COD-PS Paraguay
Update Year 2023 / Reference Year 2023

Objective of This Explanatory Technical Note

This explanatory technical note provides supplementary notes on the strengths and limitations of each Common Operational Dataset on Population Statistics (COD-PS) against the projections by the WPP 2022 Revision of the UN to enable informed humanitarian decision-making.

Structure of Supplementary Note

This supplementary note is organized into the following sections:
1. Metadata
2. Methodological Documentation
3. Intrinsic Population Growth Rates (ADM-0 & 1)
4. Population counts by age and sex (ADM-0)
5. Relative population size by age and sex (ADM-1)

1. Metadata

Item	Metadata
Country	Paraguay
Source(s)	INE Paraguay
Source(s) Link(s)	https://www.ine.gov.py/default.php?publicacion=2
Population Data Type (Census enumeration, Direct estimate, or Population projection)	Population projection
Baseline Population Year	2002 (last census was in 2012 but the 2002 census was used as the actual baseline population)
COD-PS Reference Year	2023
COD-PS Publication Year	2023
ADM-1 Name	Departamento
ADM-1 Number of Units	18
ADM-1 Sex and Age Disaggregation	Sex and age disaggregated by 5-year age groups
ADM-1 Open-ended Age Group	80+

Item	Metadata
ADM-2 Name	Distrito
ADM-2 Number of Units	249
ADM-2 Sex and Age Disaggregation	Sex and age disaggregated by 5-year age groups
ADM-2 Open-ended Age Group	80+
ADM-3 Name	N/A
ADM-3 Number of Units	N/A
ADM-3 Sex and Age Disaggregation	N/A
ADM-3 Open-ended Age Group	N/A
General Notes	End-users must be aware that the NSO postcensal projections, on which this COD-PS is based, are likely to over-estimate populations across all age groups at the national level, when compared to the WPP 2022 projection. Moreover, due to the coverage rate of 74.4% of the 2012 census, the population obtained from the 2002 census was used as the actual baseline population instead for building postcensal projections.
Data Limitations	The NSO postcensal projections, on which this COD-PS is based, were built almost exclusively with data from censuses without taking into account other historical sources of population data (e.g. MICS, DHS) - unlike the WPP 2022 ADM-0 projections for Paraguay. Furthermore, the use of 2002 census in lieu of the 2012 census as the baseline population introduces a greater margins of error in the postcensal projections due to the low coverage rate of 74.4% of the more recent census from 2012. These factors may explain the discrepancies consistent across all age groups between the NSO postcensal projections and WPP 2022 projections at the ADM-0 level.
COD-PS Demographic Data Quality Assessment	The COD-PS was assessed against ADM-0 estimates and projections published by the World Population Prospects (2022 Revision), and found to be greater than WPP 2022 projections across all age groups at the ADM-0 level.

2. Methodological Documentation

Item	Methodological Documentation
Methodology Used	Cohort component method was used for each department (ADM-1 unit) to produce regional postcensal projections based on the 2012 census results and previous census results from 1982, 1992 and 2002, then combined to produce projections at the national (ADM-0) level. Logistic growth method

Item	Methodological Documentation
	and iterative proportional fitting methods were applied to produce municipal level (ADM-2) projections from the departmental (ADM-1) projections.
Baseline Population	2002 census (due to the coverage rate of 74.4% of the 2012 census)
Post-enumeration survey (PES)	The 2012 National Population and Housing Census had a national coverage rate of 74.4%.
Assessment and Adjustment of the Baseline Population	Given the coverage rate of 74.4% of the 2012 census, the population obtained from the 2002 census was used as the base population instead, which had an omission rate of 6.85% (urban 6.32%, rural 7.59%). Subsequently, the departmental populations were adjusted using their respective department- and district-level omission percentages. Then the base population thus corrected was transferred to June 30, 2000, using geometric growth rates by sex and age groups calculated between the populations of the 1992 and 2002 censuses (without adjusting with omission). Because the 0-4 years age group requires differential treatment since it is the group with the highest omission in the censuses, indirect estimation was applied at the departmental level.
Fertility (births)	Paraguay does not have complete vital statistics on fertility. Therefore, historical fertility trends were estimated with census data from 1982, 1992, 2002 and 2012 on children born alive during the 12 months prior to the census. Across all departments, fertility rates are projected to decline over time during the projection period (2000-2025).
Mortality (deaths)	As in the case of fertility, the information on mortality available in Paraguay's vital statistics system is neither complete nor reliable. For this reason, mortality was estimated using indirect methods. These methods make it possible to use data collected by censuses or surveys to estimate child mortality and adult mortality. Infant mortality for each of the departments was indirectly calculated from the census data of 1982, 1992, 2002 and 2012 with the Trussell variant of the original Brass method. The mortality of 5 years of age and over was estimated using the census data on deaths, by sex, that occurred in households during the twelve months prior to the 2002 and 2012 censuses.
International migration (net migration)	In Paraguay, there are no adequate and direct sources to accurately measure international migration. Nevertheless, the 2012 census incorporated questions related to international emigrants for the first time, which measured with the question on household members who left in the last 5 years (2007-2011) and are abroad establishing permanent residence. On the other hand, the question on place of residence for 5 years prior to the 2012 census were also fielded to identify immigrants and which has been included in all censuses. To establish a trend on the behavior of migration in Paraguay and calculate the migratory balance prior to projecting forward from the 2012 census, it was also necessary to estimate emigrants from previous censuses (1992, 2002). For this purpose,

Item	Methodological Documentation
	assumptions were made based on the proportion observed in the 2012 census. Based on this, it was estimated that the emigration rate for 2002 was 5% less than that observed in 2012 and 10% less for the 1992 census year. Starting from the historical net migratory balances, the final assumption was that the migratory balance will tend to zero at the end of the projection period (2000-2025).
Internal migration (migration within country)	To measure internal migration, data from a question included in most censuses and which refers to the place of residence for the 5 years prior to the census were used. Those people who declared living in a certain department 5 years ago and who currently reside in another are considered immigrants to the second department, or what is the same, emigrants from the first. Then, it was assumed that the interdepartmental migratory balance will reach zero by 2050.

3. Intrinsic Population Growth Rates (ADM-0 & 1)

At ADM-0, the implied postcensal (since 2002, the year of the actual baseline population used) population growth rates of this COD-PS (1.52% per year: female: 1.55%, male: 1.50%) are generally higher than the UN's population projections published in the World Population Prospects (WPP) 2022 revision (2003: 1.20%, 2007: 9.98%, 2012: 1.36%, 2017: 1.39%, 2022: 1.11%).

The NSO projects departmental (ADM-1) growth rates mostly at between 1-2% per year since 2002, the year of the actual baseline population. The NSO projects the highest population growth rates for Central (2.33% per year: small population, large land, rapid growth), Boquerón (2.30%: area surrounding the capital Asuncion), and Canindeyú (2.36%: borders Brazil with consistent influx of immigrants). In contrast, the NSO projects the lowest population growth rates for Asunción (-0.08%: capital city but population size has been consistent since 2000), as well as Paraguarí and Ñeembucú (0.48% and 0.58% respectively: almost entirely rural areas).

ADM-1	Last Census, Female	Last Census, Male	CODPS, Female	CODPS, Male	PGR(%), Female	PGR(%), Male	PGR(%), Both
Alto Paraguay	6,041	6,962	9,021	10,210	1.91	1.82	1.86
Alto Paraná	293,029	306,129	427,292	437,264	1.80	1.70	1.75
Amambay	62,452	62,407	90,007	89,682	1.74	1.73	1.73
Asunción	282,460	247,323	274,224	246,849	-0.14	-0.01	-0.08
Boquerón	20,700	22,789	34,242	36,213	2.40	2.21	2.30
Caaguazú	225,066	241,823	282,732	299,517	1.09	1.02	1.06
Caazapá	72,656	78,510	97,068	102,212	1.38	1.26	1.32
Canindeyú	70,579	80,552	118,369	129,551	2.46	2.26	2.36

ADM-1	Last Census, Female	Last Census, Male	CODPS, Female	CODPS, Male	PGR(%), Female	PGR(%), Male	PGR(%), Both
Central	721,299	704,986	1,182,129	1,146,014	2.35	2.31	2.33
Concepción	96,242	99,245	129,105	136,779	1.40	1.53	1.46
Cordillera	119,479	127,830	155,675	167,023	1.26	1.27	1.27
Guairá	92,571	98,311	113,938	120,682	0.99	0.98	0.98
Itapúa	234,734	249,072	318,279	323,969	1.45	1.25	1.35
Misiones	52,574	54,148	66,042	67,023	1.09	1.02	1.06
Ñeembucú	39,709	41,009	45,741	45,707	0.67	0.52	0.60
Paraguarí	114,664	122,600	127,075	135,707	0.49	0.48	0.48
Pdte. Hayes	42,428	45,950	65,112	69,643	2.04	1.98	2.01
San Pedro	162,815	181,186	215,867	234,578	1.34	1.23	1.29
Total	2,709,498	2,770,832	3,751,918	3,798,623	1.55	1.50	1.52

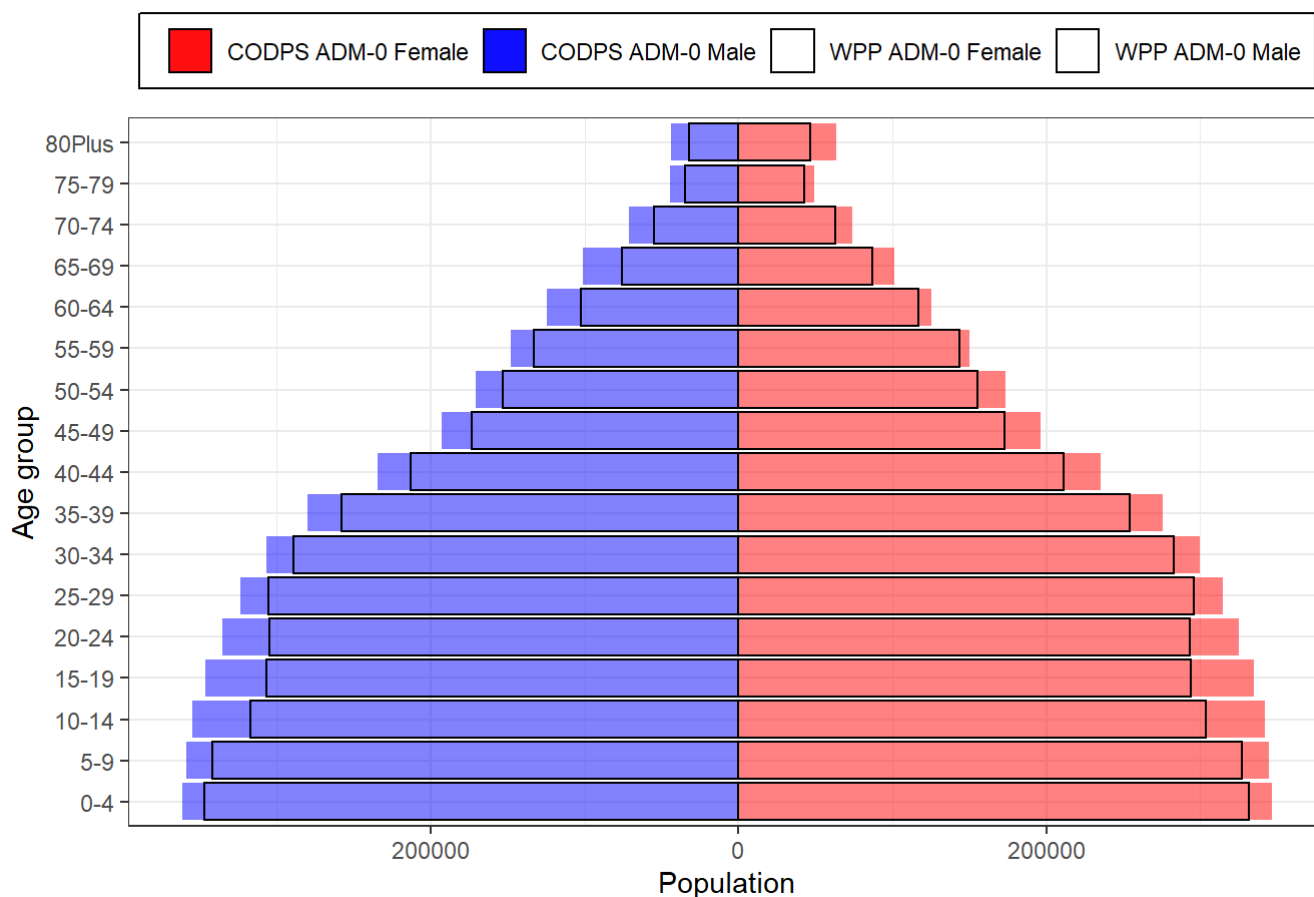## 4. Population Counts by age and sex (ADM-0)

Below, we compare the population structure across sex and age groups between the COD-PS and WPP projections at the national level.

The age- and sex-specific population counts of this COD-PS at ADM-0 are generally higher than the WPP 2022 Revision projections across all age groups at ADM-0, following from the differences in projected postcensal growth rates from 2002 to 2023 shown in the previous section.

	CODPS-WPP, Female	Difference(%)	CODPS-WPP, Male	Difference(%)
0-4	15,151	4.57	14,242	4.10
5-9	18,121	5.55	16,628	4.86
10-14	38,535	12.69	37,480	11.81
15-19	41,165	14.02	40,282	13.14
20-24	31,534	10.75	30,957	10.16
25-29	18,570	6.27	18,590	6.09
30-34	17,182	6.08	17,983	6.22
35-39	21,272	8.36	22,276	8.63
40-44	24,136	11.43	21,830	10.26
45-49	22,982	13.29	19,110	11.02
50-54	18,113	11.68	17,942	11.74
55-59	6,632	4.63	15,005	11.30

	CODPS-WPP, Female	Difference(%)	CODPS-WPP, Male	Difference(%)
60-64	9,010	7.73	22,514	22.04
65-69	14,452	16.62	24,931	32.80
70-74	11,244	17.88	16,202	29.56
75-79	6,892	16.19	9,191	26.25
80Plus	16,804	36.10	12,056	37.78

WPP ADM-0 vs CODPS ADM-0

5. Relative population size by age and sex (ADM-1)

Below, we compare the relative population proportions for 5-year age groups by sex between the COD-PS ADM-1 projections and the WPP ADM-0 projection.

While the department of Central showed the highest annual population growth rate since the last census (2.33% per year), the proportions of children are actually lower than those of the WPP ADM-0 projection, implying that there must be factors other than fertility which contribute to the high population growth rate in this department. Two ADM-1 units with low population growth rates since last census - Asuncion and Ñeembucú - exhibit relatively high proportions of working-age adults (over 35 years old) and older adults but low proportions of children and young people under 30 in comparison to other departments as well as the WPP ADM-0 projection. The departments of Caazapa, Concepcion, and San Pedro exhibit relatively high proportions of children in comparison to other departments as well as the WPP ADM-0 projection.

Alto.Paraguay

Alto.Paran□ADM1

Amambay

Asunci□

Boquer□

Caaguaz□ADM1

Caazap□ADM1

Canindey□ADM1

Central

Concepci□

Cordillera

Guair□ADM1

Itap□

Misiones

□embuc□ADM1

Paraguar□ADM1

Pdte..Hayes

San.Pedro