TECHNICAL NOTE

Estimating Education Demand in Cali, Colombia

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March 2019

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Introduction

This technical note was prepared by the World Bank's Education team as part of the Cali Safer Schools Technical Assistance. It presents the results of the analysis undertaken to calculate the projections for the calculation of public education demand projections for 2019 to 2035 in Cali as part of the planning of school infrastructure investment in the short and medium term.

This document begins with a presentation of the available data sources and reviews the quality of these sources to determine their usefulness as a reference in projecting education demand. It then describes the methodology used to project education demand and presents the results for the coming 15 years. The third section analyses the results of the projection in comparison with other indicators and discusses the implications in terms of available places to handle education demand. Finally, the operation of the calculator is described.

1. Assessment of the available data

The estimate of the school age population is the main input for the education demand projections. Using estimates of the total population of the corresponding ages, assumptions are developed to project the portion of that population that will require public sector education in the following years.

In Colombia there are two potential data sources that can be used as a reference for this approximation: official population projections prepared by the National Administrative Department on Statistics (DANE) and vital statistics on births and deaths, also compiled by DANE. A detailed description and analysis of their quality and relevance is provided below to identify the pros and cons of using either the one or the other.

Although they are the official source, the most recent available figures provided by DANE are based on the population and housing census conducted in 2005. The definitive results of the 2018 census are not yet public so updated information is not available, and it is only natural to expect gaps in the current projections since the data have not been updated between censuses and the census was three years behind schedule.

The preliminary results of the most recent census show significant gaps in the estimates of population growth trends over the past 13 years. Projections based on the 2005 census had estimated that Colombia would have around 50 million inhabitants in 2018, but the preliminary results of the more recent census estimate this figure at around 45.5 million, a gap of 9.5 percentage points. Although the actual population was expected to be lower than projected, the size of the gap was substantial: double that observed in other countries in the region.

The gap for the city of Santiago de Cali is even greater than the national gap. The preliminary data from the 2018 census indicated an overestimate in the population projections of 28.7 percent vis-à-vis the most recent calculation. While the projections based on the 2005 census estimated that there would be around 2,445,000 inhabitants in 2018, the 2018 census recorded just 1.9 million (see Figure 1). Thus, despite the fact that the population projections could, by definition, have been the most relevant data source for estimating the school age population, since they capture births, deaths, and migrations, the available versions are too outdated for use in this exercise.

FIGURE 1   Projections of the Population of Santiago de Cali: 2005 Census vs. 2018 Census (Preliminary)
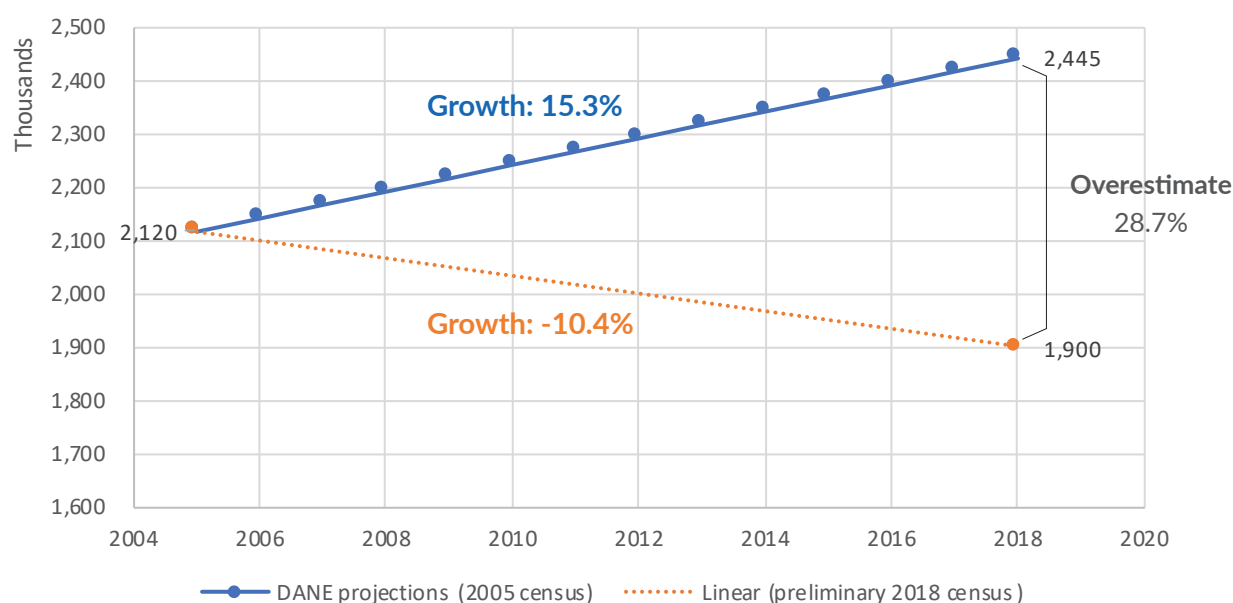
The second available data source to estimate the school age population is the Vital Statistics (EEVV), showing births and deaths. These data are obtained from the Civil Registry and Vital Statistics System, which is intended to collect data on the main events of an individual's life (birth, death, etc.). DANE produces the statistics based on administrative records obtained from live birth and death certificates prepared by doctors or authorized health officials present at such events. Other sources included are the National Institute of Legal Medicine and Forensic Sciences, which certifies deaths that have been subject to autopsies, and the Civil Registry offices, which issue certificates when the health sector is not involved.

The EEVV databases provide information by age group and place of residence at the time of birth and death from 1998[1] through 2017. It is thus possible to reconstruct growth trends for the school age population at the municipal level.[2] Although the data have limitations compared with the data from population census, as total migratory flows are not included,[3] the use of this data source appears to be the best option owing to the clear gaps in the official projections and limited migration in the Valle del Cauca, as we will see below.

The EEVV reveal demographic transition trends in Colombia in recent years and indicate that the official sources overestimated the natural growth rate of the population[4] (see Table 1). According to the EEVV, births at the national level fell 8.1 percent between 2006 and 2017, reflecting a decline in the crude birth rate of more than 5 births per 1000 inhabitants (from 19.86 per thousand in 2006 to 14 per thousand in 2017).[5] In contrast, deaths increased 18 percent over the same period, representing a decline in the crude death rate of a little less than one death per 1000 inhabitants (from 5.8 per thousand in 2006 to 5 in 2017). At the same time, Colombia shows a negative balance for migration in all years, i.e., the number of persons leaving the country has been greater than those coming in. In short, at first sight the vital statistics data show trends in line with the preliminary results of the 2018 census.

TABLE 1   Vital Statistics and Migration at the National Level 2006–2017

Year	Births	Deaths	Net Migration[6]
2006	714,450	192,814	- 142,263
2007	709,253	193,936	- 169,013
2008	715,453	196,943	- 135,216
2009	699,775	196,933	- 79,565
2010	654,627	200,524	- 108,756
2011	665,499	195,823	- 161,710
2012	676,835	199,756	- 239,936
2013	658,835	203,071	- 161,866
2014	669,137	210,051	- 139,056
2015	660,999	219,472	- 90,172
2016	647,521	223,078	- 161,926
2017	656,704	227,624	- 52,466

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[1] DANE open data provide information on births since 1998 and deaths since 1979.

[2] As there are data available for births and deaths [only] since 1998, a full picture of the population between the ages of 0 and 16 is available only from 2014.

[3] The EEVV captures births of migrant mothers and resident mothers with migrant partners.

[4] The natural growth rate is the difference between the crude birth rate and the crude death rate.

[5] The data for 2006 correspond to the crude birth rate estimated by DANE for the five-year period 2005-2010 and the data for 2017 correspond to calculations by the authors based on preliminary birth data and preliminary data from the most recent census.

[6] *Source:* Colombia Special Administrative Unit on Migration (UAEMC). DANE calculations.

The natural result of these population trends is that the school age population in Colombia has been declining (see Figure 2). This trend is not recent. Based on census snapshots, the population between 0 and 14 years of age represented 46.6 percent of the total population in 1960, while in 2018 this proportion was reduced by almost half to 22.5 percent. This trend has begun to be evident in the number of pupils registered in preschool, elementary, and lower secondary school and upper secondary school at the national level, which has been declining on an annual percentage basis since 2010.[7]

FIGURE 2   Population Participation Between Ages 0 and 14[8]
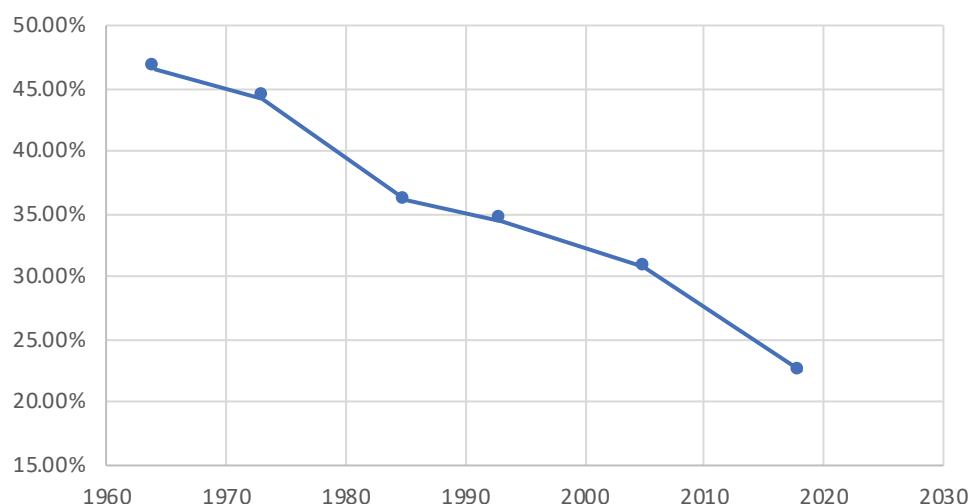
Vital statistics for Cali show the same downward trend for births as seen at the national level and little variation in death rates in the school age population (see Figures 3 and 4). Between 2005 and 2017 births declined by 20.6 percent, almost double the national decline. In contrast, during the same period, the death rate for the population between ages 0 and 4 declined by less than 0.1 percent and the death rate for the population between ages 5 and 9 and between 10 and 14 remained relatively constant.

FIGURE 3   Vital Statistics: Live Births, Residents of Cali

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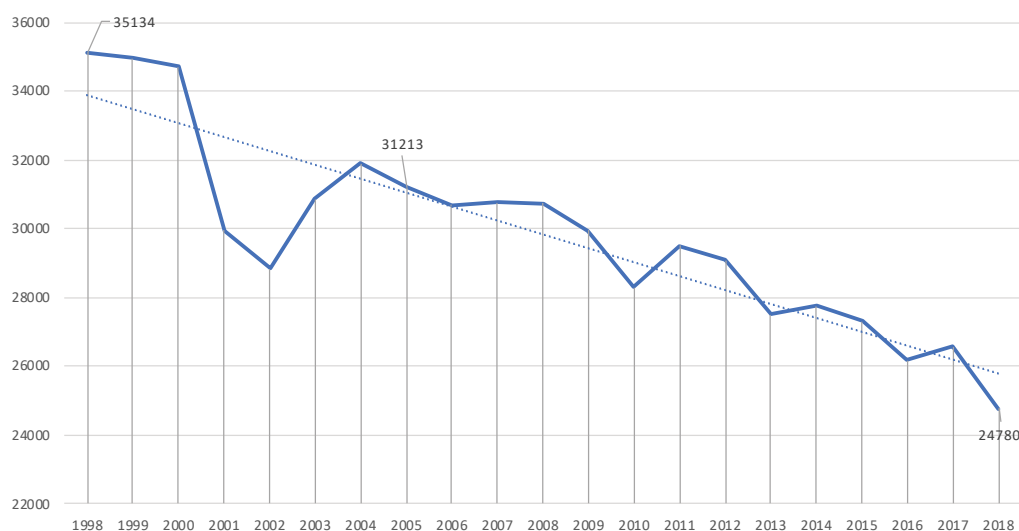
[7] *Source:* DANE, Formal Education (EDUC).

[8] *Source:* DANE. Censuses and Population.

FIGURE 4   Death Rates by Age Group, Residents of Cali[9]
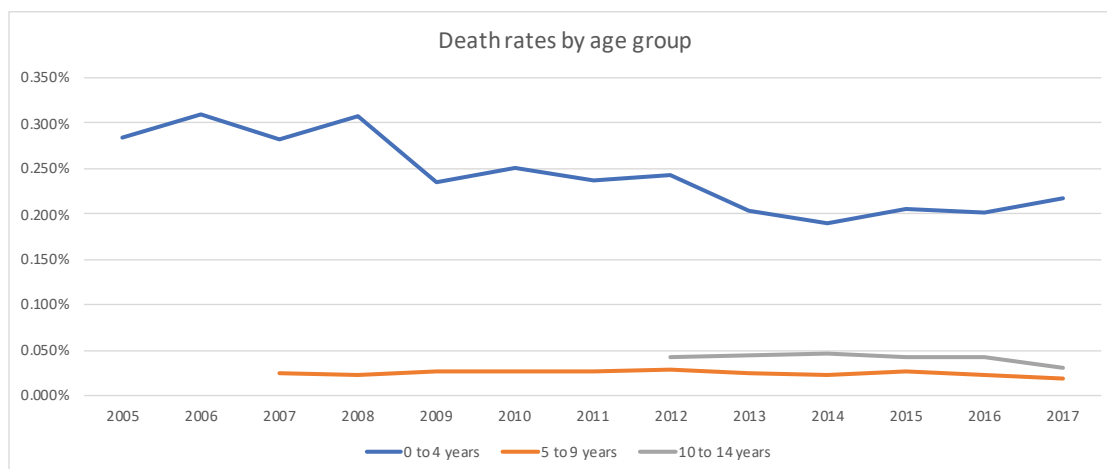
In addition to births and deaths, migration is the other key component to understanding the growth dynamics in the school age population in Cali. Net migration is the third variable, in addition to birth and death rates, that affects the reference population, since it is a factor that can increase or decrease the projected population.

The most recent data on migratory flows (internal and external) in Cali come from the 2018 census, which means that these figures are preliminary and are not disaggregated at the municipal level or by age group. Until now these data have only been published at the departmental level on an aggregated basis, so it is not possible to include them directly in the population projections for estimating education demand. However, based on the data from the Valle del Cauca, an approximation of migratory flows in Cali can be developed and used to develop assumptions for use in the estimates. It should be noted that work is being done to deal with this problem in the *School Demand Calculator*, as described in the section on this topic (see Chapter 4, page 7).

The data available on internal migration indicate that the Valle del Cauca is among the departments in Colombia with lower internal migration flows. The national analysis of flows of internal immigrants (see Figure 5: Immigrants, left-hand map; and Emigrants, right-hand map) shows that the Valle del Cauca is one of the departments in Colombia with less dynamic internal migratory flows, since it is among the departments with 10 or fewer immigrants per 1000 inhabitants and 40 or fewer emigrants per 1000 inhabitants.

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[9] *Source:* Author calculations based on EEVV data.

FIGURE 5   Internal Migration in the Valle del Cauca

Number of persons who immigrated in the past 12 months, per 1,000 inhabitants

Less than or equal to 10
11 to 16
17 to 22
Over 22

Departments with the darkest color on the map attracted population

Number of persons who emigrated in the past 12 months, per 1,000 inhabitants

Less than or equal to 40
41 to 55
56 to 75
Over 75

Departments with the darkest color on the map lost population

Source: DANE, Results of preliminary 2018 census.

The Valle del Cauca was also not one of the main poles of attraction for Venezuelan immigration to Colombia. Based on the preliminary results of the 2018 census, Venezuelan migration represented 87.9 percent of the entire international immigrant population of around 801,043 persons over the past five years. Looking at the distribution of this population at the regional level (see Figure 6), the Valle del Cauca is not among the top 10 departments receiving foreign immigrants from Venezuela. As well, based on the census of Venezuelans conducted in 2018 by the Colombian Administrative Registry of Venezuelan Migrants (RAMV), there are 16,572 Venezuelans resident in the Valle del Cauca, equivalent to 3.75 percent of the Venezuelan population with irregular status in Colombia.

As well, in recent history the Valle del Cauca has been a region with low net migratory flows. Based on census reconciliation statistics, net migration to this department in the five-year period 1995-2000 was 2.77 inhabitants per thousand, making it the fifth lowest department in the country in terms of absolute net migration. For the period 2000-2005, it was second in this ranking (net migration of -1.56 inhabitants per thousand), behind only Antioquia.

Distribution of Immigrant Population from Venezuela by Department (past 5 years)

	Norte de Santander 11.0%	Antioquia 9.4%
Bogotá, D. C. 19.1%	Bolívar 6.0% / Cundinam... 5.2%	La Guajira 5.1%
Atlántico 11.6%	Santander 5.5% / Magdalena 5.1%	Cesar 5.1%
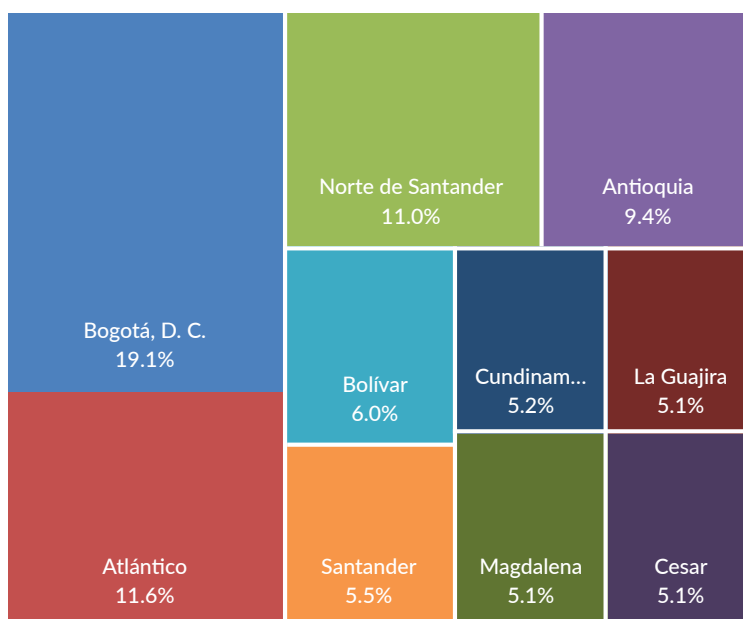
The overall trends described above result in a decline in the school age population that is reflected in the steadily declining number of registered pupils. Specifically, these trends are based on a decline in the birth rate, stable death rates in the school age population, and low immigration and emigration levels in the department, which have resulted in a decline in the enrolled population. Public enrollment fell from 270.9 thousand in 2014 to 223.8 thousand in 2018, equivalent to a decline of 17.4 percent, while private registration fell from 124.4 thousand to 118.7 thousand over the same period, a decline of 4.7 percent (see Figure 7).

Change in Public and Private Enrollment
(preschool, elementary and lower secondary, upper secondary)

Year	Private	Public
2014	124,474	270,920
2015	108,500	259,070
2016	127,073	225,548
2017	116,947	223,377
2018	118,731	223,843

■ Private ■ Public
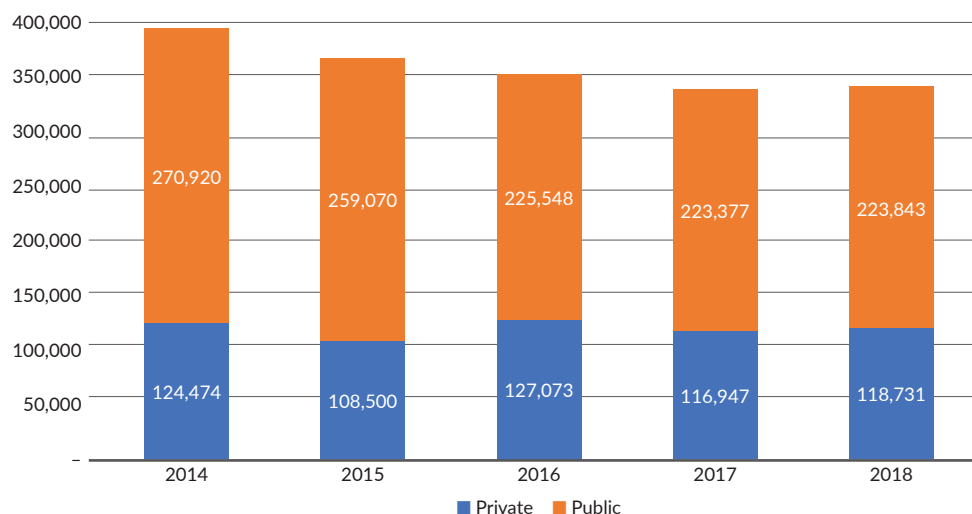
Based not only on the quality of the data but also their consistency with the preliminary results of the 2018 census and enrollment trends in recent years, the EEVV will be the point of departure for the calculation of the population projections. Given that the registration source is official birth certificates prepared by hospitals, civil registries, and even forensic medicine, this data source is considered to be relatively reliable for use as an initial reference in the calculation of the population projections. It is important to note that the estimation gaps resulting from the fact that migratory flows are not included will not be very large given the low net migration in the region, as indicated above. Moreover, the official population projections available (based on the 2005 census) show a different, occasionally opposing, trend to that revealed by the preliminary results of the 2018 census and the change in enrollment in recent years.

2. Projections of education demand

Methodology

This section describes the methodology developed to estimate the population that will demand public education over the next 17 years (2019-2035) in the municipality of Cali. The procedure was constructed on the basis of the available data sources; the relevance and feasibility of conducting the calculations and estimating the results; and the ability to update the projection calculations on the basis of new available data.

Each of the methodological steps is described below.

1. Population projections

The estimation of the school age population is divided into two parts: (i) a reconstruction of annual population totals by specific age based on vital statistics between 1998 and 2018; and (ii) an extrapolation of birth and death trends to project the population by specific age for the period 2019-2035.

The equation for the first phase of the projection is:

$$1.\ \text{Population}_{o,\ t} = \text{Live births}_t - \text{Deaths}_{0,t}$$
$$t = 1998\ \dots\ 2018$$

Iterating 1 gives:

$$2.\ \text{Population}_{e,\ t} = \text{Population}_{e-1,\ t-1} - \text{Deaths}_{0,t}$$
$$e = 1\ \dots\ 16;\ t = 1998\ \dots\ 2018$$

Equation 1 shows the method of calculating the population aged 0[10] in the year t, which is equal to the number of live births in the year t less deaths in the population aged 0 in the year t. Equation 2 is the iteration of the first equation. That is to say, the population aged e in a year t is equal to the population aged e - 1 in the year t - 1, less the deaths of the population aged e in the year t.

The equations for the second phase, i.e., projection of the population by specific age between 2019 and 2035:

$$3.\ \text{Live births}_t = \text{Live births}_t - \text{Deaths}_{t-1} * (1 + n_t)$$

$$4.\ \text{Population}_{0,t} = \text{Live births}_t * (1 - m_{0,t})$$
$$t = 2019\ \dots\ 2035$$

Iterating 4 gives:

$$5.\ \text{Population}_{e,\ t} = \text{Population}_{e-1,\ t-1} * (1 - m_{e,t})$$
$$e = 1\ \dots\ 16;\ t = 2019\ \dots\ 2035$$

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[10] Age 0 refers to children between the ages of 0 and 11 months.

Equation 3 shows the calculation of the number of live births in the year t, which is obtained from the number of live births in the year $t - 1$ multiplied by the growth rate for births[11] n in the year t. Based on the above, Equation 4 describes the calculation of the population aged 0 in the year t, which is equal to the number of live births in the year t multiplied by the mortality rate m of the population aged 0 in the year t. Iterating Equation 4 gives equation 5, which describes the calculation of the population aged e in the year t and is equal to the population aged $e - 1$ in the year $t - 1$ multiplied by the mortality rate m for the population aged e in the year t.

2. Estimate of public education demand by education level: Ceteris paribus scenario

The estimates by education level are based on the population of the theoretical age for a specific educational level and the population that is over or under age for that education level. The theoretical ages established by the Ministry of National Education (MEN) are used as a reference. The ratio between levels and theoretical ages is shown in the following table.

TABLE 2   Range of Legal Ages and/or Official Ages[12]

Education Levels	Grades	Theoretical Ages
Preschool	Pre-nursery, Nursery and Transition	3 to 5 years[13]
Primary	First to fifth	6 to 10 years
Lower secondary	Sixth to ninth	11 to 14 years
Upper secondary	Eleventh and twelfth	15 and 16 years

Equations 6 and 7 below describe the calculation of demand by education level for each year of the projection:

$$6.\ Public\ education\ demand_{n,\ t} = School - age\ population_{n,\ t*}$$
$$Gross\ public\ coverage_{n,\ t*}$$

$$7.\ Gross\ public\ coverage_{n,\ t*} = \left(\frac{Enrollment_{n,\ t*}}{School\text{-}age\ population_{n,\ t*}} \right)$$

$$n = Child\ Development\ Centers\ (CDIs),\ Preschool,\ Primary,\ Lower\ Secondary,\ Upper\ Secondary$$
$$t = 2019 \ldots 2035$$

Equation 6 specifies that education demand for the level n in projection year t corresponds to the population of the theoretical age for level n in year t multiplied by the gross coverage rate for that level, where the public gross coverage rate[14] corresponds to the ratio between the number of students in public education enrolled at an education level versus the population of the theoretical age for that education level.

The logic behind the use of gross coverage as an indicator to measure education demand is based on the fact that it includes repetition and late or early enrollment in the school system. This indicator, in synergy with population projections, indicates the capacity that the public education system will need to have to meet the social demand for public education in the coming years, regardless of the age at a specific level of education.

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[11] The birth and death rates are extrapolated on the basis of historical data, using the trend that best reflects the data.

[12] *Source:* National System of Education Indicators for Preschool, Elementary and Lower Secondary School and Upper Secondary School in Colombia. MEN.

[13] The National System of Education Indicators does not include a theoretical age range for preschool, so the age ranges for this level are determined by extrapolating from the current regulations.

[14] *Gross public coverage* is not an official indicator nor is it extensively used and its name constitutes an intuitive way of labeling this component of the equation for the projection of education demand

It should be noted that *gross public coverage* in the year *t** corresponds to the ratio between the most recent annual data available for *public enrollment* and the *population of school age* in that year.[15] It is impossible to understand or predict the behavior of this indicator based on its historical data. This is because birth data have been public only since 1998, which means that a complete reconstruction of the school age population (between 5 and 16 years) is not available until 2014. Moreover, an analysis using the existing data shows that the results are very sensitive to the number of years used for the projection and tend to be counterintuitive.

3. Estimate of potential public demand by education level: Total coverage scenario

This scenario seeks to estimate the number of available places needed if public education is to absorb the entire school age population that is outside the education system. This means that this scenario is equivalent to the estimates of education demand in the *ceteris paribus* scenario plus an estimate of the unschooled population. Equations 8 and 9 below show the calculation for the *total coverage* scenario:

$$8.\ Total\ coverage_{n,\ t} = Public\ education\ demand_{n,\ t} +$$
$$Population\ outside\ the\ system_{n,\ t}$$

$$9.\ Population\ outside\ the\ system_{n,\ t} = Population\ of\ theoretical\ age_{n,\ t} * pfs_{n,2018}$$

$$n= Preschool,\ Primary,\ Lower\ Secondary,\ Upper\ Secondary^{16}$$
$$t = 2019\ \ldots\ 2035$$

Based on equation 8, total coverage is equal to public education demand for level n in year t plus the population outside the system of the theoretical age to be enrolled in level n (see table 2), which in turn is equal to the (total) population of the theoretical age to be enrolled in level n in year t multiplied by the share of the school age population for level n outside the system in 2018 ($pfs_{n,2018}$).

4. Projections of demand by commune

The projections of demand by commune require additional assumptions to distribute education demand by level in these administrative subdivisions. The projection calculator makes it possible to approximate this scenario from two different perspectives: the first using the distribution of public enrollment by commune from the Integrated Enrollment System (SIMAT) and the second using the distribution of municipal population projections by commune.[17] Both are described in greater detail below, indicating the implications of their use.

i. <u>Distribution of enrollment based on SIMAT</u>: Using the share of total public enrollment (in preschool, elementary and lower secondary, and upper secondary school) in each commune, the results of the projections will reflect the geographic distribution of the education supply. This means that it will show the availability of infrastructure in each commune and not necessarily the capacity required in the system to cope with demand.

ii. <u>Distribution of the population based on the 2005 census</u>:[18] Using the population distribution by commune, the results of the projections will reflect social demand for education in each commune, without taking into consideration the spatial restrictions resulting from the location of education infrastructure.[19]

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[15] This parameter can be updated in the calculator by inputting the annual public enrollment data.

[16] The total coverage scenario does not include child development centers (CDIs) owing to the lack of data on the ages of the pupils enrolled in the centers.

[17] It should be noted that both options are available in the calculator, for both the *ceteris paribus* scenario and the *total coverage* scenario.

[18] *Source:* Population projections by neighborhood, commune, and district 2006-2020/Harold Banguero/DAP, DAP calculations.

[19] Despite the fact that the population projections based on the 2005 census have clear gaps, the bias they produce is not necessarily correlated with possible biases in the distribution of the population by commune. In fact, the Pearson correlation coefficient between the number of births by commune and the number of inhabitants by commune in 2017 is 0.87, an indicator that supports this hypothesis.

The differences between the results using the SIMAT and DANE population distributions can be attributed the spatial gaps between education supply and demand. Using the data from both sources will provide an understanding of the degree of oversupply or saturation of demand in a particular commune (e.g., if the education demand estimate based on enrollment is higher than the estimate based on population in a particular commune, this can be seen as education oversupply, given that the number of available places is higher than those needed to serve the school population in this commune).

Results

This section presents the results of the education demand projections under the *ceteris paribus* and total coverage scenarios (including projections of the school population outside the system). The figures shown below correspond to totals for the municipality of Cali, although the *Demand Projection Calculator in Excel* can be used to disaggregate the results by urban and rural area. The results of the population and education demand projections by commune can also be found in the calculator.

The results of the projections show that education demand will continue to decline in the coming years as a result of the decline of the school age population. Overall, it is estimated that education demand will have declined by 20 percent in 2035 from the level in 2017, which would represent 45,534 fewer pupils in CDIs, preschool, elementary and lower secondary school, $pfs_{n,2018}$ and upper secondary school.

FIGURE 8   Demand Projections: Ceteris Paribus Scenario

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
■ Upper secondary	28,694	30,164	30,327	29,790	29,581	29,597	29,217	28,053	27,904	28,267	27,298	26,716	26,614	25,829	25,488	24,757	24,034	23,999
■ Lower secondary	84,579	83,941	83,101	81,265	80,531	79,639	78,013	77,475	76,078	74,169	73,475	71,321	69,795	68,763	67,552	67,165	66,582	66,073
■ Primary	15,290	15,428	15,176	14,549	14,742	13,759	13,876	13,726	13,599	13,489	13,392	13,305	13,226	13,154	13,088	13,027	12,970	12,917
■ Preschool	95,280	93,296	91,948	91,365	89,237	87,620	85,850	84,064	82,327	81,212	79,711	79,294	78,624	78,038	77,517	77,048	76,621	76,230
■ CDIs	6,426	6,311	6,183	6,064	5,986	5,883	5,851	5,803	5,761	5,724	5,690	5,659	5,631	5,605	5,580	5,557	5,536	5,516

Compared with the total coverage scenario, the estimates of the school age population outside the system show that in 2018 there were 46,039 children and young people between the ages of 5 and 16 in this situation. If children aged 3 and 4 who do not attend early education (pre-nursery and nursery) are included, the figure rises to around 99,000. However, under the scenario in which coverage rates are maintained at today's levels, it is also expected that this population will decline in the coming years.

FIGURE 9 Population Outside the Education System

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Upper secondary	4,286	4,286	4,510	4,539	4,459	4,425	4,428	4,373	4,202	4,171	4,230	4,089	3,996	3,983	3,868	3,812	3,709	3,596
Lower secondary	8,505	8,432	8,348	8,189	8,107	8,001	7,837	7,805	7,659	7,461	7,396	7,189	7,028	6,927	6,784	6,751	6,691	6,639
Primary	18,505	18,117	17,850	17,736	17,322	17,009	16,663	16,312	15,982	15,768	15,481	15,399	15,270	15,156	15,056	14,965	14,882	14,807
Preschool	67,705	66,611	65,619	63,509	62,526	61,006	60,776	60,203	59,709	59,274	58,886	58,536	58,216	57,922	57,650	57,397	57,160	56,938

FIGURE 10 Demand Projections: Total Coverage Scenario

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Upper secondary	32,980	34,450	34,837	34,329	34,039	34,023	33,645	32,426	32,106	32,438	31,528	30,805	30,610	29,812	29,356	28,569	27,743	27,594
Lower secondary	93,084	92,373	91,450	89,453	88,638	87,640	85,850	85,281	83,737	81,631	80,872	78,510	76,823	75,690	74,337	73,916	73,273	72,712
Primary	111,90	109,56	107,98	107,29	104,79	102,89	100,81	98,716	96,683	95,376	93,617	93,127	92,340	91,652	91,040	90,490	89,989	89,530
Preschool	82,995	82,039	80,795	78,059	77,268	74,764	74,652	73,929	73,308	72,763	72,278	71,840	71,442	71,076	70,738	70,424	70,131	69,855

3. Conclusions drawn from the results

Public education demand projected for the coming years shows a downward trend caused primarily by the decline in the school age population. As described in the previous sections, this trend contrasts with the population projections from the 2005 census, which are the official sources used to measure school coverage.

Using vital statistics to recalculate the gross and net coverage rates in recent years provides better results for these indicators. Given that the formulas for these rates use the population at the theoretical age for the education level in question as the denominator, which is based on the population projections (2005 census), overestimates result when the official sources are used. It should be noted that in the case of gross coverage, the numerator of the formula is the total number of students enrolled at the corresponding education level *n*, while net coverage refers to the population at the official age range *e* for that level, as shown below:

FIGURE 11   Definitions of Gross and Net Coverage, DANE

Gross coverage

$$TCB_{n,\,t} = \frac{M_{n,\,t}}{P_{e,n,\,t}}$$

$M_{n,t}$ Number of pupils enrolled in education level *n*.

$M_{e,n,t}$ Enrollment in education level *n* at the official age *e* for that education level.

$P_{e,n,t}$ Population at the theoretical age *e* for education level *n*.

Net coverage

$$TCN_{n,\,t} = \frac{M_{e,n,t}}{P_{e,n,\,t}}$$

e   Official age, regulatory age range, theoretical age (up to two years more).
  • age 5 (transition)
  • ages 6 to 10 (primary)
  • ages 11 to 14 (lower secondary)
  • ages 15 and 16 (upper secondary)

The gross and net coverage rates based on vital statistics are higher than those calculated using the 2005 census at all education levels. As can be seen in Figure 8, in the gross coverage rates this difference ranges from 17 to 20 percentage points at each education level. In the net coverage estimates, this difference, comparing the indicators based on vital statistics and the 2005 projections (2005 census), is maintained at the transitional and primary levels, while it is 16 percentage points at the lower and upper secondary levels.

The results of the education demand projections predict an increase in the capacity of the education system compared with the school age population. This will make it possible to guarantee that the population currently enrolled in the public education system will be able to continue its education path in the coming years. It also facilitates the transition to a single shift (full school day) as the capacity will increase from year to year compared with the current system. Third, it provides options for developing policies for the integration of the school age population that is not in the public or private system for socioeconomic reasons.

FIGURE 12   Gross and Net Coverage: 2005 Census vs. Vital Statistics (EEVV)
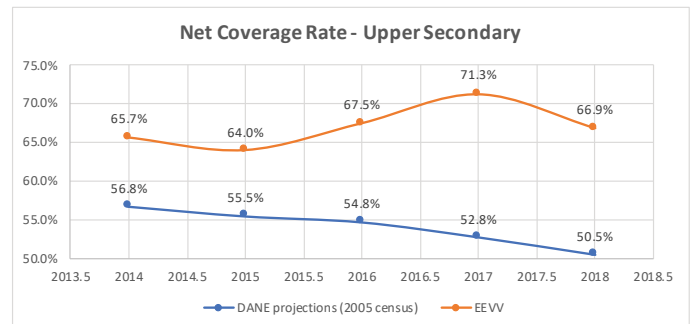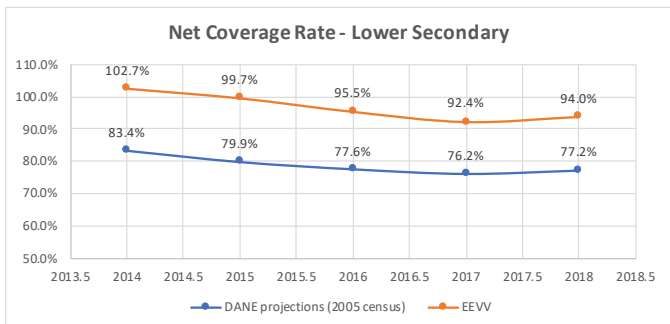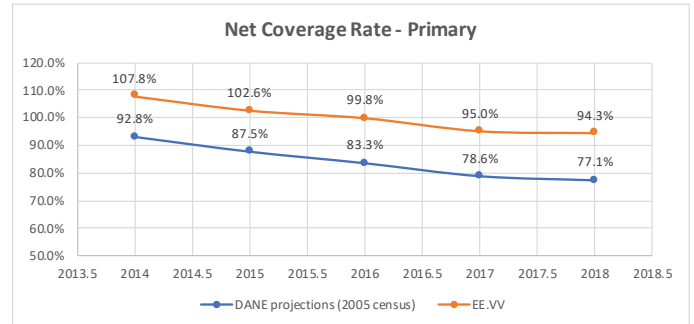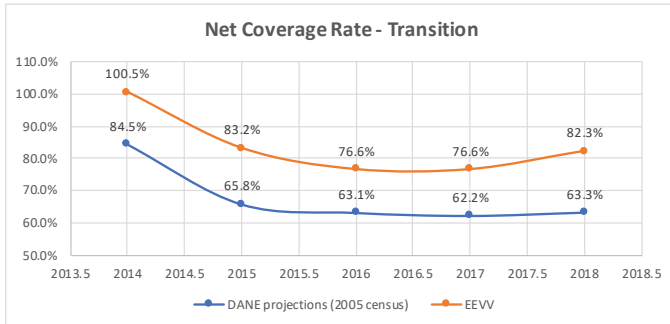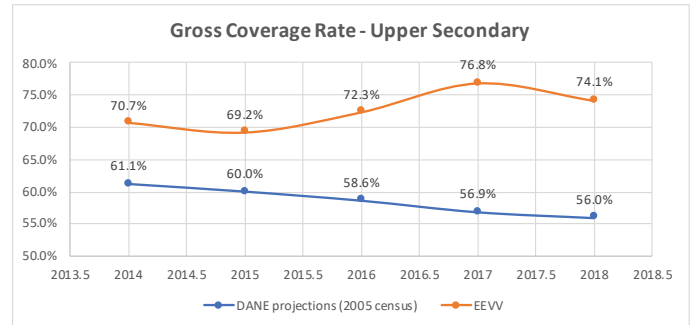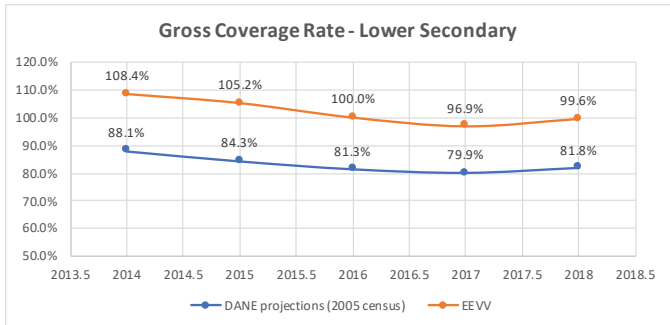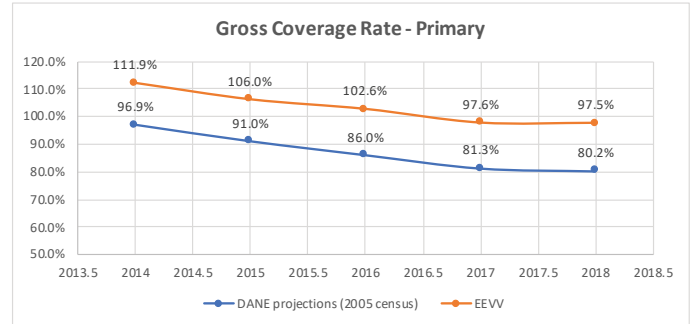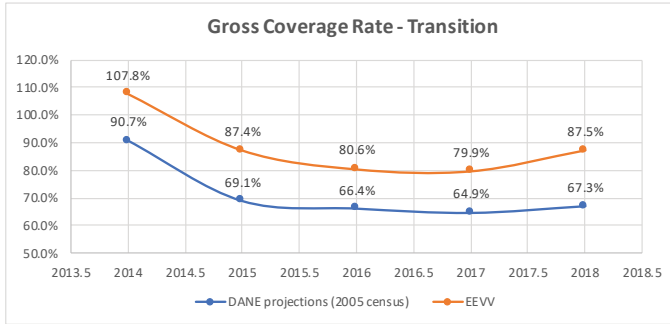
Following on from the above, Figure 13 shows that not only will the capacity of the system to move toward a single shift system improve, but its capacity to absorb the population outside the education system will also improve. Using maximum enrollment over the past five years as a proxy for the capacity of the system, the figure shows (in orange) the deficit or surplus places that would exist in the coming years if the population outside the education system were included and (in blue) the number of available places if only education demand under current coverage is taken into account. As the orange columns show, in the initial years the system cannot include the entire school age population and has a capacity deficit. As time passes, owing to the decline in the school age population, the system with its current capacity would be able to absorb this population and even show a surplus of places. As well, the blue columns show that, with current coverage maintained, the number of available places will steadily grow and thus indicate a greater capacity to transit to a single shift system.

FIGURE 13 Capacity of the System to Absorb the Population Outside the System
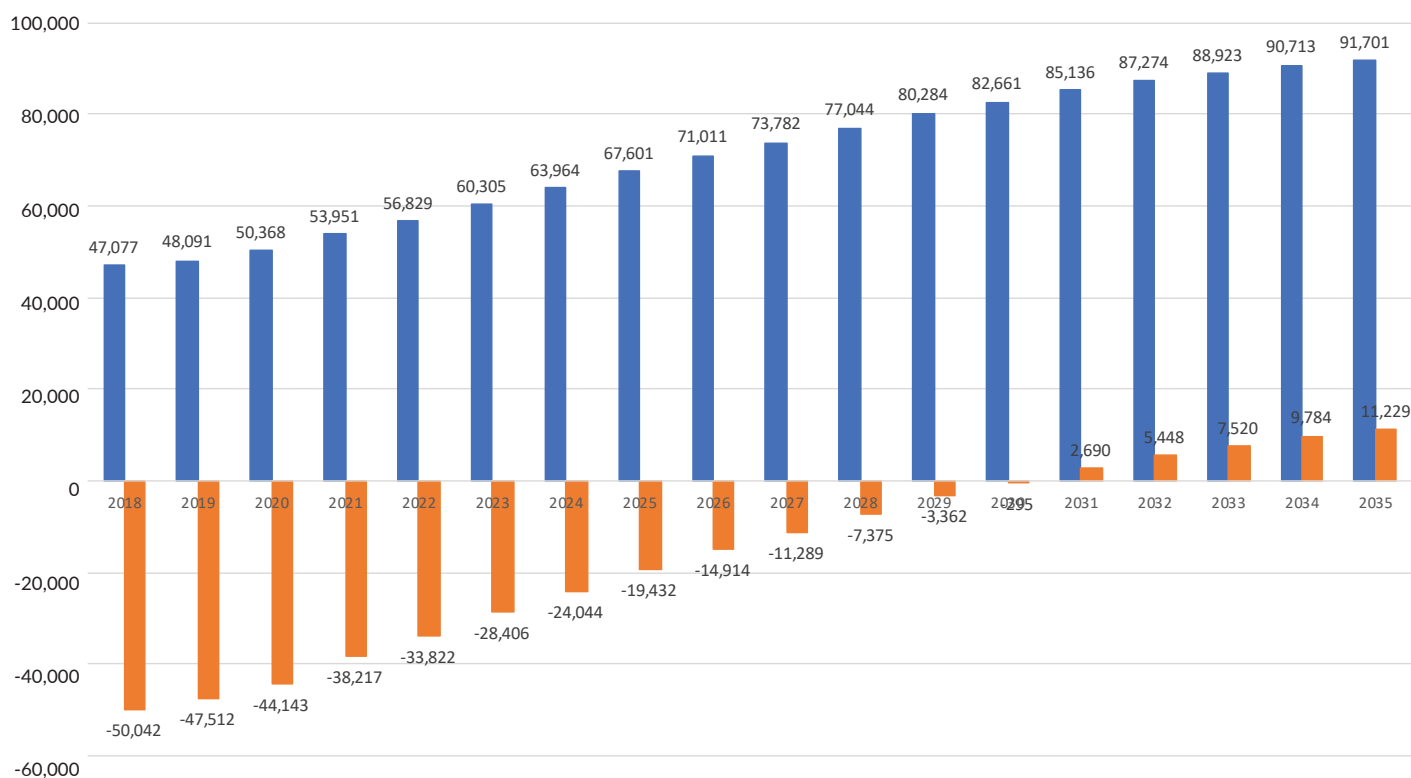
4. Description and use of the education demand calculator

This section describes the various components of the *Education Demand Calculator* for the period 2019 to 2035 in Cali. This calculator is constructed in Excel so that it can operate on any computer and be manipulated by the decision makers concerned.

This tool will be described in sections, representing the various sheets in the Excel file, indicating the components of each and explaining how they relate to each other. First the data sources, calculations for projecting demand, and results sections are presented.

Then, the sections corresponding to the education demand projections under the *ceteris paribus* scenario will be presented, followed by the sections corresponding to the *total coverage* scenario, estimates for the *CDI demand* projections and additional approximations to calculate *additional distributions* by commune, education level, and urban-rural populations.

It should be noted that the figures in this section are shown in "landscape" view so that the technical team can easily identify them. However, it is recommended that the calculator be viewed at the same time as this chapter is read, so that the references to the formulas in each section can be related to the data sources and subsequent formulas, through to the results of the education demand estimates.

1. Description of the calculator for *ceteris paribus* estimates

As described in the methodology, the education demand projections are based on projections of the changes in the age cohorts based on flows of births and deaths. In cells C89 to X112 on the sheet entitled "1B. Population Projections" data are copied from the official sources on birth flows between 1998 and 2018. Cells Y89 to AS112 show the calculation of death flows during the same period. Using these data, the vital statistics for each generation is calculated in the section from C89 to X112 without estimating migratory effects, as shown in Figure 14.

FIGURE 14 Registrations of Births and Deaths and Vital Statistic Projections

Projection of cohort changes (birth and death flows, EEVV)

Cali - 76001

Birth flows

Age/Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
0 to 5 months	18348	17679	17625	14658	14593	15837	16093	15750	15829	15499	15638	15062	14270	15422	14908	14141	14310	14035	13070	13620	12701
6 to 11 months	16786	17275	17072	15294	14249	15030	15798	15463	14858	15271	15111	14878	14026	14074	14172	13355	13440	13283	13110	12953	12079
1		35134	34954	34697	29952	28842	30867	31891	31213	30687	30770	30749	29940	28296	29496	29080	27496	27750	27318	26180	26573
2			35134	34954	34697	29952	28842	30867	31891	31213	30687	30770	30749	29940	28296	29496	29080	27496	27750	27318	26180
3				35134	34954	34697	29952	28842	30867	31891	31213	30687	30770	30749	29940	28296	29496	29080	27496	27750	27318
4					35134	34954	34697	29952	28842	30867	31891	31213	30687	30770	30749	29940	28296	29496	29080	27496	27750
5						35134	34954	34697	29952	28842	30867	31891	31213	30687	30770	30749	29940	28296	29496	29080	27496
6							35134	34954	34697	29952	28842	30867	31891	31213	30687	30770	30749	29940	28296	29496	29080
7								35134	34954	34697	29952	28842	30867	31891	31213	30687	30770	30749	29940	28296	29496
8									35134	34954	34697	29952	28842	30867	31891	31213	30687	30770	30749	29940	28296
9										35134	34954	34697	29952	28842	30867	31891	31213	30687	30770	30749	29940
10											35134	34954	34697	29952	28842	30867	31891	31213	30687	30770	30749
11												35134	34954	34697	29952	28842	30867	31891	31213	30687	30770
12													35134	34954	34697	29952	28842	30867	31891	31213	30687
13														35134	34954	34697	29952	28842	30867	31891	31213
14															35134	34954	34697	29952	28842	30867	31891
15																35134	34954	34697	29952	28842	30867
16																	35134	34954	34697	29952	28842
17																		35134	34954	34697	29952
18																			35134	34954	34697
19																				35134	34954
20																					35134

FIGURE 14 Registrations of Births and Deaths and Vital Statistic Projections (Cont.)

	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS
89	Birth flows																					
90	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
91	450	500	455	462	382	339	409	303	340	337	374	263	283	265	270	223	214	213	216	13620	12701
92	68	75	60	70	51	35	48	37	44	34	38	34	33	23	24	23	23	29	22	12953	12079
93	74	48	43	42	32	47	35	46	38	28	27	28	28	22	30	20	9	17	16	26180	26573
94	18	22	20	18	20	22	16	13	16	12	11	11	9	13	10	8	7	9	7	27318	26180
95	18	22	20	18	20	22	16	13	16	12	11	11	9	13	10	8	7	9	7	27750	27318
96	18	22	20	18	20	22	16	13	16	12	11	11	9	13	10	8	7	9	7	27496	27750
97	12	11	12	12	12	11	11	10	10	8	7	8	8	8	9	8	7	8	7	29080	27496
98	12	11	12	12	12	11	11	10	10	8	7	8	8	8	9	8	7	8	7	29496	29080
99	12	11	12	12	12	11	11	10	10	8	7	8	8	8	9	8	7	8	7	28296	29496
100	12	11	12	12	12	11	11	10	10	8	7	8	8	8	9	8	7	8	7	29940	28296
101	12	11	12	12	12	11	11	10	10	8	7	8	8	8	9	8	7	8	7	30749	29940
102	18	17	19	16	15	16	18	12	13	14	16	14	15	14	13	14	14	13	13	30770	30749
103	18	17	19	16	15	16	18	12	13	14	16	14	15	14	13	14	14	13	13	30687	30770
104	18	17	19	16	15	16	18	12	13	14	16	14	15	14	13	14	14	13	13	31213	30687
105	18	17	19	16	15	16	18	12	13	14	16	14	15	14	13	14	14	13	13	31891	31213
106	18	17	19	16	15	16	18	12	13	14	16	14	15	14	13	14	14	13	13	30867	31891
107	89	103	92	106	100	94	85	74	72	76	74	92	92	95	94	100	85	85	69	28842	30867
108	89	103	92	106	100	94	85	74	72	76	74	92	92	95	94	100	85	85	69	29952	28842
109	89	103	92	106	100	94	85	74	72	76	74	92	92	95	94	100	85	85	69	34697	29952
110	89	103	92	106	100	94	85	74	72	76	74	92	92	95	94	100	85	85	69	34954	34697
111	89	103	92	106	100	94	85	74	72	76	74	92	92	95	94	100	85	85	69	35134	34954
112	103	126	133	135	125	118	136	106	100	97	98	107	110	103	110	117	98	108	92		35134

FIGURE 14 Registrations of Births and Deaths and Vital Statistic Projections (Cont.)

	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN
89	Projections of vital statistics, *excluding migration*																				
90	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
91	17898	17179	17170	14196	14211	15498	15684	15447	15489	15162	15264	14799	13987	15157	14638	13918	14096	13822	12854	13391	12478
92	16718	17200	17012	15224	14198	14995	15750	15426	14814	15237	15073	14844	13993	14051	14148	13332	13417	13254	13088	12937	12061
93		34568	34336	34140	29388	28362	30458	31388	30835	30275	30372	30309	29615	27958	29178	28766	27241	27496	27060	25918	26306
94			34548	34318	34120	29366	28346	30445	31372	30823	30264	30361	30300	29602	27948	29170	28759	27232	27489	27053	25911
95				34530	34298	34098	29351	28333	30429	31360	30813	30254	30352	30287	29592	27940	29163	28750	27224	27481	27045
96					34510	34277	34083	29337	28317	30417	31350	30802	30244	30339	30277	29584	27933	29154	28742	27217	27474
97						34500	34266	34073	29327	28309	30410	31342	30794	30236	30330	30269	29577	27925	29147	28737	27211
98							34489	34256	34063	29319	28301	30402	31333	30786	30227	30323	30262	29569	27918	29141	28731
99								34479	34246	34055	29312	28293	30393	31325	30777	30220	30316	30254	29562	27912	29135
100									34469	34238	34047	29304	28285	30385	31316	30769	30213	30307	30247	29556	27907
101										34461	34230	34039	29296	28277	30376	31309	30762	30205	30301	30241	29551
102											34445	34216	34024	29282	28264	30362	31295	30750	30192	30291	30232
103												34431	34201	34011	29269	28250	30348	31282	30737	30183	30282
104													34416	34188	33997	29255	28236	30336	31270	30728	30173
105														34402	34174	33983	29241	28223	30323	31260	30718
106															34389	34160	33969	29228	28210	30314	31251
107																34288	34075	33885	29159	28151	30263
108																	34203	33990	33815	29099	28100
109																		34119	33921	33756	29048
110																			34049	33861	33705
111																				33990	33811
112																					33910

These values are used to construct the annual school age population totals by specific age based on vital statistics data from 1998 to 2018. To extrapolate these trends in order to project the population by age, n, for the period 2019-2035, the mortality rate (described in Y65 to AO86) is subtracted from the cohort for the previous year, $n - 1$, and the formula is established for weighting by the net migration rate by age (described in D32 to AA53), as shown in Figure 15.

FIGURE 15 Net Migration Rates by Age

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
31		Net migration rates by age														
32		Age/Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
33		0 to 11 months														
34		1														
35		2														
36		3														
37		4														
38		5														
39		6														
40		7														
41		8														
42		9														
43		10														
44		11														
45		12														
46		13														
47		14														
48		15														
49		16														
50		17														
51		18														
52		19														
53		20														
54	Note: Input data as percentage rates															

The table on migration rates shown above includes an area highlighted in yellow, indicating a space that can be updated once data on net migratory flows by age are available.

The result of these calculations is shown in cells K6 to AA28 of the same section of the calculator, which provides population projections by age, as shown in Figure 16.

Using the results shown in Figure 16, "1A. Projections by Grade" links these results and reorganizes them by grade and schooling level on the basis of the corresponding ages in each. This section is also designed to be updatable in the event that more recent data are available, which is why it is highlighted in yellow, as shown in Figure 17.

FIGURE 16 Population Projections by Age (EEVV)

Annex 1B. Population Projections

Population projections by age (EEVV)

Age/Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
0 to 11 months	28786	27250	27513	27076	25942	26328	24539	24757	24488	24261	24064	23890	23735	23595	23466	23348	23239	23138	23042	22953	22869	22789	22714	22642
1	29178	28766	27241	27496	27060	25918	26306	24518	24736	24468	24241	24044	23871	23716	23575	23447	23329	23220	23119	23023	22934	22850	22770	22695
2	27948	29170	28759	27232	27489	27053	25911	26299	24511	24729	24461	24234	24037	23864	23709	23568	23440	23322	23213	23112	23017	22928	22843	22764
3	29592	27940	29163	28750	27224	27481	27045	25903	26291	24505	24722	24454	24227	24031	23857	23702	23562	23434	23316	23207	23105	23010	22921	22837
4	30277	29584	27933	29154	28742	27217	27474	27038	25896	26284	24498	24716	24447	24220	24024	23851	23696	23555	23427	23310	23201	23099	23004	22915
5	30330	30269	29577	27925	29147	28737	27211	27468	27032	25891	26279	24493	24710	24442	24215	24019	23846	23691	23550	23422	23305	23196	23094	22999
6	30227	30323	30262	29569	27918	29141	28731	27206	27462	27026	25885	26273	24488	24705	24437	24210	24014	23841	23686	23546	23418	23300	23191	23089
7	30777	30220	30316	30254	29562	27912	29135	28725	27200	27457	27021	25880	26268	24483	24700	24432	24205	24009	23836	23681	23541	23413	23295	23186
8	31316	30769	30213	30307	30247	29556	27907	29129	28719	27194	27451	27015	25875	26262	24478	24695	24427	24200	24004	23831	23676	23536	23408	23290
9	30376	31309	30762	30205	30301	30241	29551	27901	29124	28713	27189	27446	27010	25870	26257	24473	24690	24422	24196	23999	23826	23671	23531	23403
10	28264	30362	31295	30750	30192	30291	30232	29541	27892	29115	28704	27181	27437	27002	25862	26249	24465	24683	24415	24188	23992	23819	23664	23524
11	29269	28250	30348	31282	30737	30183	30282	30223	29532	27884	29106	28696	27172	27429	26993	25854	26241	24458	24675	24407	24181	23985	23812	23657
12	33997	29255	28236	30336	31270	30728	30173	30273	30213	29523	27875	29097	28687	27164	27420	26985	25846	26233	24450	24667	24400	24173	23977	23804
13	34174	33983	29241	28223	30323	31260	30718	30164	30263	30204	29514	27867	29088	28678	27156	27412	26977	25838	26225	24443	24660	24392	24166	23970
14	34389	34160	33969	29228	28210	30314	31251	30709	30155	30254	30195	29505	27858	29079	28669	27148	27404	26969	25830	26217	24435	24652	24385	24159
15		34288	34075	33885	29159	28151	30263	31199	30658	30105	30204	30145	29456	27812	29031	28622	27102	27358	26924	25787	26173	24395	24611	24344
16			34203	33990	33815	29099	28100	30209	31143	30603	30051	30150	30091	29403	27762	28978	28570	27054	27309	26875	25741	26126	24351	24567
17				34119	33921	33756	29048	28051	30156	31089	30550	29998	30097	30038	29352	27714	28928	28520	27007	27261	26829	25696	26081	24309
18					34049	33861	33705	29005	28009	30111	31042	30504	29953	30052	29993	29308	27672	28885	28478	26966	27221	26789	25658	26042
19						33990	33811	33655	28961	27967	30066	30996	30458	29909	30007	29949	29264	27631	28842	28435	26926	27180	26749	25619
20							33910	33732	33576	28894	27902	29996	30923	30387	29839	29937	29878	29196	27566	28774	28369	26863	27116	26686
							615303	605704	596020	586276	581020	576578	569889	562140	554803	547901	540797	533656	527109	522106	515817	509862	505342	500502

Note: The population corresponds to December of each year.

FIGURE 17 Annex 1A. Projections by Grade

Annex 1A. Projections by Grade

Education level	Grade	Theoretical ages (years)																					
		0	27,513	27,076	25,942	26,320	24,532	24,750	24,482	24,254	24,058	23,884	23,729	23,588	23,460	23,342	23,233	23,131	23,036	22,947	22,863	22,783	22,708	22,636
		1	27,241	27,496	27,060	25,918	26,298	24,512	24,730	24,461	24,234	24,038	23,864	23,709	23,569	23,441	23,323	23,214	23,112	23,017	22,928	22,844	22,764	22,689
		2	28,759	27,232	27,489	27,053	25,911	26,291	24,505	24,723	24,454	24,227	24,031	23,858	23,702	23,562	23,434	23,316	23,207	23,106	23,011	22,921	22,837	22,758
Preschool	Pre-nursery	3	29,163	28,750	27,224	27,481	27,045	25,903	26,283	24,498	24,716	24,448	24,221	24,024	23,851	23,696	23,556	23,428	23,310	23,201	23,099	23,004	22,915	22,831
	Nursery	4	27,933	29,154	28,742	27,217	27,474	27,038	25,896	26,276	24,491	24,709	24,441	24,214	24,018	23,844	23,689	23,549	23,421	23,303	23,194	23,093	22,998	22,909
	Transition	5	29,577	27,925	29,147	28,737	27,211	27,468	27,032	25,891	26,271	24,486	24,704	24,436	24,209	24,012	23,839	23,684	23,544	23,416	23,298	23,189	23,088	22,993
Basic Primary	1°	6	30,262	29,569	27,918	29,141	28,731	27,206	27,462	27,026	25,885	26,265	24,481	24,699	24,431	24,204	24,008	23,834	23,680	23,539	23,411	23,294	23,185	23,083
	2°	7	30,316	30,254	29,562	27,912	29,135	28,725	27,200	27,457	27,021	25,880	26,260	24,476	24,694	24,426	24,199	24,003	23,830	23,675	23,535	23,407	23,289	23,180
	3°	8	30,213	30,307	30,247	29,556	27,907	29,129	28,719	27,194	27,451	27,015	25,875	26,254	24,471	24,689	24,421	24,194	23,998	23,825	23,670	23,530	23,402	23,284
	4°	9	30,762	30,205	30,301	30,241	29,551	27,901	29,124	28,713	27,189	27,446	27,010	25,870	26,249	24,466	24,684	24,416	24,189	23,993	23,820	23,665	23,525	23,397
	5°	10	31,295	30,750	30,192	30,291	30,232	29,541	27,892	29,115	28,704	27,181	27,437	27,002	25,862	26,241	24,459	24,676	24,408	24,182	23,986	23,813	23,658	23,518
Basic Lower Secondary	6°	11	30,348	31,282	30,737	30,183	30,282	30,223	29,532	27,884	29,106	28,696	27,172	27,429	26,993	25,854	26,233	24,451	24,668	24,401	24,174	23,978	23,805	23,651
	7°	12	28,236	30,336	31,270	30,728	30,173	30,273	30,213	29,523	27,875	29,097	28,687	27,164	27,420	26,985	25,846	26,225	24,444	24,661	24,393	24,167	23,971	23,798
	8°	13	29,241	28,223	30,323	31,260	30,718	30,164	30,263	30,204	29,514	27,867	29,088	28,678	27,156	27,412	26,977	25,838	26,217	24,436	24,653	24,386	24,160	23,964
	9°	14	33,969	29,228	28,210	30,314	31,251	30,709	30,155	30,254	30,195	29,505	27,858	29,079	28,669	27,148	27,404	26,969	25,830	26,209	24,429	24,646	24,378	24,152
Upper Secondary	10°	15	34,075	33,885	29,159	28,151	30,263	31,199	30,658	30,105	30,204	30,145	29,456	27,812	29,031	28,622	27,102	27,358	26,924	25,787	26,166	24,388	24,605	24,338
	11°	16	34,203	33,990	33,815	29,099	28,100	30,209	31,143	30,603	30,051	30,150	30,091	29,403	27,762	28,978	28,570	27,054	27,309	26,875	25,741	26,119	24,344	24,561
		TOTAL	513,105	505,660	497,339	489,602	484,814	481,240	475,290	468,182	461,420	455,038	448,405	441,695	435,547	430,922	424,976	419,341	415,128	410,574	406,371	403,227	399,633	397,741

Up to this point, projections of the total school age population by education grade have been used, providing an amount that must be weighted by a participation rate for public education. To estimate this, the data available from SIMAT for the number of students enrolled in the public education system will be used, distinguishing between students in urban and rural education institutions and the number of students enrolled in the private sector.

The first step was to copy the total enrollment tables by education grade for the 2014 through 2018 school years in "2B. SIMAT Flows." The available spaces are shown in yellow from 2019 to 2035 to allow for continued updating of the data as the total school enrollment databases for the previously described categories (public-urban, public-rural, private) become available, as shown in Figure 18.

The results in this section will be used to calculate the existing share of the total population that is of school age and is in the public education system, which will serve as a reference for running the education demand projections for the period 2019-2035 based on the most up-to-date information for this share of the population.

Thus, in "2A. SIMAT Rates" the share of the total population recorded in the public sector in the SIMAT rates, based on the data resulting from "1A. Projections by Grade" and "2B. SIMAT Flows" is calculated, broken down by education grade. In this case, the values calculated from 2019 going forward contain formulas linked to "2B. SIMAT Flows" so as to use the most up-to-date data available as an assumption, considering that the calculator could be updated frequently (see Figure 19).

FIGURE 18   SIMAT Public-Urban, Public-Rural and Private Enrollments Flows

	A	B	C	D	E	F	G	H	I	J	K
1											
2		**Annex 2B. SIMAT Flows**									
3											
43		**Public-urban enrollment**									
44		**Education level**	**Grade**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
45			-2 Pre-nursery	0	0	0	1	0			
46		Preschool	-1 Nursery I or A or Kindergarten	52	40	0	9	227			
47			0 Nursery II or B, Transition or Grade 0	19,019.00	13,838.00	12,724.00	12,902.00	14,450.00			
48			1 First	22,676.00	22,640.00	16,876.00	17,161.00	17,016.00			
49			2 Second	23,311.00	21,275.00	18,595.00	17,384.00	16,960.00			
50		Basic Lower Secondary	3 Third	24,181.00	22,723.00	18,832.00	18,896.00	17,499.00			
51			4 Fourth	23,542.00	23,491.00	20,049.00	19,162.00	18,827.00			
52			5 Fifth	22,581.00	22,694.00	20,604.00	19,949.00	19,217.00			
53			99 Accelerated learning	1,822.00	2,153.00	1,607.00	1,695.00	1,749.00			
54			6 Sixth	25,722.00	25,502.00	23,256.00	23,994.00	23,477.00			
55		Upper Secondary	7 Seventh	23,509.00	22,722.00	20,243.00	21,032.00	21,605.00			
56			8 Eighth	22,015.00	20,778.00	18,208.00	18,210.00	19,592.00			
57			9 Ninth	19,456.00	19,369.00	16,516.00	16,271.00	16,336.00			
58		Grade	10 Tenth	17,341.00	17,215.00	15,485.00	14,818.00	14,887.00			
59			11 Eleventh	14,636.00	14,515.00	13,181.00	13,198.00	12,662.00			
60				**258,041**	**246,802**	**214,569**	**212,987**	**212,755**	**0**	**0**	**0**

FIGURE 19 Annex 2. SIMAT Rates

	A	B	C	D	E	F	G	H	I	J	K	O
1												
2			**Annex 2. SIMAT Rates**									
3												
48			**Public sector participation**									
49			Rate	Education level	Grade	2014	2015	2016	2017	2018	2019	2020
50												
51												
52												
53					Pre-nursery	13.33%	11.19%	13.59%	13.49%	13.22%	13.22%	13.22%
54				Preschool	Nursery	22.10%	18.01%	19.55%	20.27%	21.56%	21.56%	21.56%
55					Transition	40.81%	35.66%	35.11%	33.10%	32.23%	32.23%	32.23%
56					1 First	35.02%	30.13%	40.81%	33.43%	36.18%	36.18%	36.18%
57					2 Second	33.29%	28.54%	35.88%	34.54%	33.04%	33.04%	33.04%
58			Coverage rates	Basic Primary	3 Third	33.61%	28.91%	34.72%	32.47%	35.17%	35.17%	35.17%
59					4 Fourth	31.63%	27.81%	34.08%	31.53%	32.43%	32.43%	32.43%
60					5 Fifth	29.46%	26.11%	33.22%	31.53%	30.28%	30.28%	30.28%
61					Accelerated learning	0.10%	0.10%	0.11%	0.05%	0.02%	0.02%	0.02%
62					6 Sixth	32.31%	27.90%	34.92%	31.98%	33.50%	33.50%	33.50%
63				Basic Lower Secondary	7 Seventh	33.60%	27.47%	32.06%	30.70%	31.97%	31.97%	31.97%
64					8 Eighth	31.96%	29.03%	30.72%	27.77%	29.68%	29.68%	29.68%
65					9 Ninth	25.91%	27.44%	31.30%	26.85%	26.96%	26.96%	26.96%
66				Upper Secondary	10 Tenth	22.17%	21.12%	27.45%	25.99%	24.17%	24.17%	24.17%
67					11 Eleventh	22.09%	20.32%	22.93%	25.96%	25.77%	25.77%	25.77%

Based on the sections described above, particularly "1A. Projections by Grade" and "2A. SIMAT Rates" it is possible to estimate education demand for the period 2019-2035, since the first contains population projections (based on vital statistics) and the second projects the share of the population that will demand public education services. The results of the *ceteris paribus* estimate are shown in the "Education Demand Base Projections" section from F7 to W12.

FIGURE 20   Education Demand Base Projections: Ceteris Paribus

				Education level	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Projection Calculator-Santiago de Cali Preschool, Primary, Lower Secondary, and Upper Secondary Demand															
1a. Education Demand <u>Base</u> Projections: Ceteris Paribus															
By education level															
				Preschool[1]	15,290	15,428	15,176	14,549	14,742	13,759	13,876	13,726	13,599	13,489
				Primary[2]	95,280	93,296	91,948	91,365	89,237	87,620	85,850	84,064	82,327	81,212
				Lower Secondary	84,579	83,941	83,101	81,265	80,531	79,639	78,013	77,475	76,078	74,169
				Upper Secondary	28,694	30,164	30,327	29,790	29,581	29,597	29,217	28,053	27,904	28,267
				TOTAL[3]	**223,843**	**222,829**	**220,552**	**216,969**	**214,091**	**210,615**	**206,956**	**203,319**	**199,909**	**197,138**

[1] Does not include Child Development Centers
[2] Includes Accelerated Learning
[3] Does not include Special Integrated Academic Years in Adult Formal Education (CLEI)

To calculate education demand under the *total coverage* scenario, which includes the share of the population outside the education system that should be in the education system in the estimate, the total population enrolled in both the public sector and private sector is subtracted from the population projections based on vital statistics.

This calculation uses "3.B. Distribution by Age" and "3A. Population Outside the Education System." The first breaks down the distribution by age in the education system, to identify the number of enrolled students of each age shown in SIMAT. These data are used in the second section in the table showing the population in the education system, located in cells C62 to H84, which in turn uses the upper portion, where the population outside the education system (flows and rates) is estimated, as shown in Figure 21.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1														
2			Annex 3A. Calculation of the Population Outside the Education System											
3														
4														
5			Estimate of the population outside the education system: Flows											
6			Education level	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
7			Preschool	55,316	64,495	63,658	66,570	67,705	66,611	65,619	63,509	62,526	61,006	60,776
8			Primary	6,576	14,743	16,875	20,532	18,505	18,117	17,850	17,736	17,322	17,009	16,663
9			Lower Secondary	−5,704	−27	4,657	9,227	8,505	8,432	8,348	8,189	8,107	8,001	7,837
10			Upper Secondary	6,088	7,051	6,566	4,491	4,286	4,286	4,510	4,539	4,459	4,425	4,428
11			TOTAL	62,276	86,262	91,756	100,820	99,002	97,446	96,327	93,973	92,414	90,441	89,704
12														
13			Estimate of the population outside the education system: Rates											
14			Education level	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
15			Preschool	63.8%	75.1%	74.8%	79.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%
16			Primary	4.3%	9.8%	11.4%	14.0%	12.7%	12.7%	12.7%	12.7%	12.7%	12.7%	12.7%
17			Lower Secondary	−4.7	0.0%	3.9%	7.5%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
18			Upper Secondary	8.9%	10.4%	10.4%	7.8%	7.3%	7.3%	7.3%	7.3%	7.3%	7.3%	7.3%
19			TOTAL	14.5%	20.4%	22.0%	24.6%	24.3%	24.0%	24.0%	23.8%	23.8%	23.6%	23.8%

The results shown in "Education Demand Base Projections" on the *total coverage* scenario, in Figure 22, are based on the sum of the demand projection by grade, which is shown in "Demand Projections (by grade)," plus the population outside the education system described above.

FIGURE 22   Education Demand Base Projections: Total Coverage

	A	B	C	D	E	F	G	H	I	J	K	L	M
1					**PROJECTION CALCULATOR- SANTIAGO DE CALI** Preschool, Primary, Lower Secondary, and Upper Secondary Demand								
2													
3													
4					**1b. Education Demand Base Projections: Total Coverage**								
5													
6					By education level: Total								
8					Education level	2018	2019	2020	2021	2022	2023	2024	2025
9					Preschool[1]	82,995	82,039	80,795	78,059	77,268	74,764	74,652	73,929
10					Primary[2]	111,902	109,569	107,982	104,797	102,898	100,817	98,716	84,064
11					Lower Secondary	93,084	92,373	91,450	89,453	88,638	87,640	85,850	85,281
12					Upper Secondary	32,980	34,450	34,837	34,329	34,039	34,023	33,645	32,426
13					TOTAL[3]	**320,962**	**318,432**	**315,063**	**309,137**	**304,742**	**299,326**	**294,964**	**290,352**

[1] Does not include Child Development Centers
[2] Includes Accelerated Learning
[3] Does not include Special Integrated Academic Years in Adult Formal Education (CLEI)

For early education, which shows education demand received in the CDIs, the reference is the most recent school year, which in this case is 2018, but which can be updated when more data are available (yellow cells). In this case, the results are shown in "Demand Projections CDIs," in the first part (1A).

Finally, to disaggregate the education demand projections by commune, education level, and urban-rural distribution, additional assumptions must be included as a reference to run this projection with a greater degree of disaggregation.

In the case of disaggregation by commune, the reference used is the distribution of the projected total population based on the 2005 census. It should be noted that although these data sources were over-reporting population, there is no indication that this bias is related to the distribution by commune, and it is thus considered an acceptable reference for this particular calculation. For the projections by education level, the distribution of public enrollments provided by SIMAT is used.

These data for calculating the assumptions are found in "5A. Distribution by Commune and Education Level," which are used in the sections showing the results of the projections of elementary school and CDI demand following the general projections. The section showing the elementary school demand projection, "Education Demand Base Projections," is found in cells E33 to E72 for the disaggregation by commune, and in cells E79 to E231 for the disaggregation by commune and education level. For the CDI projections, the disaggregations are found in the section "Demand Projections CDIs," in cells D14 to D52, only by commune.

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