the level of analysis (e.g., geographies, classifications) expected for each defined table, ensuring appropriate questionnaire design, organized data processing, and timely dissemination of census results (Demographic and Health Surveys Program, 2022).

Tabulations resulting from the TP are one of the most important outcomes of the PHC. The tabulations are the aggregate data that will be presented to the public and other data users in various formats. They are also funda-

mental to many of the targets that measure a country’s progress toward achieving the vision of the world put forth by the Sustainable Development Goals in 2030 (U.S. Census Bureau, 2018).

This technical note focuses on the various considerations, including recommended topics, cross-tabulations, classifications, and challenges that NSOs must weigh in the process of creating a census TP. This note will help NSOs to build census TPs for their PHC data to produce effective, internationally comparable, and timely census tabulations.

TOPIC RECOMMENDATIONS

The topics recommended by the United Nations for PHCs are based on global and regional census experiences of the past several decades. Table 1 presents a number of these United Nations (UN) recommended topics (refer to Tables A-1 and A-2 for a full list of topics). Together, these data provide means to measure the demographic, economic, social, and household characteristics of a country’s population.

Country-Specific Topics

Though UN recommendations are internationally comprehensive, there are a number of country-specific topics for which NSOs may want to collect data. Examples of additional census topics of national interest in listed census years include (United Nations Statistics Division, 2022):

- Albinism: Tanzania, 2012.
- Remittances: Malawi, 2018.
- Third gender: Kenya, 2019.
- Caste affiliation: Nepal, 2021.
- Health insurance: Jordan, 2015.
- Registration as refugee: Jordan, 2015.

¹ This technical note is part of a series on *Select Topics in International Censuses* (STIC) that explore matters of interest to the international statistical community. The U.S. Census Bureau helps countries improve their national statistical systems by engaging in capacity building to enhance statistical competencies in sustainable ways. Any views expressed are those of the author(s) and not necessarily those of the Census Bureau.

² Referred to as “tabulation programme” in the UN’s “Principles and Recommendations for Population and Housing Censuses” (United Nations Statistics Division, 2008 and 2017).

Table 1.

Topic Recommendations for Population and Housing Censuses

Topics	Description	Sample Census Variables
Geographic and internal migration	Migration characteristics of a country's usual residents.	Place of usual residence, locality, urban or rural.
International migration	Migration characteristics of a country's foreign-born population and of foreign citizens living in the country of enumeration.	Country of birth, country of citizenship.
Household and family	Household and family composition and status.	Family nucleus.
Demographic and social	A wide range of demographic characteristics of a population.	Sex, age, marital status, religion, language, and disability.
Fertility and mortality	Fertility rates of women (between 15 and 50 years old) and mortality rates across the population.	Children ever born, children living, and household deaths.
Education	The skill levels and knowledge domains of the population.	Literacy, school attendance, and educational attainment.
Economy	Characteristics of the economically active population including employment, unemployment, and underemployment.	Labor force status, occupation, and industry.
Agriculture	Agricultural activities of the population involved in agriculture as a primary livelihood or otherwise.	Farm size and own-use production.
Housing	Characteristics of buildings, living quarters, and occupants within households.	Occupancy status, rooms, bedrooms, and ownership.
Water, sanitation, and hygiene (WASH)	The adequacy of access to WASH systems.	Drinking water and sewage disposal system.
Energy use	The range of energy sources used by households.	Fuel used for cooking/heating, lighting, and electricity.
Information and communication technology (ICT)	The range and availability of ICT devices to households.	Internet access and mobile phone/computer access.

Source: United Nations Economic Commission for Europe, 2015; United Nations Statistics Division, 2017.

TABULATION AND CLASSIFICATION RECOMMENDATIONS

By aligning NSO tabulations with UN standards (e.g., concepts, definitions, and classifications), NSOs can improve the international harmonization and comparability of statistics. Table 2 presents a few common concepts from PHCs and their associated UN definitions (UN Statistics Division, 2017).

Classifications

NSOs are responsible for maintaining a database of standard census classifications. These classifications are the

basis on which various aggregations and disaggregations (expected by census data users) are built. Common classifications include:

Geographical division: (i) total country, (ii) major civil division, (iii) minor civil division, and (iv) principal locality. Urban vs. rural for (i-iii).

Sex: Both sexes.

Age: All ages, 5-year age groups to 100 years and over.

Marital status: Single (never married), married, widowed, divorced, or separated.

Table 2.

Examples of International Concepts and Definitions for Population and Housing Censuses

Concept	Definition
Religion	(a) Religious or spiritual belief of preference, regardless of whether or not this belief is represented by an organized group; or, (b) affiliation with an organized group having specific religious or spiritual tenets (page 203).
Age	The interval of time between the date of birth and the date of the census, expressed in completed solar years (page 200).
Unemployed persons	All those above the specified age who: (a) were not in employment, (b) carried out activities to seek employment during a specified recent period, and (c) were currently available to take up employment given a job opportunity (page 229).
Occupancy status	Whether or not a conventional dwelling is occupied at the time of the census. For those dwellings not occupied (because they are vacant or in secondary use), the reason for not being occupied should be classified (page 256).
Kitchen	A space that conforms in all respects to the criteria for a room and is equipped for the preparation of the principal meals of the day and intended primarily for that purpose (page 263).

Source: United Nations Statistics Division, 2017.

These classifications (and all additional UN recommended classifications) can be found in the recommended tabulation shells provided by the UN (United Nations Statistics Division, 2008).

Tabulation Shells

The UN has a recommended tabulation shell available for each core topic in the appendices of the second revision of the “Principles and Recommendations for Population and Housing Censuses” (United Nations Statistics Division, 2008).

Box 1 presents one of the tabulation shells for population censuses. Each shell provides details regarding:

- The tabulation universe (entire group of population units included).
- The various classifications and cross-classifications recommended.
- Necessary metadata to include with the released tabulation.
- Core topics covered by the tabulation.
- A note detailing what exactly each tabulation provides to data users.

Tabulation possibilities are extensive (refer to data.census.gov for more than 1,000 American Community Survey tables, and Eurostat [2019] for European Union (EU)-legislated census hypercubes).³ For this reason, the UN’s recommendations are key resources for making challenging decisions about which topics and tabulations to prioritize.

CONSIDERATIONS

It is essential that NSOs develop their TP early in the census timeline. The population and housing questionnaire content and design should be based on the TP. However, the topics and tabulations outlined above are not meant to be covered in full by any country.⁴ In most countries, the TP represents a compromise between a full range of desired tabulations and the practical limits of time and resources. Countries must prioritize topics and tabulations objectively by balancing the following considerations:⁵

The Needs of Data Users—NSOs must consider the national uses (e.g., policy, administration, and research) and users (e.g., national and local government agencies, private sector, academic, and other researchers) of census data products. First and foremost, the census should

³ A hypercube is a “multidimensional cross tabulation;” these are the tables the EU requires of its member states (Official Journal of the EU, 2010).

⁴ Except in cases where: (1) many topics are available via administrative data sources; or (2) the census may be the only chance a country has to investigate said data topics.

⁵ NSOs must demonstrate neutrality and objectivity in the presentation and interpretation of census results (UN General Assembly, 2014; United Nations Statistics Division, 2017); this includes ensuring that census tabulations are free from real or perceived political interference (i.e., statistical impartiality assured).

provide information on those topics of most interest and greatest value to the country. NSOs can solicit information about data users’ needs and priorities through public consultation/engagement (e.g., questionnaires/surveys), data user advisory committees such as a panel of experts, or a notice-and-comments process (i.e., where the NSO must consider all public comments and justify actions). The PHC should also provide comparability across census years so that users can track trends through time. In a case where concepts, definitions, or variables change, NSOs provision of metadata to data users becomes especially important and facilitates mapping data between years.⁶

International Recommendations and Comparability

National and international objectives of a PHC are usually compatible. Thus, employing UN standards that are based on definitions and methods that have successfully met national needs in practice over these last decades is highly recommended. In doing so, NSOs will achieve international (e.g., regional and worldwide) comparability. Should NSOs choose tabulations or topics that depart from UN standards, they should clearly explain the necessity for these departures (and how to adapt disseminated data to meet international standards) in all census products and publications.

Topic Sensitivity and Respondent Burden—When selecting tabulation content, NSOs should consider whether some topics may be too sensitive for respondents in the country. It may be necessary to avoid topics likely to arouse fear, prejudice, or superstition, or material that is too complicated or difficult for the average respondent to understand. In an interview-based census, consideration also needs to be given to the level of knowledge and skill of the interviewer or enumerator and whether they can be adequately trained to collect this information accurately.

The Availability of Relevant Information Held in Alternate Sources

One way to limit the size of the questionnaire is for NSOs to consider whether data are available from other sources (e.g., administrative data sources [ADS]), such that collection in the census is unnecessary (U.S. Census Bureau, 2022). Increasingly, NSOs are using ADS to either supplant or support field enumeration for household-based PHCs, decreasing the cost and increasing the efficiency of data collection (United Nations Economic Commission for Europe, 2015). NSOs may leverage ADS, taking into account the limitations of the alternative sources, to prioritize data collection on topics where alternative sources do not exist.

⁶ Metadata, the documentation describing the production process (e.g., data sources, definitions, concepts, and methods used), should accompany all census products. All tabulations should include the following published metadata: census questions and why they are asked, conceptual definitions such as census data dictionaries, geographic hierarchies used, changes since the previous census (e.g., content, operational methods, geographic boundaries), and quality indicators (e.g., survey response rates, item nonresponse, and coverage indicators for administrative records used in a register-based census). (United Nations Statistics Division, 2017)

UN-Defined Census Tabulation Shells

P5.2-R. Female population 10 years of age and over, by age and number of children living (or dead) by sex

Geographical division, age of females (in years) and sex of child	Total	Female population with indicated number of children living (or dead)						Total number of children living (or dead)
		0	1	2	...	12 or more	Not stated	
Total country		Population included: female population 10 years of age and over. (If the population included is restricted to ever-married females, this fact should be clearly stated.)						
Children, both sexes		Classifications:						
TOTAL 10 years and over		(a) Geographical division: (i) total country; (ii) each major civil division; (iii) each principal locality. Distinguish between urban and rural for (i), (ii) and (iii)						
10-14		(b) Age: total 10 years and over; 10-14 years; 15-19 years; 20-24 years; 25-29 years; 30-34 years; 35-39 years; 40-44 years; 45-49 years; 50-54 years; 55-59 years; 60-64 years; 65-69 years; 70-74 years; 75-79 years; 80-84 years; 90-94 years; 95-99 years; and 100 years and over; not stated						
15-19		(c) Sex: both sexes; male and female children ever born alive						
20-24		(d) Number of children living (or dead): none; 1 child; 2 children; 3 children; 4 children; 5 children; 6 children; 7 children; 8 children; 9 children; 10 children; 11 children; 12 or more children; not stated; and, separately, the aggregate number of children living (or dead) to women in each age category						
25-29		Metadata for this tabulation:						
30-34		(a) Source of statistics:						
35-39		<ul style="list-style-type: none"> ▶ Traditional population census ▶ Register-based population census ▶ Registers/Surveys systems ▶ Rolling surveys ▶ Civil registration 						
40-44		(b) De jure or de facto population or a combination with detailed description						
45-49		(c) Definition of urban and rural areas						
50-54		Core topics:						
55-59		<ul style="list-style-type: none"> ▶ Place of usual residence or Place where present at time of census ▶ Sex ▶ Age ▶ Children living 						
60-64		Note:						
65-69		These data are most useful for countries where death registration statistics are lacking or deficient. Census estimates of fertility and mortality can be derived directly or using generally more reliable indirect techniques. Two measures of fertility can be derived from the tabulations. These are (a) the net fertility ratio (average number of children surviving to women of childbearing age and over) and (b) cumulative average net fertility ratios by age groups. Child mortality rates can be estimated for each sex. Some measure of mortality in a generation can also be obtained by comparison of the net fertility ratio derived from this tabulation with the gross fertility ratio, which can be derived from recommended tabulation P5.1-R. This measure is particularly valuable where death rates estimated from civil registration data are not available or are defective. In addition to the above-mentioned measures of fertility and mortality, the tabulation also provides information for the analysis of family composition by number of living offspring by sex. These data cannot be obtained from birth registration statistics; neither can they be obtained from the census information on relationship to head of household because census families comprise only those persons who live and are enumerated within the same household; thus they do not necessarily include all the living (or dead) children of the woman enumerated.						
70-74								
75-79								
80-84								
85-89								
90-94								
95-99								
100 and over								
Not stated								
Children, males (age groups as above)								
Children, females (age groups as above)								

Source: United Nations Statistics Division, 2008.

CHALLENGES

Apart from the considerations listed above, there are also some challenges when developing a census TP. Two that are worthy of mention relate to confidentiality and data disclosure avoidance, and selecting the tables.

Small Area Classifications and Statistical Disclosure Limitation

As NSOs build TPs, best practices in data stewardship must be prioritized (U.S. Census Bureau, Data Stewardship

Executive Policy Committee). One flagship principle of official statistics is that an individual's data are to be legally protected and strictly confidential (UN General Assembly, 2014). Disseminating accurate and useful small area statistics and cross-tabulations and safeguarding the privacy of respondents are of equally immense importance (U.S. Census Bureau, 2020). NSOs must consider the risk of identity disclosure (i.e., risk to confidentiality breaches) when building cross-tabulations that have a small number of records within each grouping. By setting and following

rules (i.e., a “standard threshold”), NSOs can flag any units that violate them for further investigation.

The following are just a few examples of the many statistical disclosure limitation rules that guide releases of the U.S. Census Bureau’s American Community Survey and the 2010 Census Public Use Microdata Sample file (McKenna and Haubach, 2019):

- All geographic areas (including urban/rural status) must contain at least 50 unweighted people or households for a single variable.
- Tabulations require a mean cell size of at least three unweighted cases.

Public trust is fundamental to the success of any PHC and ensuring data confidentiality is an indispensable element of its maintenance. Should respondents think that their NSO will not protect the confidentiality of their personal identifiable information, they are less likely to cooperate with census operations or to provide accurate information. Statistical disclosure limitation rules, which ensure data confidentiality, are key to maintaining accurate, quality census data (United Nations Statistics Division, 2017).

Tabulation Choice

Making decisions regarding which tabulations, cross-tabulations, and classifications to produce and disseminate is another challenge NSOs encounter when designing a TP. Though it can be tempting, NSOs should not create universal cross-tabulations, where all topics are tabulated by all possible aggregations. Every additional data product or table that an NSO releases increases the disclosure risk to the populace.

NSOs should plan on identifying reasonable categories—creating tables only because it makes sense for end-users, international and historical comparability, and government reporting.

CONCLUSION

The ultimate goal of a TP is to lay out the major findings that should be presented in official reports, including the level of analysis expected for each defined table. Developing a TP is of critical importance to a PHC, ensuring appropriate questionnaire design, organized data processing, and timely dissemination of census results.

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APPENDIX A

Table A-1.

Population Census Topics

(Legend: ♦ Core topic, collected directly (**displayed in bold**); □ Core topic, derived; ○ Additional topic; △ Additional topic, derived from a core topic)

A. Geographic and Internal Migration Characteristics		
♦ Place of usual residence	♦ Place of birth	♦ Place of previous residence
♦ Place where present at time of census	♦ Duration of residence	♦ Place of residence at a specified date in the past
□ Total population	□ Locality	□ Urban and rural
B. International Migration Characteristics		
♦ Country of birth	♦ Country of citizenship	○ Acquisition of citizenship
♦ Year or period of arrival		
C. Household and Family Characteristics		
♦ Relationship to the reference person of household	□ Household and family composition	○ Household and family status
D. Demographic and Social Characteristics		
♦ Sex	♦ Age	♦ Marital status
○ Ethnocultural characteristics	○ Religion	○ Language
○ Ethnicity	○ Indigenous peoples	♦ Disability status
E. Fertility and Mortality		
♦ Children ever born alive	♦ Children living	♦ Date of birth of last child born alive
△ Births in the past 12 months	△ Deaths among children born in the past 12 months	○ Age, date, or duration of first marriage
○ Age of mother at birth of (date or time when) first child born alive	♦ Household deaths in the past 12 months	○ Maternal or paternal orphanhood
F. Educational Characteristics		
♦ Literacy	♦ School attendance	♦ Educational attainment
○ Field of education and training, and educational qualifications		
G. Economic Characteristics		
♦ Labour force status	♦ Status in employment	♦ Occupation
♦ Industry	○ Place of work	○ Institutional sector of employment
○ Working time	♦ Participation in own-use production of goods	○ Income
H. Agriculture		
○ Own-account agriculture production	○ Characteristics of all agricultural jobs during the last year	

Source: United Nations Statistics Division, 2017.

Table A-2.

Housing Census Topics by Unit of Enumeration(Legend: ♦ Core topic, collected directly (**displayed in bold**); □ Core topic, derived; ○ Additional topic)

Topic	Living quarters			
	Housing unit	Collective living quarters	Building	Household
Living quarters—type of	□	♦		
Location of living quarters	□	♦		□
Occupancy status	♦			
Ownership—type of	♦			□
Rooms: number of	♦			○
Bedrooms—number of	○			○
Useful floor space	○			□
Water supply system	♦	○		□
Drinking water—main source of	♦	○		□
Toilet—type of	♦	○		□
Sewage disposal	♦	○		□
Solid waste disposal—main type of	♦			□
Bathing facilities	♦	○		□
Kitchen—availability of	♦	○		□
Fuel used for cooking	♦			□
Lighting or electricity—type of	♦	○		□
Heating—type and energy used	○			○
Hot water—availability of	○			○
Piped gas—availability of	○			○
Use of housing unit	○			○
Occupancy by one or more households	□			♦
Occupants—number of	♦	♦		□
Building—type of			♦	
Year or period of construction	○		○	
Dwellings in the building—number of	○		○	
Position of dwelling in the building			○	
Accessibility to dwelling	○			
Construction material of outer walls	♦		♦	
Construction material of floor and roof	○		○	
Elevator—availability of	○		○	
Farm building	○		○	
State of repair	○		○	
Age and sex of the reference person of the household				
Tenure				
Rental and housing costs				
Furnished/unfurnished	○			○
Information and communication technology devices—availability of				○
Cars—number of available				○
Durable household appliances—availability of				○
Outdoor space—access to				○

Source: United Nations Statistics Division, 2017.



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