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The Evolution and Need for Indirect Techniques for Demographic Estimation**Shanta Upadhyaya (Adhikari)****Lecturer, Mahendra Ratna Campus TU, Kathmandu**

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Abstract

Indirect Technique refers to methods of estimating demographic measures such as fertility, mortality, and migration. The title of this study is the evaluation and need for indirect techniques for demographic estimation. The objectives of this study are to explore the descriptive analysis of indirect techniques and their concept, historical development, and contemporary necessity in demographic research.

This study is based on secondary sources of data, including academic notes, textbooks, and scholarly articles. These findings demonstrated the importance of both direct and indirect methods of demographic estimation. Some examples of direct estimation include censuses, vital registration system, and surveys. The study explores both direct and indirect demographic techniques are essential for estimating demographic data and correcting demographic errors.

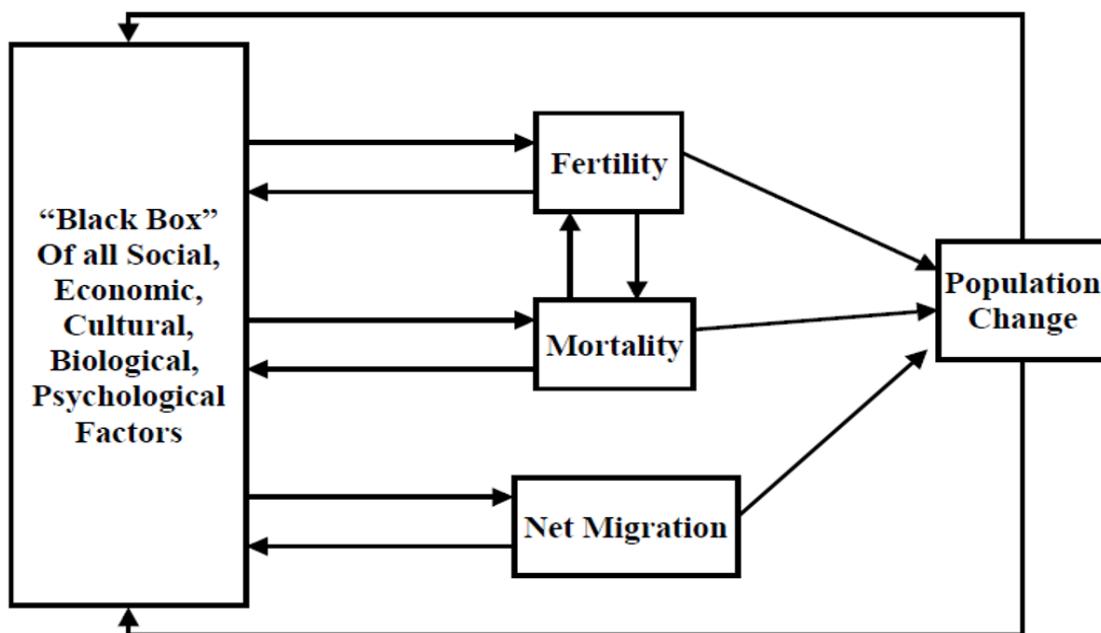
Direct techniques of population estimation, includes the collection of population data through censuses, vital registration system, and sample surveys. However, indirect technique indicates this demographic estimation which is relatively straight forward to apply and produce more accurate demographic data by detecting inconsistencies and adjusting imperfect data. Both direct and indirect techniques of demographic estimation are essential for generating accurate and reliable demographic data and information, monitoring population changes over time, and supporting evidence-based policy formulation and development planning. Furthermore, indirect techniques or estimation developed across various countries enhance the comparability and validity of demographic analysis in data-deficient settings. So, indirect techniques play a central role in improving the quality of demographic data and are indispensable tools for demographers and policymakers working in contexts where direct demographic data are limited.

Keywords: Demographic, Evolution, Demographic estimation, Indirect techniques, Parameters, Secondary source,

Background of the study

Demographic estimation consists of the attempt to measure key demographic parameters such as birth rate, death rate, and total fertility rate, especially in contexts where data is incomplete, inaccurate, or unavailable. In the case of developing countries including Nepal, direct estimation like census and civil registration systems may be unreliable or inconsistent. So, necessary of indirect techniques of demographic estimation is essential. Which play key role in understanding the areas of population dynamics including policy decision complete of empirical data (Thasineku, 2019). Thus, demographic estimation is relatively straightforward in countries with comprehensive and reliable census data and vital registration systems that accurately record births and deaths. However, such conditions are rare and primarily found in a limited number of developed nations. In many contexts, especially in developing countries or historical and anthropological populations, direct demographic data are often incomplete, inconsistent, or biased due to underreporting, misreporting, or gaps in registration systems. Subsequently, these kind of limitations necessitate the application of indirect techniques allow for researchers to infer demographic parameters through alternative sources of data and statistical models, thus improving the reliability of demographic analysis in data-deficient settings (Gage, 2010).

Concept of Demography and Population Studies



The above picture's name is "Black Box" which indicates the relationship between social, cultural, economic, cultural and psychological factors that indirectly influence population change by affecting demographic components of population changes like fertility mortality and migration population change by influencing demographic components of population including fertility mortality and migration.

Fertility indicates the actual childbearing preferences of women in their reproductive child bearing age. Which is affected by various socio-economic and cultural beliefs and psychological factors.

Mortality represents the incidence of death in a population during the given time periods. Which is influenced by various health, nutrition, lifestyle and environmental conditions.

Migration refers to the movement of people from one place to another for specific place in specific time periods.

Typically, a woman's reproductive lifespan ranges from ages 15 to 49 (Rai, Pareek, Joshi, & Tiwari, 2018).

Direct measures of demographic estimation such as, the census, vital registration system, sample survey, and admirative records. These methods are generally most accurate in developing countries. However, in developing countries, including Nepal, errors often occur due to the irregularity and incomplete coverage of some direct techniques, particularly the vital registration system.

The term "indirect" in demographic estimation refers to methods or techniques that produce estimates of demographic parameters based on information that is only indirectly related to their actual values. Demographic estimation consists to measure the fundamental parameters, such as the birth rate, the death rate, and the total fertility rate even under less-than-perfect data conditions. These basic Parameters are important and essential for understanding the way in which a population will evolve, in terms of size and age structure, over time

A balancing equation (component method) is an example.

$$P_t - P_0 = (B - D) + (I - O) + \epsilon$$

Where,

$P_t - P_0$ = net population change during intercensal period;

$B - D$ = rate of natural increase during intercensal period;

$I - O$ = net migration during intercensal period; and

ϵ = error term.

In the context of Nepal, as well as developing countries, indirect techniques of demographic estimation is important. So, accurate, reliable and comprehensive data are often lacking. In this situation, indirect estimation of demographic techniques serves as essential tools for analyzing population dynamics. These technique of demographic estimation, including the Brass P/F ratio and logistic curve functions helps to estimation of demographic data. These are important indicators like fertility and mortality rates in the absence of reliable estimation of demographic data. Indirect techniques play central role in the case of inconsistencies and inaccurate data. In this situation. Their application is particularly significant during demographic transition, as they provide and helps and supports effective for demographers, academic inquiry planning and policy formulation. (Bijaya Mani Devkota, 2024). Demographic estimation of demographic techniques Demographic parameters and techniques denotes to essential grounded methods, which is used to estimate or calculate or estimate of demographic parameters. These techniques play key roles and they are theoretically guided, mathematically correct and methodologically rigorous. Different straightforward measures, the information used is not always directly related, and the process of estimation is often indirect, trusting on systematic scientific approaches to derive accurate demographic insights. According to (Lucciano, 2023) indirect techniques is a demographic estimation method that uses in consistency checks of conventional data in an unconventional way. Generally speaking, the methods of estimating reliability and validity related to demographic elements and statistics is called indirect method. It calculates more accurate rates, ratio, etc. using various demographic patterns in addition to detecting errors in data. It is one of the most important techniques in demographic estimation. It is the methods adopted to reduce the mistakes made by direct techniques. This helps to reduce the statistical errors associated with the population. There are errors in the various rates and

proportions calculated based on the data obtained from various sources such as census, vital registration system, sample survey etc. which is based on direct techniques. Indirect techniques are one which calculated indirect way and minimize the errors.

Indirect techniques in demographic estimation are methods used to estimate various demographic parameters or characteristics when direct data collection is not feasible or unavailable. These techniques rely on alternative sources of information or use models and assumptions to infer demographic measures. They are commonly used in situations where traditional direct data collection methods, such as censuses or surveys, are difficult, expensive, or impractical to conduct UN (1983).

Purpose of indirect techniques

The purpose of obtaining reliable and valid estimates of demographic parameters is defined by as involving three key objectives: using conventional data in unconventional ways, performing consistency checks to ensure data accuracy, and applying demographic models to improve estimation processes.

Indirect techniques of demographic estimation

- i. Brass P/F ratio methods used to estimate of total fertility rate used to by comparing current fertility with cumulative fertility from older cohorts. This method adjusts for age misreporting and incomplete birth histories.
- ii. Orphanhood method used to estimate adult mortality by analyzing the proportion of respondents whose mothers or fathers have died. It assumes a stable age distribution and known fertility patterns.
- iii. Indirect methods with sisterhoods methods used to estimate maternal mortality by asking respondents about the survival rates of their sisters. It is especially useful in settings with high maternal mortality and weak health information systems.
- iv. Model Life Tables like, United National models, Coale-Demeny models, allow to estimation of age specific mortality rate and life expectancy rates using partial data inputs.
- v. Techniques of Synthetic cohort, which is used to estimate demographic estimation based on hypothetical cohorts, allow to analysis to simulate long term outcomes from short term data.

Results

In this section, discusses several important aspects related to indirect techniques, including their needs, importance, uses, evaluation and their limitations.

Evaluation of Demographic Estimation

Traditionally, demographic estimation has relied on data collected through censuses and vital registration systems, which continuously record vital events such as births, deaths, marriages, and divorces when these data sources function perfectly, direct calculation of demographic parameters is possible. Although, in the case of many developing countries like Nepal, vital registration systems are incomplete or irregular. That kind of situation, the data are poor quality inaccurate due to underreporting of demographic events like births deaths, or incorrect recording of demographic events like, births, deaths and migration including age at deaths or mothers' parity. Similarly direct estimation like data of census explore often suffer from coverage errors including over counts and under counts. These kinds of issues seen at the time of age reporting, which, affects the accuracy of population by age and sex. To address this kind of challenges, demographers have developed indirect techniques of demographic estimation that enable accurate estimation despite inaccurate data. According to the development of such techniques has focused on either robust method for analyzing traditional data or on designing survey questions that provide sufficient information to permit indirect estimation of demographic phenomena.

The use of indirect techniques of demographic estimation is essential not only for estimation demographic parameters but also directing and minimizing hidden errors in the time of data collection and measurement, ensuring accurate reliable demographic analysis and also better monitoring of trends of population and development (Rai et al., 2018).

Demographers have developed a range of indirect estimation techniques to monitor and evaluate population and development, following two main approaches: refining methods to analyze data from traditional systems, and designing survey questions that can accurately capture key demographic information to enable indirect estimation. To achieve globally comparable data and methods, surveys and censuses use specific questions aimed at minimizing omissions for example, asking respondents separately about children living with them, children living elsewhere, and children who have died. Summing responses to these detailed questions provides a

more accurate count of children ever born, often differentiated by sex through a set of six targeted questions UN (1983).

Importance of indirect techniques

In demographic estimation consists of the attempt to measures values of basis demographic parameter such as birth rates, death rates and so on. Indirect techniques of demographic estimation play significance role to minimize the errors of population data. The importance of demographic estimation lies in its ability to describe assumptions, actual models, and their applications for estimating demographic parameters through indirect techniques. These techniques are particularly valuable because they are relatively easy to apply, allowing researchers and policymakers to derive meaningful demographic insights even when direct data are incomplete or unreliable Bijaya Mani Devkota and Devkota (2011). Indirect techniques of demographic estimation have been used in developing countries including Nepal, where direct estimation like vital registration system reflect irregularity and or poor quality. So, it is necessary to conduct indirect techniques of demographic parameters when the measures in questions at that time when the fertility and mortality rates are not easily available (Singh, Karunakara, Burnham, & Hill, 2004).

Indirect techniques of demographic estimation are essential aspects of demographic research, especially in contexts where complete data are lacking, such as in historical demography or much of the developing world. One example of some indirect methods is the sisterhood method, where women report on the survival and reproductive histories of their sisters. Which enables researchers to estimate birth and death rate indirectly. Furthermore, surveys that collect information about siblings, parents and children provide valuable insights into demographic patterns. In both historical and in modern settings, demographic modeling tools cover fertility, mortality, disability, marriage and population growth. These indicators play a key role in analyzing population dynamics.

Long-term, nationally representative cohort studies, such as those in Britain, continue to offer valuable data on generational differences in health, education, attitudes, childbearing, and employment, even without direct enumeration (Lucciano, 2023).

Uses of Indirect Demographic techniques

Indirect techniques of demographic estimation are very useful tools for estimating demographic parameters. they play a central role to minimizing the errors of direct techniques

and providing reliable and valid data. These techniques also help to produce demographic data at regular interval, which is essential for continuous monitoring.

These techniques offer nearly accurate demographic information, making them valuable tools for policymakers involved in population and development planning. By addressing data problems commonly found in various sources, indirect methods improve the quality of demographic analysis, especially in developing countries where data collection systems may be weak. Furthermore, estimation of indirect techniques from different countries to enhance estimation accurateness by helping to solve the challenges and supports the population data challenges and supports evidence-based decision making.

Needs of indirect techniques

Traditionally, direct demographic estimation methods such as censuses, vital registration systems, sample surveys have been developed to estimate demographic parameters. However, in many developing countries including Nepal, vital registration system has not regular interval. As a result, accurate information is not found. So, indirect techniques are essential. However, this ideal scenario assumes both systems are flawless, which is rarely the case. In many countries, vital registration systems either do not exist or perform poorly, leading to severely flawed direct estimates due to issues like failure to record all vital events such as child or adult deaths or inadequate recording of event characteristics like age at death, mother's age at birth, or parity. Similarly, censuses are prone to errors such as undercounts, overcounts, or multiple counts, and frequently suffer from poor age reporting, which complicates the accurate classification of population by age and sex, further affecting the reliability of demographic estimates (UN, 1983); (Gurung, 2079).

The demographic estimation is an essential aspect of demographic estimation, in that it trusts direct demographic techniques like censuses, vital registration systems and sample survey data when registration systems are incomplete, especially in the case of child mortality. Indirect techniques of demographic estimation of child mortality involve asking mothers about their children regarding child mortality of children ever born and surviving, then transforming the proportion of deceased children into life table measures. (Guedes, Siviero, Queiroz, & Machado, 2011).

Discussion

The study emphasizes the critical role of indirect methods in demographic estimation, especially when direct data collection is either impractical or impossible. Indirect techniques serve as scientifically guided, mathematically sound, and methodologically rigorous approaches that allow researchers to estimate demographic parameters by using alternative data sources or models based on assumptions. This study highlights that in order to estimate demographic patterns and minimize the errors in population data, indirect techniques are very crucial.

Traditional method of estimating demography is heavily based on censuses and vital registration systems, which records events like births, deaths, and migration. However, in the context of developing countries like Nepal, these data sources are usually found incomplete due to misreported ages, underreporting, and unrecorded events (Gurung, 2079). These gaps are addressed through indirect techniques with the application of models and check consistency to adjust and correct data so as to produce more reliable estimates than direct methods.

The findings also indicate that indirect techniques can produce more accurate rates of demography by finding out errors in the data sources and analyzing pattern. The indirect techniques are also the relatively simple to apply. They support the consistency of censuses, surveys, and vital registration systems, supporting the policymakers to monitor population change more effectively. Furthermore, these methods allow for the estimation of demographic changes over time intervals, which is very essential for planning and development. Various demographic models also develop accuracy in settings in which there is a poor data quality and a weak collection system (Devkota & Devkota, 2011).

Despite all the importance of indirect techniques, they also have certain limitations. These techniques are based on certain models and assumptions that may not reflect local demographic realities completely (G.C. & Adhikari, 2075). However, they correct the incorrect data providing accurate estimates. Due to this, they are considered as a valuable tool in demographic research and practice.

Conclusion

Indirect techniques of demographic estimation are mostly used when direct data are unavailable or incomplete. They generate a valid and accurate demographic information. These methods rely on standardized models and alternative data sources. The methods also infer demographic measures, reducing the problems and minimizing the inaccurate figures in

population. This method eases the process of application and helps to detect and correct the errors making them useful in the context of weak data collection systems.

Indirect techniques play a vital role to understand the population dynamics, monitor the changes in demography and support policy and planning and improve the accuracy of demographic estimates. Although they are based on assumptions that may not perfectly capture local realities, their contribution to produce consistent, comparable, and scientifically sound statistics remains significant. Ultimately, these methods are very essential for both policymakers and researchers who are concerned with population and development. They ensure an accurate and evidence-based demographic information that is suitable for long-term planning.

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