Chapter 13
Other Applications of Demographic Concepts, Techniques and Data

Abstract The final chapter summarizes activities in other contexts where applications of demographic principles and techniques are useful. Applications in such areas as education, criminal justice, disaster planning, and community development illustrate the breadth of usefulness of demographic methods and materials.

13.1 Educational Demography

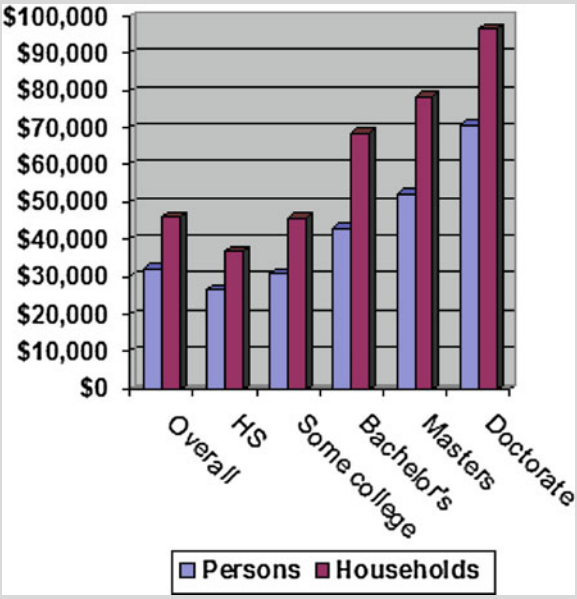
Educational demography (or the demography of education) involves the application of demographic concepts, techniques and data to issues within the educational arena. The problems that might be addressed by demographers in this sphere include: planning for school construction; determining teacher requirements; determining English-language training requirements; estimating the demand for pre-school programs; and monitoring the racial mix for a school system, among others.

The educational level of a population has implications for other demographic attributes with education often interacting with other variables. A population's level of education is a determining factor in the types of occupations that are filled and, to a lesser degree, the relative importance of different industrial sectors. The educational level interacts with income, making each a relatively effective predictor of the other. On the other hand, there are additional factors that influence the level of education. Income not only interacts with education but one's family's income level is a predictor of the individual's level of education (an issue discussed later in this section).

The educational level also determines the type of job one is likely to hold. Education has an impact on various demographic processes; the fertility rate is a function of educational level in the U.S. and exhibits an association with mortality as well. The level of morbidity and the type of health problem (physical and mental) are also reflections of the educational level. Exhibit 13.1 illustrates the relationship between education and income.

R. K. Thomas, *Concepts, Methods and Practical Applications in Applied Demography*, https://doi.org/10.1007/978-3-319-65439-3_13

Exhibit 13.1: Educational Attainment and Income 2000



Source Creative Commons Attribution

Demographers are often called upon to generate estimates of the demand for educational services. They may be asked for figures on the number of children expected to enter kindergarten at some point in the future, or the number of expected to enter high school or college. A useful technique for generating such estimates is cohort analysis, a method that allows demographers to take advantage of existing information. For projections of this type, demographers have a built-in advantage in that the information they need is already available. A table that shows the number of people found in each age cohort provides the basis for projecting into the future as described earlier. If x number of one-year-olds are found in the population this year, there should be x number of six-year-olds in the population five years from now. This assumes, of course, that there no attrition due to death and that there was no impact of migration. This method can be used to project the demand for educational services several years into the future.

Other planning-type activities that demographers may be involved in include drawing school district boundaries, estimating teacher requirements and monitoring racial equality programs. The latter may include expert testimony related to school discrimination and funding activities. Case Study 13.1 describes the application of demographic techniques to school planning.

Another area in which demographers may be employed is in workforce development. With a constantly changing economic environment the educational

requirements for the workforce will continue to evolve. Educational demographers (for example at the Bureau of Labor Statistics) may calculate the education requirements necessary for future workers in the light of anticipated industrial activity. There is already thought to be a mismatch between the educational status of the U.S. workforce and the requirements of the industries that are expanding. This situation has already reached dire levels in some European countries (Coomans, 2005).

Case Study 13.1: Enrollment Effects of Opening a New School: Build It and They Will Come!

A public school district hired a demographic consultant to investigate whether the recent growth in school enrollment was likely to continue into the future. Overall enrollments, especially in kindergarten, had increased unexpectedly. Officials of the Belmont-Redwood Shores School District, located about 20 miles south of San Francisco, California, needed a demographic analysis of recent trends and their causes in order to make assumptions about future enrollment patterns.

During the investigation, it was found that some of the enrollment increase was associated with the opening of a new K-3 elementary school in an area separated from the rest of the district by a busy freeway, U.S. Highway 101. This area, a set of recently-built housing developments called Redwood Shores, is located on the edge of San Francisco Bay. Until the new school opened (Sandpiper Elementary), there was no neighborhood public school, and children living in Redwood Shores had to cross the freeway to attend public schools in the western part of the district. Before Sandpiper opened some parents had chosen options other than enrolling their children in the district's schools on the other side of the freeway.

The first thing the consultant did was to obtain student address data in order to geocode the records and identify the location of the children living in Redwood Shores who had attended District schools. The District was able to supply only two years of student address data, but it was possible to identify how many children lived in Redwood Shores the year before the school opened and the year that it opened.

The consultants found that the number of the school district's kindergartners who lived in Redwood Shores and attended a district school *nearly doubled* after Sandpiper School opened in the fall of 1997 (from 44 students in fall 1996 to 84 the following year, see Fig. 13.1). Clearly, before the school opened, some parents did not enroll their kindergartners in the district's other public schools. Instead, they must have enrolled their children in private schools or public schools close to their workplaces outside the school district, and chose the new, neighborhood public school in Redwood Shores as soon as it opened.

The consultants also studied how enrollments in other grades changed after Sandpiper opened. They measured "grade progressions," which quantify

changes in the size of a student cohort as the children move to the next higher grade and found that the number of Redwood Shores kindergartners already enrolled in district schools before Sandpiper opened grew by 22 as the cohort moved to first grade the year it opened (Fig. 13.2). Some increase usually occurs as parents transfer children from private day care and preschool to public schools for first grade, but the size of this increase was surprising.

Although opening Sandpiper evidently increased kindergarten and first grade enrollments, there was not much change in the number of Redwood Shores children who switched from other schools in the district to enroll in second and third grades at Sandpiper. We believe that parents may have been reluctant to switch young children who were already established in another school. They found that the older the child, the less likely the new school was to attract them.

Postscript: The number of BRSSD kindergartners living in Redwood Shores rose to 120 in 2007 and 149 in fall 2016, and a second elementary school (Redwood Shores) was opened in that part of the district. This resulted largely from housing growth after 1997, but it is believed that some of the increase is explained by more families purchasing homes in Redwood Shores because it now had neighborhood schools.

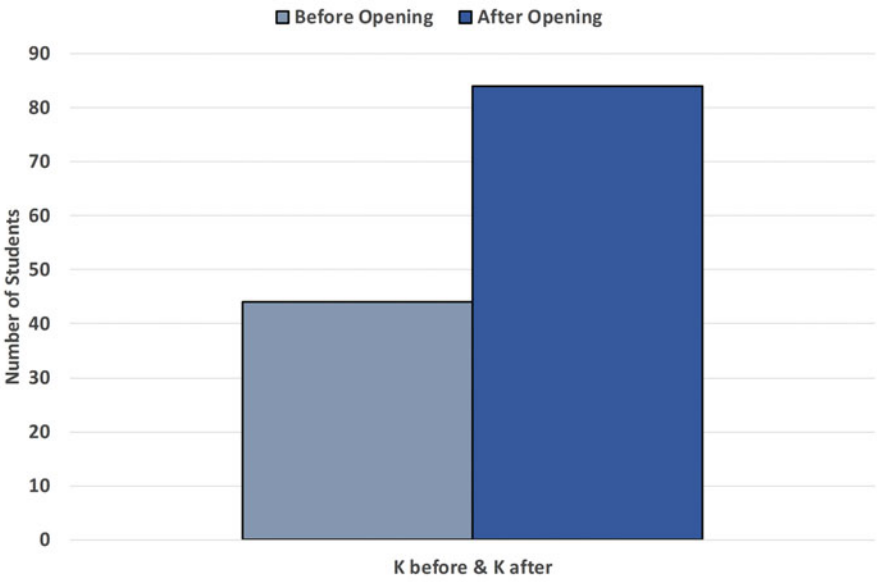


Fig. 13.1 Number of BRSSD kindergartners living in redwood shores before and after sandpiper school opened

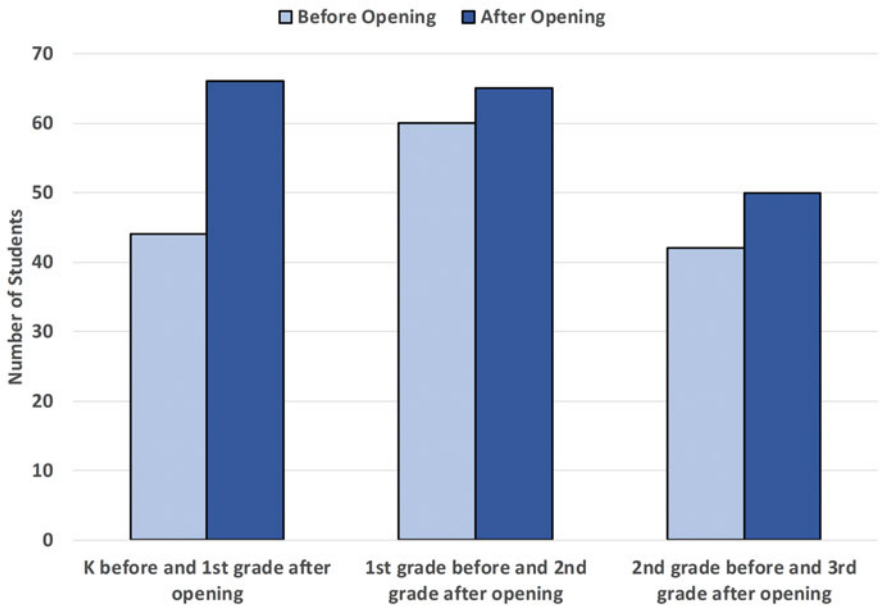


Fig. 13.2 Primary grade progressions before and after sandpiper school opened. *Source* Lapkoff and Gobalet (2017) Demographic Research, Inc., www.demographers.com

13.2 Educational Demography and Educational Policy

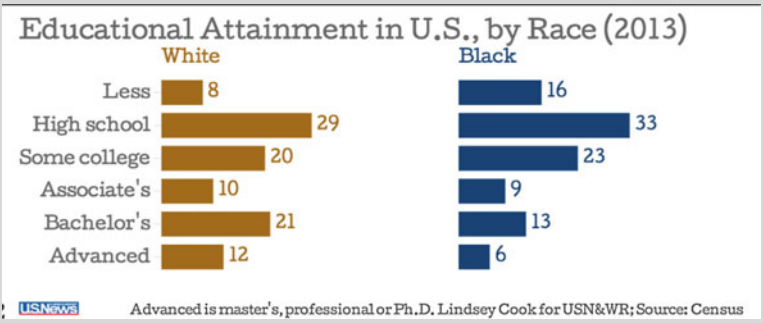
There are a variety of issues of interest to educational demographers that have implications for educational policy. The dangers of neglecting the demographic dimension in formulating educational policy can be clearly seen, as the effectiveness of the U.S. educational system is increasingly called into question.

An issue that is impossible to ignore is the continued bifurcation of educational attainment along racial and socioeconomic lines, with racial disparities in educational attainment being particularly stark. These disparities were highlighted in a recent study that quantified the differences in the educational experience for whites and blacks in the U.S. today (Cook, 2015a, b). Although in 2010, the U.S. spent much more per full-time student than comparable countries, this does not translate into better educational outcomes. Among problems facing the U.S. educational system is glaring differences between white students and students of color. Indeed, more than 60 years after Brown vs. Board of Education, school systems in the United States remain separate and unequal, and the trend is toward more disparities as the proportion of minority students continues to increase. Exhibit 13.2 illustrates differences in educational attainment by race.

As the percentage of white students in our education system shrinks and the percentage of students of color grows, the U.S. will be left with an education system

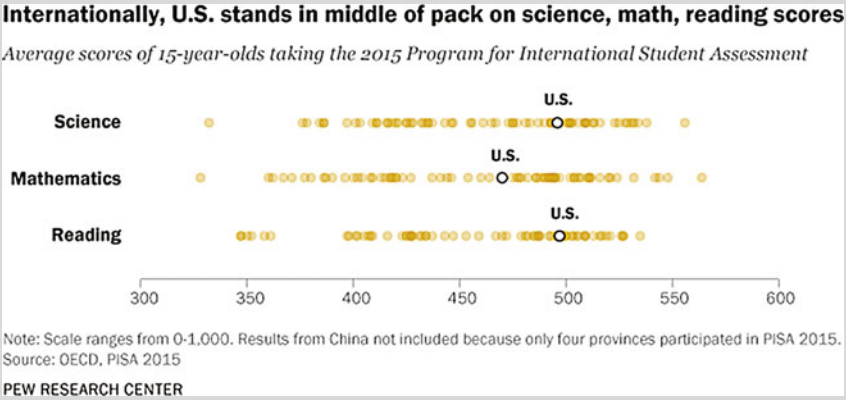
that does not serve the majority of its children properly. Lower wealth, lower health, lower parental education levels, more involvement with the justice system and other circumstances create a perfect storm that leaves blacks without the same educational opportunities as whites (Cook, 2015a, b). Black parents, most of whom are less educated than their white counterparts, do not expect their children to attain as much education as white parents expect. Lower expectations become self-fulfilling prophecies, contributing to less motivated students, less-positive attitudes toward school, fewer out-of-school learning opportunities and less parent-child communication about school.

Exhibit 13.2



At the same time that disparities in educational attainment are increasing, the level of education of Americans is slipping relative to citizens of comparable countries. Recently released data from international math and science assessments indicate that U.S. students continue to rank around the middle of the pack, and behind many other advanced industrial nations. On the major cross-national tests the U.S. ranked 38th out of 71 countries in math and 24th in science. Among the 35 members of the Organization for Economic Cooperation and Development the U.S. ranked 30th in math and 19th in science. In the most recent tests, from 2015, 10 countries (out of 48 total) had statistically higher average fourth-grade math scores than the U.S., while seven countries had higher average science scores. In the eighth-grade tests, seven out of 37 countries had statistically higher average math scores than the U.S., and seven recorded higher science scores. Exhibit 13.3 indicates how the U.S. stacks up against comparable countries.

Exhibit 13.3



As with other sectors of society, the U.S. does not have a clear national policy for education. Despite the efforts of the U.S. Department of Education and its various programs, little in the way of policy guidance for the U.S. educational system exists. In addition to the resistance shown in the U.S. to any type of centralized control, the fact is that the responsibility for education rests with the individual states and, ultimately, with local school systems. One attempt that was made during the Bush administration was the enactment of the "No Child Left Behind" initiative. No Child Left Behind was first introduced as House Resolution 1 during the 107th Congress in March of 2001. The Act aimed to ensure that all students, regardless of race or socioeconomic status, had an opportunity for a solid education (Chen, 2015).

There has been plenty of controversy surrounding No Child Left Behind. Teachers, schools, educational organizations and even entire states have come forth and declared No Child Left Behind to be "flawed" and "ineffective" for various reasons. As reform of the law moves forward, debates about how to make NCLB more effective continue within Congress and among different schools and districts.

The No Child Left Behind policy was given impetus by the seeming failure of many public schools to reach an adequate level of achievement for their students. Ultimately, the differences observed among schools were in effect demographic differences as minority-heavy schools and schools in poorer neighborhoods demonstrated lower achievement on the standard measures.

Exercise 13.1: Projecting the Demand for Educational Services
Demographers are often called upon to generate estimates of the demand for educational services. They may be asked for figures on the number of children expected to enter kindergarten at some point in the future, or the number expected to enter high school or college. A useful technique for generating such estimates is cohort analysis, a method that allows demographers to take advantage of existing information. Based on the table showing the youth population below, students should project the number of children who will enter the first grade (age 6) in five years, the number of teens who will enter high school (age 15) in eight years, and the number of students who will be eligible for college (age 18) in ten years.

Age	Number
1 year	1174
2 years	910
3 years	766
4 years	886
5 years	2515
6 years	2659
7 years	2300
8 years	1629
9 years	1581
10 years	1413
11 years	1557
12 years	1988
13 years	1605
14 years	1149
15 years	1671
16 years	1479
17 years	1359
18 years	1311

Provide the following figures:
Number entering the first grade in 5 years: ____
Number entering high school in 8 years: ____
Number eligible for college in 10 years: ____

13.3 Criminal Justice

Demographers have long been involved in studying the U.S. criminal justice system and applying demographic concepts, techniques and data to real-world problems. A number of areas of inquiry can be highlighted that reflect the relationship between demography and crime and criminal justice, along with the study of the operation of the system, the characteristics of criminals and victims, disparities in law enforcement and a variety of other issues. There is also interest in the relationship between various demographic attributes and criminal activity.

There are two different interfaces between demography and criminal justice that are particularly salient. One of these is the disparities that exist in the operation of the criminal justice system—disparities that exist primarily along demographic dimensions. African-Americans, Latinos and poor people are disproportionately represented on every indicator of criminality. All other things being equal, members of these groups record more encounters with the law, more arrests, more convictions and harsher sentences. Members of these groups are disproportionately represented among the prison population.

The second area where demography is particularly relevant is in the examination of the roots of crime in U.S. society. As with other factors, it could be argued that one's ZIP code of residence is the best predictor of involvement with the criminal justice system. The roots of America's mass-incarceration policies are tangled in history, politics, social conflict and inequality. These "roots" include poverty, unemployment, lack of education, and poor health (often including disability). This is not to mention chronic exposure to discrimination and the stress that entails. This type of environment is clearly not conducive to good relationships with the criminal justice system.

13.4 Contemporary Issues of Relevance to Demography

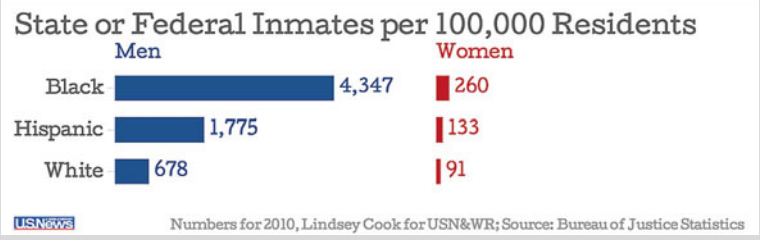
There are a number of issues currently facing the criminal justice system for which demography has significance. It is hard to deny that the U.S. criminal justice system is not effectively or efficiently achieving its stated goals. There is no measure on which the system can be considered effective at this point.

A major consideration is the "mass incarceration" among the U.S. population. The U.S. has by far the largest prison population among comparable countries. Some analysts call that sky-high incarceration rate this era's civil rights issue, and argue that the justice system warehouses inmates, damages families and hollows out communities. About two-thirds of African-American men with low levels of schooling will go to prison during their lifetimes, and most inmates are minority men under age 40. Case Study 13.2 describes some of the inequities that exist in the U.S. criminal justice system.

Case Study 13.2: Criminal Justice is Not Colorblind

The recent protests and controversy surrounding the Black Lives Matter movement show that the United States is in no way post-racial. While the debate continues over whether the criminal justice system is colorblind or not, the answer lies with the data. First, the U.S. is extremely accomplished at throwing its citizens in jail. With only 5% of the world's population, we house 25% of all prisoners, making the U.S. the world's biggest jailer. The prison population has increased by 700% since 1970, to the point that one in every 31 adults is under some sort of correctional management. The U.S.'s love of throwing people behind bars is also expensive—the annual cost per inmate is $21,006 for minimum security and $33,930 for high security.

The prison population is far from equally distributed. Black Americans are imprisoned at a much higher rate than white Americans, prompting critics to refer to our criminal justice system as "the new Jim Crow." While people of color represent a minority of the country's overall population, they represents a majority in U.S. prisons.



Many of the factors contributing to this inequality can be attributed to the system instead of to different behavior between blacks and whites. Nothing illustrates the difference between justice for the races than the "war on drugs," Whites and blacks use drugs at roughly the same rate, but black people are arrested for drug use at a much higher rate. At the disparities' peak in the late 1980s and early 1990s, blacks were five times more likely to be arrested for drugs than whites were. Recent figures reflect the same pattern: The national arrests rates for marijuana possession were 716 arrests per 100,000 black residents in 2010 compared to 192 arrests per 100,000 white residents.

The events in Ferguson, Missouri, raised our consciousness with regard to disparities in policing but that was not an anomaly. In Boston, blacks represent less than 1 in 4 residents but from 2007 to 2010 accounted for more than 3 of 5 field interrogations, observations, frisks and/or searches. The ACLU found that even after controlling for potential confounding factors such as neighborhood crime rates, past arrest records and alleged gang affiliation, racial differences persisted in encounters with the Boston

police. New York's Stop-and-Frisk policy consistently led to police stopping more blacks and Latinos, even when the area's population was less than ¼ black and Latino. The difference between police killings for white and black teenagers is stark. Black teenage men are 21 times as likely to be the victim of a reported police killing as white teenage men.

The disparities do not stop after encounters with police. At every level of the justice system, data show that not everyone whose case goes in front of a jury is evaluated equally, not everyone who stands in front of a judge is sentenced equally, and not everyone's case is prosecuted equally.

The majority of people serving life sentences at the federal level are black, and almost half of those serving life sentences nationally are black. In some states, the percentage is even higher: In Maryland, 77% of inmates serving life sentences are black, in Georgia and Mississippi it's 72% The ACLU also found authorization to seek the death penalty was more likely when there was at least one white victim in the case. Overall, the sentences for black male offenders are almost 20% longer than sentences for white male offenders.

Black Americans have a different relationship with police and with the criminal justice system than white Americans do, which influences how blacks think about the system itself. Blacks believe less in the "perceived honesty and ethics" of police officers. Black Americans also have less confidence in the criminal justice system, less confidence in police, and are more likely to say the unequal rates of incarceration between blacks and whites are due to racism.

Racial differences between the citizens or defendants and those dispensing justice may also contribute to distrust and unequal punishments. In many U.S. counties, Ferguson included, police officers serving the citizens are mostly white, while residents of the county are mostly people of color.

Source Cook (2015a).

Exercise 13.2: Projecting Incarceration Rates

Demographics often drive crime rates—a growing number of young males in the population, for example, often leads to higher crime rates. This exercise describes what is known about future demographic trends and examines how planners can use this knowledge as an advance-warning tool to craft effective policies and prevention programs and reduce crime in the future. For this exercise, students are to project the rate of incarceration for 2025. The two factors to consider are the racial/ethnic mix of the population and its age structure, since these are the two factors that have the most influence on incarceration rates.

Race of inmates	Age of inmates
White—59%	<25 years—6%
Black—38%	25–34 years—28%
Native American—2%	35–44 years—34%
Asian—2%	45–54 years—13%
Hispanic—34%	55+ years—10%

Projected change by 2025:

Race of population	Age of population
White—−8%	<25 years—−6%
Black—+2%	25–34 years—-2%
Native American—+1%	35–44 years—+2%
Asian—+2%	45–54 years—+5%
Hispanic—+15%	55+ years—+10%

Given the current distribution of the incarcerated population, consider the following:

1. What are the likely implications of the changing racial and ethnic mix of the population for incarceration rates in 2025?
2. What are the likely implications of the changing age structure of the population for incarceration rates in 2025?

13.5 Urban Planning and Community Development

There is a long history of demographic input into urban planning and community development activities. Since the commencement of the planning "movement" in the 1960s, demographers and demographic data have served an important function in advancing planning activities. The input of demographers into private sector endeavors was highlighted in the chapter on business demography. Planners in the public sector use demographic information and analysis to assist with a number of planning decisions as indicated below (Measure Evaluation, 2017).

- Planners use population information to determine the demand for services among different segments of the population. Demand is determined by the composition of the population and how it is changing over time in terms of age-sex distribution, marital status, household types, occupation distribution, spatial distribution of the population, educational levels and income levels.

- Planners study the present and future composition of the population and its spatial distribution to identify the best locations to provide services to meet local needs.
- Planners examine population characteristics to determine the feasibility for new programs. Community residents may ask the government for a new school. Planners assess the age-sex distribution at present and in the future to determine whether or not it is feasible to construct a new facility.
- Planners are concerned about the impact of new plans on population change. A new plan to promote rural industries can lead to population growth as new families move into the community for job opportunities. Housing and educational plans may need to be revised to meet the needs of new households that may move into the area.
- Planners are concerned about the impact of population growth on the ability to implement existing plans. Planners are interested in how changes in size, spatial distribution and composition will affect efforts to implement various types of plans—housing, social services, and infrastructure such as roads, water supply and electricity.

Demographic analysis is needed in all stages of the planning process. Population analysis is needed to identify problems and community needs, establish goals and objectives, assess alternative courses of action, allocate resources for plan implementation, and evaluate the ability of the plan to achieve its goals and objectives.

An example of how demographic analysis can be used in the planning process is presented in Exhibit 13.5. In this example, a health planner is asked to design a plan for expanding primary healthcare within the district. The planner may use the following demographic analysis and information to develop the plan (Measure Evaluation, 2017).

Exhibit 13.5: Demographic Analysis in the Planning Process: Healthcare Example

Planning process	Demographic analysis
Identify problems and needs	• Study trends in mortality rates and causes of death among different segments of the population • Study trends in fertility to plan for maternal and child health care • Project total population size by age-sex structure since it provides insights on the different health needs among different age groups
Goals and objectives	Collect information to establish objectives on: • Population size • Population composition • Geographic distribution • Population projections

(continued)

(continued)

Generating alternative strategies	Collect information on the size, location and composition of the target population to develop alternative strategies to achieve stated goals and objectives
Select and implement a plan of action	Collect demographic data to determine: • Demand for services • Resource needs including the number of facilities, staff, medicine, and money • Locations for new facilities
Monitoring and evaluation	Use of demographic indicators to measure the achievement of the objectives. This could include • Infant mortality rates • Age specific fertility rates • Age specific death rates • Morbidity statistics

13.6 Focus Areas for Demographers Involved in Planning and Development

A major responsibility of demographers in planning and development activities is the production of population statistics. While population estimates and projections may be available from the Census Bureau, state data centers, commercial data vendors or other sources, the demographer has the responsibility for verifying these statistics. The smaller the geographic area under consideration, the more important this process is, and government agencies seldom generate data below the county level. While more granular data (e.g., ZIP code, census tract) may be available from commercial data vendors, it should be realized that these estimates and projections are generated using computer models for 3000 counties and 30,000 census tracts. That means that any peculiarities of a particular community are not likely to be taken into consideration.

For example, if the population of an area, even a county, is rapidly increasing or rapidly decreasing, most standard projection techniques are not likely to account for this development. Or, on the other hand, if it is a short-term although substantial gain or loss, the global projection model may overstate the changes into the future. In any case, the demographer must be able to verify any externally generated data and be prepared to adjust it as necessary.

In the absence of data from an external source for a project or in cases where a non-standard population or geographical area is involved, the demographer may be required to independently generate data. In that case, the techniques for generating estimates and projections discussed in Chap. 9 come into play. The importance of these population statistics cannot be overstated since they provide the foundation for virtually all other activities related to planning and development.

Demographers involved in these activities will typically require more than a population count for purposes of planning and development. Size matters, of course, but it is also necessary to determine the distribution of the population within the affected area and the characteristics of that population. Some attributes that are likely to be particularly important within a planning/development context are age distribution, household structure, length of residence, commuting patterns and home ownership along with other relevant variables. Unlike some analyses the relationship between people and the environment is of particular importance within a planning/development context.

A major function that requires demographic input is land use planning. Most municipalities have zoning ordinances in place to guide the development process. Rather than allowing development to occur in a haphazard fashion local governments typically generate land use plans as a basis for decisions related to future development. The formulation of these plans typically starts with an understanding of the size, location and characteristics of the affected population discussed above.

An important component of land use planning involves the consideration of housing options. Even in the absence of a formal land use plan, most communities must address the issue of adequate housing for their residents. Demographers involved in these activities are responsible for generating data on the available housing, its occupancy level, state of adequacy, affordability and so forth. Questions must be addressed related to the adequacy of the housing stock today but, more important, into the future. (Again, the population projections generated earlier come into play.) The need for public housing is an issue that is likely to arise, including the issue of homelessness and the extent this is a problem that needs to be addressed within the planning/development context.

Demographers involved in these activities may also provide input into transportation planning. As urban development has accelerated transportation planning has become an increasingly important issue, especially with the growth of urban sprawl. With urban congestion public transportation has resurfaced as an issue facing urban planners. Today's city centers are being choked with traffic and growing numbers of residents do not have adequate access to transportation. A record number of "millennials" do not have cars, and they are flocking to city centers and need transportation.

Today, the impact of transportation decisions has become recognized because of the variety of other aspects of urban life they impact. Transportation routes have become an increasingly important contributor to urban development and serve to drive economic activity. In addition, transportation decisions affect many other aspects of human life—the physical and social environments, access to services, even the health of the population. Even outside of urban areas the impact of development on transportation is being debated as witnessed by recent controversies over the impact of new "big box" stores on transportation patterns and, subsequently, on the quality of life for nearby residents.

Urban planning efforts are increasingly incorporating health planning into their initiatives on the assumption that the health of the population is inextricably

intertwined with the physical environment. Planning for health facilities is increasingly carried out within the larger framework of community development and, conversely, most major planning decisions take health consequences into consideration. Health impact assessments (HIAs) have become a regular contributor to planning decisions as the health implications of decisions have come to be recognized. HIAs are a spin-off from the environmental impact assessments described in Exhibit 13.6. Case Study 13.3 describes the implementation of a health impact assessment.

Exhibit 13.6: Environmental Impact Assessment

Demographers involved in planning and development often provide input into environmental impact assessments. An Environmental Impact Statement (EIS) is a document prepared to describe the effects of proposed activities on the environment. "Environment," in this case, is defined as the natural and physical environment and the relationship of people with that environment. This means that the "environment" considered in an EIS includes land, water, air, structures, living organisms, environmental values at the site, and the social, cultural, and economic aspects. An "impact" is a change in consequence that results from an activity. Impacts can be positive or negative or both. An EIS describes impacts, as well as ways to "mitigate" impacts. To "mitigate" means to lessen or remove negative impacts. Ultimately, an environmental impact statement describes the impacts on the environment as a result of a proposed action. It also describes impacts of alternatives as well as plans to mitigate the impacts.

Federal laws and regulations require the federal government to evaluate the effects of its actions on the environment and to consider alternative courses of action. The National Environmental Policy Act of 1969 (NEPA) specifies when an environmental impact statement (EIS) must be prepared. NEPA regulations require, among other things, federal agencies to include discussion of a proposed action and the range of reasonable alternatives in an EIS. Sufficient information must be included in the EIS for reviewers to evaluate the relative merits of each alternative.

An EIS must take into consideration the impact of any development on human activity on the condition of the humans involved. The demographer can play a role here through examining the impact of a decision on an affected population. In the past decisions made, for example, related to the placement of a toxic dump without regard to its impact on nearly residents. The demographer can play a role in identifying the ways in which residents will be affected and are likely to be sensitive to factors that non-demographers would not take into consideration.

Case Study 13.3: Atlanta's Beltline

Atlanta is notorious for its traffic—sometimes called the worst in the southeast United States. Local officials envisioned creating a more pedestrian-friendly urban area and a light-rail system as part of the solution to the region's jammed roadways. Known as the Atlanta BeltLine, the intent of the project was to create a light-rail system and major redevelopment along a corridor of abandoned railways encircling the city's core. The officials involved also saw this as an opportunity to incorporate multi-use trails, parks and affordable housing. However, concern over the potential impact of the project on surrounding areas led to calls for the implementation of a health impact assessment (HIA). The HIA was a collaborative effort of the Center for Quality Growth and Regional Development (CQGRD), a research center of the Georgia Institute of Technology's College of Architecture, and staff at the Centers for Disease Control and Prevention.

To better understand how the project would affect Atlanta communities and to help protect the health of the 200,000 people living within the area, local planners evaluated the project via one of the United States' first HIAs. Led by Professor Catherine Ross at the Georgia Institute of Technology, the HIA provided information on how the BeltLine proposal might affect neighboring communities and, most important, provided practical recommendations for enhancements that would maximize the health benefits of the project.

Used as a reference by community members and decision makers, the HIA report determined that the project would have a largely favorable impact on community health, through improving the availability of green spaces and healthy food, creating opportunities for physical activity, reconnecting people and places previously separated by the rail corridor, and increasing transportation options. The HIA revealed how developers could strategically place parks, residential areas, schools, transit routes and grocery stores to increase residents' health and decrease potential health problems.

As a result of the HIA, construction of green space became a top priority and project and funding decisions took health into account. New partnerships between community groups, health experts and government agencies helped ensure that project plans continued to take into account health-related concerns. Acknowledging the HIA's overarching conclusion that the Beltline project would offer important health benefits for Atlanta residents, the U.S. Environmental Protection Agency (EPA) awarded a $1 million dollar grant to clean up abandoned industrial sites along the corridor, and speed the development process.

This HIA demonstrates that when decision makers at all levels understand the health implications of a project, more effective policies can be advanced that improve health and help project dollars go further.

Exercise 13.3: Planning for Urban Development
Your class of fledging applied demographers has just been given an assignment with the city's planning department. The planning staff is concerned about the impact of the city's changing population on its ability to implement the existing urban land use plan. You have been asked to write a population analysis report that studies the impact of past, present, and future demographic trends on planning activities. (Refer to Case Study 8.1 for some of the data you need for the analysis.)

a. What types of population information would you collect to assess the ability of the plan to meet its stated goals and objectives?
b. What types of statements and/or recommendations will the population information allow you to make about the comprehensive plan?
c. What types of analysis will you need to conduct to discuss the impact of population trends on the plan?

13.7 Emergency Preparedness

Demographers and demographic concepts, techniques and data are increasingly being used to address issues related to disaster preparedness. The term "disaster preparedness" is used here to cover not only preparedness but disaster response. In order to make effective preparedness plans, key methods in demography need to be systematically integrated into the discipline of disaster preparedness (Allen & Katz, 2010). The responsibility for disaster preparedness planning is shared by a myriad of state and federal entities. The breadth and depth of government entities involved in disaster preparedness is substantial and particularly in recent years, disaster preparedness has been recognized as fundamental and closely related to the nation's security.

Because effective preparedness plans require the understanding of population characteristics, demographic methods and data underlie preparedness planning (Allen & Katz, 2010). Responding to a public health emergency, such as the intentional release of a biological agent, will require a certain level of infrastructure (transportation, hospital beds) and medical countermeasures (vaccines and other pharmaceuticals). A rapid response requires that plans take into account the likely surge of individuals into hospitals and other medical care centers and the uncertainties regarding the magnitude and duration of such a surge. In order to effectively approximate the level of infrastructure required and the amount of medical countermeasures needed, disaster preparedness practitioners must have sufficient and reasonably accurate information about a given population. Demographic data and

calculations, such as age of a population, sex ratio, SES, and geographical dispersion are essential for formulating empirically-based preparedness plans. More specifically, employing certain population projections and non-emergent morbidity rates in the creation of policy can help to ensure that there are sufficient drugs, devices, hospital beds, transport, and care providers for a given population in the case of a public health emergency.

Population-level data can be used to evaluate the costs and benefits of preparedness policies and the development of particular levels and types of countermeasures and infrastructure (Zohrabian et al. 2004). Many pharmaceutical countermeasures are not appropriate for all ages or all individuals. In order to ensure that appropriate logistical considerations are in place, disaster preparedness practitioners need to turn to demographers for information. Analyzing the age structure of a population, for example, should help to dictate the type and respective number of goods and services required in response to a disaster.

There also needs to be some consideration of the mobility of various groups within the population. Before, during and after a disaster, an appreciation of the ability of the total population and, more importantly, of vulnerable portions of the population to move themselves out of harm's way is necessary. This was an important lesson learned after Hurricane Katrina (although no doubt experienced in many other places as well). It became clear that certain segments of the population did not have the ability to escape the initial impact of the natural disaster nor the consequences that followed in its wake. The failure to recognize issues related to mobility were reflected in the tragedies that occurred long after the dissipation of Hurricane Katrina.

In order to protect a population from disease outbreaks, disaster preparedness planners must estimate the number of individuals that need to be inoculated to provide the population with protection from contagion. To do so without substantial demographic information is arduous. For example, some vaccines [such as Pertussis (whooping cough)] are administered to children but traditionally not re-administered to the general population later in life, even though protection from this particular vaccination is known to diminish over time. Preparedness experts need to carefully analyze population age distributions to determine how the sub-population has "aged out" of the protective level of a vaccine.

Pandemics often impact particular age groups more significantly than others, and different types of public health emergencies are likely to affect different populations and various segments within those populations to differing degrees. For example, the H1N1 virus of 1918 targeted the healthiest individuals, which typically was the working-age and military populations. Other flu strains—such as seasonal flu—disproportionately affect the very young and the very old. Other types of public health emergencies such as chemical or radiation emergencies are likely to impact individuals who are more susceptible to infection, such as the elderly, the very young, and those already in poor health (perhaps indicated by SES). An effective disaster preparedness plan must recognize which groups are likely to be most

severely impacted so that the public health community can respond efficiently. Demographic data are required to understand how large these sub-populations are and where they are located. Furthermore, in public health emergencies where resources are scarce, demographic information may inform disaster preparedness "triage", and help practitioners to identify where and to whom resources should be focused.

Preparedness plans should also address the possibility of emergencies that last for extended periods of time. Calculations such as dependency ratios can be used to illuminate important social and economic consequences. For example, demographers can help to estimate the number of working professionals in the labor force and the number of dependent (young or old) family members. Information about the labor force can help planners better formulate preparedness policies to take into account the impact of forced social distancing, such as school closures.

This type of planning also involves consideration of the conditions related to surviving populations. This was an important lesson learned in the wake of Hurricane Katrina. While the death toll in the immediate aftermath of the disaster was noteworthy, the conditions of life for the survivors—both those remaining at "ground zero" and those who had been displaced—extended the effects of the disaster weeks, months and even years into the future. Over ten years later, there are victims of the disaster who still exhibit symptoms of post-traumatic stress disorder.

Demographic data can also be used to identify the populations most vulnerable to the effects of a disaster. Some populations are particularly susceptible to impacts of disaster and are disproportionately affected by public health emergencies. Demographic studies that identify differing SES status and minority communities as well as the location of these communities need to be employed by disaster preparedness planners to identify these vulnerable groups. Morbidity measures are another tool that can indicate where scarce health resources are already stretched by existing health priorities and where a public health emergency is likely to have a greater impact.

The U.S. Census Bureau is an important source of data for emergency preparedness and tools for analyzing the data (U.S. Census Bureau, 2017). "OnTheMap for Emergency Management" is a web-based resource that provides a live view of selected emergencies and weather events in the U.S., 24 hours a day, 7 days a week. It automatically incorporates real-time updates from federal sources so you can view the potential effects of hurricanes (and other disasters) on America's population and workforce. The Census Bureau and the National Oceanic and Atmospheric Administration have jointly developed this application for disseminating real-time data.

This tool uses local socio-economic and demographic statistics from the American Community Survey and other Census Bureau data sources to provide a detailed look at affected areas. It gives you information on the number of people potentially affected by a storm, as well as some of their characteristics down to the neighborhood level–for example, the percentage of residents age 65 or older or

local employment patterns. The Census Bureau provides vital economic and demographic data to federal and local emergency management agencies, which can use this information to better assess the impact hurricanes have on coastal populations. For example, following Super Storm Sandy, New Jersey officials used this application to estimate the volume of traffic in affected areas.

In addition, Census Bureau data from the economic census, County Business Patterns, , Survey of Business Owners and Non-employer Statistics to supplement OnTheMap for Emergency Management.

There are limitations to the contribution demographers and demographic data can make to disaster preparedness and response. First, data about populations are rarely available in real-time. Therefore, using demographic data in disaster preparedness requires serious considerations about the accuracy and reliability of estimates; policy makers need to be aware of the sensitivity of preparedness plans to changes in figures and rates. In addition, more localized geographical data may be needed in preparedness than are gathered by traditional demographic surveys or instruments. Demographers can help preparedness experts develop appropriate surveys about populations that may potentially confront emergency situations. The disaster preparedness community must exercise informed discretion in data use and acknowledge that perfect information about a population does not exist.

Case Study 13.4: Assessing the Impact of a Disaster

In the aftermath of the destruction caused by Hurricane Katrina in the New Orleans area, a demographer was engaged to assist an insurance company in determining the extent to which it was liable for damages incurred by a New Orleans-area hospital. The hurricane and subsequent flooding had caused extensive damage throughout the area, and many of the city's health facilities had been evacuated and remained closed.

The hospital that was the subject of the analysis was some distance from "ground zero" and had sustained little physical damage. Its physician office building had suffered some superficial damage but had only been closed for a couple of days. Other than some minor damage to a parking lot, there was little else that could be attributed to the hurricane and its aftermath. The hospital never closed and, in fact, was operating at capacity due to the lack of other facilities in the area.

Despite operating at capacity, the hospital had experienced a significant drop in revenue in the months following the hurricane. In the wake of the storm the payer mix among the hospital's patient changed dramatically. While prior to the storm, the hospital's clientele was mostly well-insured suburban residents, and, although the hospital was not operating at capacity, it was generating a healthy cash flow from paying patients. After the hurricane, its patient mix changed fairly dramatically. Patients who had previously patronized inner-city hospitals using Medicaid insurance or paying out of

pocket were now forced to use this suburban hospital. Despite the increase in volume the hospital's revenue declined.

The hospital presented a "bill" to the insurance company indicating that its "damage" as a result of the natural disaster was in the range of $12–20 million dollars. This is the amount they claimed to have lost as a result of the storm. However, the insurance policy clearly stated that its liability extended only to losses incurred as a result of *physical* damage to the facility. It specifically excluded losses incurred as a result of changes in the demographics of the patient population or any other change reflecting population shifts.

The demographer engaged by the insurance company was charged with determining the extent to which the losses incurred were a result of physical damage as opposed to damage due to changes in the makeup of the patient population. This was not a difficult call for the demographic consultant. There was no damage to the property that resulted in any change in terms of utilization of the facility. On the other hand, the patient mix had changed dramatically as a result of people being displaced by the storm and the closure of several medical facilities. The most obvious finding from a review of patient data was the shift in source of payment from private insurance to Medicaid and self-pay (i.e., essentially no-pay). Further, when patient origin was examined it was found that patients were originating from areas much further away from the facility than pre-hurricane and that the racial and ethnic mix was now much different, with a much higher proportion of African-Americans and Hispanics among the patients.

Based on the information available the demographer concluded that virtually none of the losses incurred by the facility were related to physical damage. In fact, essentially 100% of the revenue decline was due to the shift in the demographics of the patients utilizing the facility. The findings from this analysis provided the information required by the insurance company to negotiate a settlement with the hospital based on factual data.

Exercise 13.5: Disaster Preparedness Planning

You have been assigned to the task force responsible for preparing response plans should a disaster occur. There are some general measures to be taken for any disaster, but specific types of disasters are likely to require different types of responses. For the type of disaster specified below, answer each of the questions posed to the task force.

Group 1: Disaster type: Flood

Will all or part of the geographic area be directly affected? Explain your answer.

Will all or part of the area population be directly affected? Explain your answer.

Will all types of housing be affected or will some be affected more than others? Explain your answer.

What, if any, demographic categories will be affected more than others and why?

What are the characteristics of the population(s) most vulnerable to the impact of this type of disaster?

What groups are going to be least able to recover from the effects of the disaster?

What type of health consequences can be expected from this type of disaster?

Which groups will suffer the greatest health consequences from this type of disaster?

What policies should be put into place to protect the total population from such a disaster? The most vulnerable population(s)?

You have been assigned to the task force responsible for preparing response plans should a disaster occur. There are some general measures to be taken for any disaster but specific types of disasters are likely to require different types of responses. For the type of disaster specified below, answer each of the questions posed to the task force.

Group 2: Disaster type: H1N1 Outbreak

Will all or part of the geographic area be directly affected? Explain your answer.

Will all or part of the area population be directly affected? Explain your answer.

Will all types of housing be affected or will some be affected more than others? Explain your answer.

What, if any, demographic categories will be affected more than others and why?

What are the characteristics of the population(s) most vulnerable to the impact of this type of disaster?

What groups are going to be least able to recover from the effects of the disaster?

What type of health consequences can be expected from this type of disaster?

Which groups will suffer the greatest health consequences from this type of disaster?

What policies should be put into place to protect the total population from such a disaster? The most vulnerable population(s)?

You have been assigned to the task force responsible for preparing response plans should a disaster occur. There are some general measures to be taken for any disaster but specific types of disasters are likely to require different types of responses. For the type of disaster specified below, answer each of the questions posed to the task force.

Group 3: Disaster type: Earthquake

Will all or part of the geographic area be directly affected? Explain your answer.

Will all or part of the area population be directly affected? Explain your answer.

Will all types of housing be affected or will some be affected more than others? Explain your answer.

What, if any, demographic categories will be affected more than others and why?

What are the characteristics of the population(s) most vulnerable to the impact of this type of disaster?

What groups are going to be least able to recover from the effects of the disaster?

What type of health consequences can be expected from this type of disaster?

Which groups will suffer the greatest health consequences from this type of disaster?

What policies should be put into place to protect the total population from such a disaster? The most vulnerable population(s)?

You have been assigned to the task force responsible for preparing response plans should a disaster occur. There are some general measures to be taken for any disaster but specific types of disasters are likely to require different types of responses. For the type of disaster specified below, answer each of the questions posed to the task force.

Group 4: Disaster type: Chemical Plant Explosion

Will all or part of the geographic area be directly affected? Explain your answer.

Will all or part of the area population be directly affected? Explain your answer.

Will all types of housing be affected or will some be affected more than others? Explain your answer.

What, if any, demographic categories will be affected more than others and why?

What are the characteristics of the population(s) most vulnerable to the impact of this type of disaster?

What groups are going to be least able to recover from the effects of the disaster?

What type of health consequences can be expected from this type of disaster?

Which groups will suffer the greatest health consequences from this type of disaster?

What policies should be put into place to protect the total population from such a disaster? The most vulnerable population(s)?

References

Allen, H., & Katz R. (2010). Demography and public health emergency preparedness: Making the connection. *Population Research and Policy Review*, *29*(4), 527–539.

Chen, G. (2015). *Understanding no child left behind*. Downloaded from URL: https://www.publicschoolreview.com/blog/understanding-no-child-left-behind.

Cook, L. (2015a). No, justice is not colorblind. *U.S. News and World Report*. Downloaded from URL: https://www.usnews.com/news/blogs/data-mine/2014/12/11/no-justice-is-not-colorblind.

Cook, L. (2015b). *U.S. education: Still separate and unequal*. Downloaded from URL: https://www.usnews.com/news/blogs/data-mine/2015/01/28/us-education-still-separate-and-unequal.

Coomans, G. (2005). *The demography/education squeeze in a knowledge-based economy (2000-2020)*. Downloaded from URL: http://ftp.jrc.es/EURdoc/eur21573en.pdf.

Lapkoff, S., & Gobalet, J. (2017). *Enrollment effects of opening a new school: Build it and they will come!* Unpublished case study.

Measure Evaluation. (2017). *Lesson 2: Population analysis and planning*. Downloaded from URL: https://www.measureevaluation.org/resources/training/online-courses-and-resources/non-certificate-courses-and-mini-tutorials/population-analysis-for-planners/lesson-2.

U.S. Census Bureau. (2017). *Providing information for emergency preparedness as hurricane matthew approaches*. Downloaded from URL: https://www.census.gov/newsroom/blogs/director/2016/10/providing_informatio.html.