

Studies in technical demography: Where are the demographers?

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Abstract

Technical demography is defined as the field of demography which deals with methods, techniques and measures used in demographic estimation and analysis. However, there is concern about the field in current academic and research curricula. In this paper, we provide a review of developments in the field and empirically demonstrate that there has been a decline in the proportion of technical demographic studies published in the last two decades. All original articles published in six demographic journals from Africa, Europe, Australia and United States were reviewed to assess the number of research publications on technical demography.

A total of 3265 studies were published in 317 issues of the selected journals between 1994 and June 2015 of which 233 (7.0%) were on technical demography . The proportion of technical demographic studies declined gradually at an annual rate of 0.45% (CI= 0.29-0.62) between 1994 (13.0%) and 2015 (6.0%). The discipline need to be strengthened in order to provide the critical data required for monitoring the post-2015 development goals especially in developing countries.

Keywords: Technical demography, Indirect demographic estimation, Demographic analysis, Developing countries

Background

Hauser and Duncan (1959) defined demography as “the study of the size, territorial distribution, composition of population, changes therein, and the components of such changes”. This definition clearly portrays the interdisciplinary nature of the field. For instance, population change could be economical, sociological, biological, etc- all of which rests in another discipline (Xie 2000). It is unequivocal that measurement, estimation and analysis is the bedrock of demography. This aspect of the field is also known as technical demography - the branch of the discipline that deals with the methods, techniques and measures used in demographic estimation and analysis (Ramakumar and Gopal 1986). It constitutes the core of demography as a discipline. This is underscored by historical developments in the field. From John Graunt - life tables to Alfred J. Lotka (who first proved the stable population theory) and several others, the discipline has thrived on the innovations, theories and models developed in technical demography.

The conventional sources of data for demographic estimation are vital registration systems (for continuous registration of births, deaths and marriages/divorce) and population censuses. Over the years, these data sources have been at different levels of advancement and completeness in different regions of the world. In the western countries, VRS and censuses have existed for long and sophisticated enough to provide reliable data for direct estimation of demographic parameters but the situation in developing countries especially sub-Saharan Africa is different. In the latter settings, though censuses were sometimes conducted, however, VRS were rare especially during the colonial and early independence era. To overcome this challenge, demographers led by William Brass pioneered the development of techniques for “indirect estimation” of demographic parameters.

Indirect demographic estimation involves the use of methods and procedures to estimate demographic parameters from data that is defective, indirect or both (Brass and

Coale 1968; United Nations 1983). Vital registration data could be defective as a result of low level of completeness in recording of births and deaths. Coverage and content errors such as age misstatement are common sources of defect in census data. Development of indirect techniques followed two pathways – search for methods to analyse data from defective traditional sources (surveys, census and VRS) and the use of indirect evidence on births and deaths. From the second path, a wide array of indirect techniques emerged from three ideas: (i) estimation of fertility from data on births in previous year and children ever born to women of childbearing age; (ii) estimation of infant and childhood mortality from data on children ever born and surviving; and (iii) the use of model life tables and stable populations to estimate fertility, mortality and adjusted age distributions (Brass and Coale 1968). These three innovations have undergone refinements, extensions and different forms of adaption and applications before it culminated in the publication of the popular Manual X by the United Nations in 1983 (United Nations 1983). Many of the techniques developed have also been applied in developed countries for assessment of the quality of census data, historical estimation of fertility and mortality rates. These efforts have enriched the subject of technical demography and the broader discipline as a whole. Prior to 1994, there were many studies applying technical demography with publications in Journals such as Demography, Population Studies, etc.

However, since 1994, despite these achievements, the teaching, training, research and future developments have been observed to be diminishing. This observation has been made at two separate seminars organised six years apart by the International Union for Scientific Study of Populations (IUSSP). The first was the seminar on demographic training in the third world in 2001 (Tomassini 2001) while the second one in 2007 was focused on data needs for monitoring the Millenium Development Goals in developing countries (IUSSP 2007). Some of the reasons adduced at the seminars include dwindling support for

demographic training and imminent ageing and subsequent retirement of skilled professionals especially in developing countries (Moultrie 2009). In response to these worrisome developments, a special meeting was convened by the IUSSP on teaching and training in applied and technical demography in developing countries in 2009 (Moultrie 2009). At the meeting, the genesis of the problem was traced to the outcome of the 1994 International Conference on Population and Development (ICPD) after which funding for population and demography was channelled to other areas such as human rights, sexual and reproductive health. Even though the ICPD plan of action touched on population and development, it however, encouraged broad approaches such as women empowerment and human rights (UNFPA 2004).

Two of the short-term interventions suggested at the 2009 meeting have since been implemented. The first is a much updated web-based version of Manual X, titled “Tools for demographic estimation” (Moultrie et al. 2013). The web-based tools for demographic estimation comprised dynamic webpages on description of the methods, rationale and data requirements as well as illustrative examples with downloadable Excel spreadsheets. It includes new methods and advances, exposition on how well each method work under different conditions. Materials on measurement of migration from census data which was not part of Manual X are now included in the web-based tool. The second intervention is an online training course on “population analysis for policies and programmes (IUSSP and UNFPA 2013). This online course module provides users with basic knowledge on technical population analysis. It covered topics ranging from sources, collection and evaluation of demographic data to advanced methods of demographic analysis such as model life tables, population dynamics/ projections and advanced fertility analysis.

In a commentary on the dying art of technical demography, Saxena (2011) also alluded to the roles of the ICPD and further blamed the dwindling fortune on the

replacement of technical demography courses by other topics on population and development issues. As a result, most demography and population studies graduates lack indepth knowledge in technical demography and therefore not adequately equipped to drive further improvements in the subject area. A paper presented at the Population Association of America annual meeting also decried the weak status of demographic training in South Africa amidst the hope of improved data quality in censuses and VRS in Africa as a whole (Pali 2015). The situation is not much different in other African countries.

Though these problems are real, there has not been empirical evidence on the dearth of technical demographic research outputs in peer-review publications. Meanwhile, it is opined that journal publication is not just a means of communication among researchers, it also reflects developments in a discipline (Keyfitz 1993). Therefore, to assess progress in a subject area, journal publication is a useful benchmark. This implies that one way to assess whether the field of technical demography is dying is by checking articles published in relevant journals and quantifying the proportion of technical demographic studies therein. Therefore, in this review, we investigate the hypothesis that there has been a decline in the proportion of technical demographic studies published in demographic journals in the past two decades. Technical demographic studies as used here means the application of indirect estimation techniques of demography in research publications.

Methods

In order to ascertain the number of technical demographic studies published between 1994 and June 2015, we reviewed all publications in six leading demographic journals: African Population Studies, Demography, Demographic Research, GENUS, Journal of Population Research and Population Studies. African Population Studies was launched in 1984 by the Union for African Population Studies based in Ghana. Demography is published bimonthly

by the Population Association of America since 1964 while the Journal of Demographic Research was launched in 1999 by the Max Planck Institute for Demographic Research, Germany. GENUS is published by the University of Rome in Italy and was founded in 1934. Journal of Population Research was formerly known as the Journal of the Australian Population Association till 1999, the first volume was published in 1984. Population Studies is published at the London School of Economics since 1947. We chose these journals to reflect the various regions. Thus African Population Studies for Africa region; Demography for North and South America; Demographic Research, GENUS and Population Studies for Europe; Journal of Population Research for Australia and Asia. These journals have international focus and do not restrict publication to papers from any region of the world.

All articles in every issue of the selected journals were screened to determine whether they could be classified as a technical demographic study. For this review, an article was deemed to be technical if it involves the use of any concept in technical demography (methods, measures, and techniques of demographic analysis). As such, we included articles that involved demographic estimation (direct and indirect), life table techniques, population projections, and assesment of quality of census or survey data. Articles on family demography, historical demography and those that merely used advanced statistical models were not classified as technical demographic studies.

For each issue of the journal, we recorded information on the year of publication, volume, issue, total number of articles and number of technical demographic studies. The technical demographic studies were further sub-classified under mortality, fertility, nuptiality, migration, data quality assessment and others (population projection and forecasts, and decomposition of changes in life expectancies). We derived yearly aggregate for total number of articles and number of technical demographic studies for 1994 to 2015 and subsequently computed the proportion of technical studies for each year. We illustrated the

trends in the proportion of technical demographic studies in a graph and also estimated the annual rate of decline using simple linear regression.

Results

A total of 3265 studies were published in 317 issues of the selected journals between 1994 and June 2015. Table 1 shows that 90 (28.4%) of the 317 issues were contributed by Demography Journal while Demographic Research had 32 (10.1%). Overall, 233 (7.0%) of the 3265 articles were based on technical demography. The proportion of technical demographic studies ranged from 13.0% in 1994 to 6.0% in 2015 (Table 2). Figure 1 shows that the proportion declined gradually at an annual rate of 0.45% (CI= 0.29-0.62) between 1994 and 2015.

The results further show that the technical demographic studies were devoted to mortality (44.4%), fertility (26.4%), data quality assessment and population projections (20.9%), migration (5.4%) and nuptiality (1.3%).

The mortality studies covered infancy and childhood, adulthood and older ages. Many of the childhood mortality studies utilized techniques such as children ever born/child surviving method (Adetunji 1996; Blacker et al. 2007), preceding birth technique (Aguirre 1994; Bairagi et al. 1997), and hazard and frailty models (Bocquier et al. 2011; Sastry 1997). For adult mortality, widowhood (Ahmed 1995), sibling survivorship (Gakidou and King 2005; Masquelier 2013), orphanhood methods (Grassly et al. 2004; Udjo 2014), Lee-Carter model (Booth et al. 2006; Booth et al. 2002; Miller and Lee 2001), method of extinct generation (Bourbeau 2000; Elo 2001; Guillot 2003; Hill et al. 2005; Preston et al. 1999), survival ratio (Spoorenberg 2008) and life tables (Kannisto et al. 1999; Kostaki and Panousis 2001; Nath and Choudhury 1995; Rowland 1996; Zaba and Paes 1995) were quite common. A few studies also explored new developments such as Bayesian extension to Lee-Carter model (Booth et al. 2006; Wisniewski et al. 2015; Zhao 2012) and multi-dimensional life table

method (Eini-Zinab 2013). However, most of the latest developments have only been used in developed countries and applied to census and VRS data.

Fertility studies cut across different regions of the world and were based on censuses, surveys and VRS data. Analytical models in the 1990s included parity progression ratio (Kohler and Ortega 2002; Moultrie et al. 2012; Sibanda 1999), relational Gompertz model (Paget and Timaeus 1994; Udjo 1998, 2014), own-children method (Abbas-Shavazi 1997; Avery et al. 2013; Dubuc 2009), P/F ratio (Hinde and Mturi 2000; Moultrie and Dorrington 2008; Moultrie and Timaeus 2003; Udjo 1998), variable-r method (Alkema et al. 2011; Cai 2008), and Bongaarts model (Bongaarts 1999; Kohler and Ortega 2002; Odimegwu and Zerai 1996). Lately, methods such as truncated cohort parity progression ratio and the own-children method were being applied in developed countries contrary to the belief that these techniques are for developing countries where reliable VRS are lacking (Avery et al. 2013; Dubuc 2009).

Studies on population projections were also fairly common based on methods such as cohort-component projection and Bayesian approaches (Alkema et al. 2011; Bocquier 2005; Keilman et al. 2002; Thomas and Clark 2011; Wisniewski et al. 2015). With the exception of South Africa (Udjo 2013, 2014, 2015), population projections were scarce for Sub-Saharan countries. A few migration studies were found but predominantly conducted in USA and Australia using an array of direct, indirect and open-stable population models applied to census data (Bell and Stratton 1998; Wilson 2010). The generalised growth balance method have also been applied in census data quality assessment (Bhat 2002a, 2002b; Williams 2014).

Discussion

This review shows that there has been a significant decline in the proportion of technical demographic studies published in demography journals since 1994. We also observed that some demographic topics such as population projection, census data quality assessment were rarely published for developing countries especially in sub-Saharan Africa. Censuses and vital registration systems were supposed to be the prime sources of demographic data for population projection, estimation of demographic parameters, monitoring of population policies. Unfortunately, these traditional sources of demographic data are very poor and unreliable in many developing countries (Mathers et al. 2005). VRS in most places are passive and level of completeness is low. These are strong reasons for indirect estimation techniques.

The notable fall in the volume of technical demography studies in scientific publications is traceable to events in the population field in the past two decades some of which include the following among others; action plan from the ICPD 1994, interdisciplinary nature of demography, proliferation of household surveys and advent of demographic surveillance sites.

Prior to the 1994 ICPD, a key strategy to boost socio-economic development was the need to control population growth. As a result, there were lots of funding and programmes targeted at the training of demographers and other population experts who were supposed to have the core skills needed to implement, monitor and evaluate policies on population growth and programmes. Regional and other demographic training centres across different parts of the world were well funded for graduate level training of demographers and population scientists. After the ICPD, the plan of action shifted to promotion of human rights, women empowerment, individual sexual and reproductive health with major roles

earmarked for Non-Governmental Organisations (Hayes 1995). Sequel to this, a lot of funding opportunities previously dedicated to demographic training were diverted to these new focal areas. The aftermath effect was a boom in NGO activities on human rights, women and gender issues and reproductive health programmes for adolescents, youths, adults and the elderly. Unfortunately, demographic training suffered as many trained demographers also tactically abandoned their arts and trade to become reproductive health researchers and practitioners. This trend is made more noticeable in the content of most international population conferences organised by Population Association of America, IUSSP, UAPS, Asian Population Association, etc. Social demographic issues tend to dominate the presentations in these conferences.

The interdisciplinary nature of demography is also contributing to the declining trend in technical demography. The few demographic training centres that could survive in the poor funding climates had to revise their curricula to accommodate more substantive topics in tandem with the new realities. In addition, the interdisciplinary nature has made demography to be seen as a stepchild of many disciplines. Thus, most of demographic training are based in Schools of Public Health, Statistics, Sociology, Geography and Economics. Both teaching, research and practice of technical demography declined as a result of the interplay of these unfavourable factors.

In developing country institutions where these effects are felt most, the poor mathematical ability of the few students was another problem (Moultrie 2009). Though, this is not surprising, it is a reflection of the poor educational system and structure through which most students get admitted into higher institutions. The structural part of this problem is the general belief among prospective students that humanities generally do not require strong mathematical abilities. Since, demography is usually domiciled in the faculties of humanities or social sciences, students who have phobia for any sort of mathematical reasoning were

most likely to be admitted before they realise their need for such abilities. Most of these students manage to graduate and end up being disinterested in technical demography. The vicious cycle has been on in many institutions in developing countries and part of the consequences is amplified in our findings in this review.

Another factor that may explain the decline in technical studies in demography is connected with the basic raw material for the trade which is data availability. Censuses are rarely at regular intervals and when conducted at all, they are fraught with political and technical controversies. Worst still, the census data are not made available to researchers, despite the efforts by Integrated Public Use Microdata Series – IPUMS (Ruggles et al. 2003). This may be the reason why census data quality assessment has been scarce in developing countries. To overcome the lacuna created by challenges associated with census and VRS data, nationally representative household surveys has become very common. Interestingly, the funders and agencies implementing these surveys make the data available for further analysis. Many demographers and population scientists have had to leverage on these alternative data sources at least to keep the discipline alive.

Demographic surveillance systems (DSS) emerged in the mid 1990s as a way to remedy the poor VRS in developing countries. Though, the contribution of DSS to our understanding about health transition is commendable (Kahn 2011; Tollman and Kahn 2007), it suffices to say that DSS is not a substitute for good population census or a reliable VRS, rather it should be a compliment. Even the claim that DSS provides quality data is debatable as many of them have never assessed the quality of their data as done for the Indian sample registration system in the past (Bhat 2002a).

This review may have been limited due to the fact that we purposively selected only six of available demographic journals. No doubt, some technical studies in other journals

may have been left out, however, we strongly believe that the journals selected gave a fair reflection of happenings in the field of demography in the recent times.

Conclusion

This review has shown that research and publication in technical demography is wanning especially, in developing countries. As the international community prepare for the post-2015 sustainable development goals, the importance of population dynamics has reverberated across many developmental issues. For these goal to be objectively set, indicators defined and properly monitored, there is urgent need to continuously improve, enhance and apply skills in methods and techniques of demographic analysis. Training/teaching and research in technical and applied demography must be revitalised in developing countries. As part of the effort to lay a solid foundation for rejuvenating the discipline, we propose a study on the assessment of demographic training in African institutions to ascertain the content and quality of teaching, training and research in technical demography. Also to be investigated is the knowledge gap and teaching facilities in these institutions.

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Table 1: Table 1: Number of issues published by major demographic journals, 1994-2015

Journal	No of journal issues (n=317)	Percentage (%)
African Population Studies	35	11.0
Demography	90	28.4
Demographic Research	32	10.1
Genus	46	14.5
Journal of Population Research	51	16.1
Population Studies	63	19.9

Table 2: Summary of technical demographic studies published in major demography journals, 1994-2015

Year	Total no of studies	Technical studies	% Technical
1994	87	11	13
1995	98	12	12
1996	87	15	17
1997	103	11	11
1998	86	7	8
1999	89	10	11
2000	111	8	7
2001	107	10	9
2002	137	16	12
2003	127	11	9
2004	160	10	6
2005	155	17	11
2006	142	8	6
2007	153	8	5
2008	197	15	8
2009	150	6	4
2010	168	3	2
2011	198	16	8
2012	174	7	4
2013	274	14	5
2014	337	11	3
2015	125	7	6
Total	3265	233	7

Fig 1: Trends in percentage of technical studies published in selected demographic journals, 1994-2015



