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The study of Tibet's population history has been marked by a pervasive debate over Tibetan population development (Ekvall, 1972; Goldstein, 1981; Childs, 2008; Fischer, 2008a). 'Basic information on Tibetan demography has long been non-existent or uncertain for two reasons: (1) limited data availability (e.g. the Tibet Autonomous Region (TAR) was not included in China's national population censuses until 1982); and (2) because of the disputes and biased views from the Communist Chinese authorities that stressed the positive effect of the Chinese "liberation" of Tibet for local populations on the one hand, and on the other, the supporters of the Tibet movement who denounced the Chinese oppression of the Tibetan people and culture' (Spoorenberg, 2019, p. 277).

The study of Tibetan population development prior to 1950 has also been persistently affected by these political considerations between the advocates and opponents of the Chinese intervention in Tibet in 1951.(1) The proponents claim that the pre-1950s Tibetan population was declining due to a series of factors following a historical maximum reached at some point during the 18th century. The integration of the Tibetan areas into the People's Republic of China is therefore considered a positive intervention that contributed to stopping the decline of the Tibetan population. In this line of argument, the continuous and significant increase of the Tibetan population since the 1950s, documented by official data that often rest on little empirical evidence,(2) is taken as the most supportive evidence of the benefits of the Chinese intervention in Tibet. In contrast, the opponents argue that the Tibetan

(1) For a more exhaustive presentation and discussion of the arguments of each camp, see Childs (2008, pp. 214–221).

(2) For example, the TAR—the region where the largest share of the Tibetan population lives—was not included in the population censuses of China until 1982.

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population was flourishing before and that the Chinese intervention resulted in a substantial loss of the Tibetan population. In the absence of data on the Tibetan population, these conflicting political interpretations have prevented an impartial evaluation of the existing evidence to estimate the two main components of population growth in Tibet (mortality and fertility), the main aim of this paper.

Few studies have delved into the development of the Tibetan population before 1950 using disinterested data.(3) These studies have challenged two main speculations about the pre-1950s development of Tibetan populations; that is, a population decline from the 18th century until the Chinese intervention as well as the role played by fraternal polyandry in the assumed historical Tibetan population decline. Polyandry is a marital arrangement in which a woman has more than one husband. In Tibet, those husbands are often brothers. The prevalence of fraternal polyandry has varied between Tibetan communities, but the marital practice was widespread in historical Tibet, serving to secure and avoid division of landholdings.(4) Fraternal polyandry declined following the Chinese intervention and was banned during the Cultural Revolution's campaign against the 'Four Olds' (old customs, old culture, old habits, and old ideas), starting in 1966 (Goldstein et al., 2009). In the 1803 edition of his *Essay*, Malthus had already noted the possible role of polyandry in Tibet (in conjunction with the large proportion of celibate Buddhist monks) as a preventive check to population growth. The corollary of polyandry is a high rate of non-marriage for women, which can potentially limit population growth. The absence of demographic data had long prevented efforts to determine the aggregate effect of polyandry on fertility in the historical Tibetan population.

The first account on the topic came from a study by Goldstein (1981) on an ethnically Tibetan community in the highlands of north-western Nepal where polyandry was prevalent. Goldstein tested the assumption that polyandry, by way of excluding many women from marriage, leads to population decline. On the contrary, Goldstein found that in the community under study, fertility was sufficiently high to generate a slight population increase. Childs (2003) arrived at a similar conclusion. Based on a 1958 census for government taxpayer households from the district of Kyirong,(5) he showed that the reconstructed historical demographic circumstances were conducive to a small population increase of about 0.5% per year. This second study is important because the district of Kyirong was still under the Tibetan administrative system in 1958,

(3) The term 'disinterested' refers to research unrelated to any of the two opposing parties whose demographic estimates are tainted by political considerations.

(4) In some villages, all landholding households with two or more sons are polyandrous (Levine, 1988, p. 143).

(5) One of approximately 60 districts (*dzong*) under the administration of Ganden Podrang, the Tibetan government in Lhasa headed by successive Dalai Lamas since the 1600s until the 14th Dalai Lama fled into exile in 1959.

and the social and economic conditions resembled those elsewhere in Tibet. Kyirong is therefore a subset of the aggregate population analysed in this study.

According to these two studies, despite the practice of fraternal polyandry, historical Tibetan populations were not declining but experiencing a slow population increase. While instructive, this conclusion is based mostly on evidence collected at the local level, and it is not clear whether this conclusion can be extended to the Tibetan population as a whole. To determine if the Tibetan population was indeed experiencing a decline or an increase in the 1950s and earlier, estimates must be derived for the demographic components for the whole Tibetan population.

Populations change due to the combination of births, deaths, and migration. These data are not readily available for the pre-1950s Tibetan population and therefore need to be estimated. This task is facilitated by the fact that migration can be considered negligible for the Tibetan population before 1950. Historically, because the Tibetan population was geographically isolated, it did not experience major migration flows. Historical Tibetan population development has therefore been mainly influenced by mortality and fertility.

The following short analysis reviews and discusses the estimation of mortality and fertility for the Tibetan population prior to 1950. It then combines both components to draw a conclusion on the likelihood of a decline or an increase of the Tibetan population before 1950.

I. Estimating mortality rates for the pre-1950s Tibetan population

The absence of reliable mortality figures is a major limitation when studying pre-1950s Tibetan population development. Figures of an infant mortality rate (IMR or ${}_1q_0$) of 0.430 and a life expectancy at birth of 35 years for the Tibetan population before the 1950s are often cited in the literature (Hao, 2000, p. 16; Childs, 2008, pp. 219–221). These values, however, are inconsistent with one another. Among the nine families of existing model life tables (United Nations, 1982; Coale et al, 1983), the highest IMR associated with a life expectancy at birth of 35 reaches 0.347 for men (Coale–Demeny east model life table), about a quarter lower than the value of 0.430 cited for the Tibetan population. In addition, an IMR of 0.430 corresponds to a life expectancy at birth lower than 20 years in the Coale–Demeny south model life table, the most appropriate model for the Tibetan population according to Childs (2003).[6] In either case, the mortality figures for the historical Tibetan population that circulate are highly inconsistent with existing empirical evidence and should therefore be taken with extreme caution.

(6) According to Childs (2003, p. 436), '[t]he South pattern of mortality (Coale et al.,1983) best represents what we know about mortality in Tibetan populations, namely, high death rates in infancy, early childhood, and old age.'

For Childs (2008, p. 220), the value of an IMR of 0.430 for the historical Tibetan population is an example of 'mutant statistics': '[i]t was born erroneously categorizing childhood deaths as infant deaths.' If the 'mutant statistics' hypothesis is true and if the value of 0.430 is instead taken as an indicator of the level of the under-5 mortality rate (and not the infant mortality rate), a corresponding value for the life expectancy at birth of about 29 years would be derived based on the Coale–Demeny south model life table.

Under-5 mortality estimates for the Tibetan population in China can be derived using data from China's 1982 population census as well as indirect estimation techniques. Coale (1984) showed that the information on the children ever born by age of women collected during China's 1982 census was of good quality and consistent with the same measure estimated from the retrospective fertility survey conducted in parallel with the census. Referring to the statistics on the children ever born, Banister (1985, p. 471) concluded that '[n]ever before have China's government and scholars had such high-quality fertility data to work with.'

Aside from classic biases that can affect the collection of information on children ever born (recall error, mortality selection), there is no reason for the census data for Tibet to be of lower quality. On the contrary, the family-planning policy was not applied to Tibetan populations before 1983 and, as members of a minority ethnic group, Tibetan couples could bear two or three children without any conditions; those living in rural areas could bear as many children as wanted (Peng, 2002, pp. 66–67). Furthermore, the continuation of family lineage (through male descent) is less important in Buddhism (Childs et al., 2005; Skirbekk et al., 2015), and therefore female births are less likely to be unreported among Tibetan populations (Goodkind, 2004).

Based on a sample of the 1982 census microdata available in IPUMS-International (Minnesota Population Center, 2015), the information on the number of children ever born and children surviving collected from Tibetan women in China served to estimate child mortality using the QFIVE procedure in MORTPAK[7] and the Coale–Demeny south model life table (United Nations, 2013). Working with information collected from women aged 15–49, the resulting mortality estimates cover only the 15 years preceding the census. A simple linear extrapolation to 1950 of the under-5 mortality rate returns a probability of dying before age 5 of 0.380.[8] This level corresponds to a life expectancy at birth of about 33 years—a figure very close to the estimates of

(7) MORTPAK is a software package for demographic measurement in developing countries developed by the United Nations Population Division. It can be downloaded at: https://www.un.org/en/development/desa/population/publications/mortality/mortpak.asp

(8) To test the sensitivity of this result, the same analysis was made using each of the Coale–Demeny model life tables. The probability of dying before age 5 in 1950 ranges from 0.320 in the case of the north model life table (corresponding to a life expectancy at birth of 35 years); 0.350 in the west model life table (corresponding to a life expectancy at birth of about 33 years); and 0.365 in the east model life table (corresponding to a life expectancy at birth of 35 years).

life expectancy at birth for Bhutan and Nepal in the early 1950s, i.e. 32 and 34 years, respectively (United Nations, 2017).

The information on the number of children ever born and surviving from the 1982 census is available until age 64. In order to use most of the available information for estimating mortality, Brass's (1964) original idea of approximating the correspondence between the age of the mothers and the probability of their children dying was applied to the Tibetan data. The technique approximates the probability of dying between birth and different ages depending on the age groups of the mothers at the time of enumeration. For example, the data on the children ever born and surviving for women in the 55–59 age group can be used as an approximation of the probability of dying between birth and age 25 ($_{25}q_0$). Following Brass, the series of approximated probabilities of dying between birth and a given age was used to derive a series of under-5 mortality rates using the CORMOR procedure in MORTPAK (United Nations, 2013). The estimates obtained through this procedure indicate a Tibetan under-5 mortality rate close to 0.200 in the late 1960s and about 0.250 in 1962. A linear extrapolation to 1950 of this trend gives a probability of dying before age 5 of about 0.350.

The mortality level given by these data is likely to be underestimated due to recall bias and mortality selection. Women's declaration of the number of children ever born and surviving can be affected by reluctance to mention deceased children. Such an effect is likely to affect women across all ages, but it is expected to increase with age because older women are more likely to have experienced the deaths of more children. In addition, the information on the number of children ever born and surviving is collected among surviving women only. Due to mortality selection, mortality can be underestimated because the reproductive experiences of women who have had a higher number of children are not accounted for. These women were subjected to higher mortality risks delivering higher-order births.

The linear extrapolation to 1950 of the under-5 mortality rate covers the tumultuous period of the Great Leap Forward (1958–1962). Because of the lack of data, it remains difficult to assess in more detail the effects of this period on Tibetan demography. Based on data from the province of Qinghai, which has a large proportion of Tibetans, the population experienced a dramatic fertility decline and a sharp increase in the crude death rate (Peng, 1987). The (indirect) methods discussed in the present study are somewhat ineffective to account for the hypothetical effect of the Great Leap Forward on Tibetan demography. As noted above, the information on the number of children ever born and surviving from women who perished during that period could not be collected in the 1982 census due to mortality selection. The indirect methods based on the average number of children ever born and surviving are also ill-equipped to capture the full magnitude of short-term variations. In light of these points, the figures here are likely be an underestimation of the level of under-5 mortality. Despite its limitations, the linear extrapolation to 1950 of

the under-5 mortality rate can be considered a baseline mortality trend, on top of which the shock of the Great Leap Forward would be superimposed.

The levels of under-5 mortality given by the 1982 census for the historical Tibetan population are close to, yet slightly under, the level of under-5 mortality rate of 0.430 produced by the 'mutant statistics' scenario (see above), giving further credibility to Childs's conclusion (2008). Based on this evidence, one can conclude that the under-5 mortality rate in the pre-1950s Tibetan population was likely oscillating around 0.400, that is, around 4 out of 10 children would die before reaching age 5, corresponding to a life expectancy at birth of about 32 years.

II. Fertility level estimations in pre-1950s Tibetan population

As in the case of mortality, existing reports on the fertility levels and trends for the pre-1950s Tibetan population are scarce. Zhang (1990, cited by Childs, 2008, p. 221) cites a value of 3.0 children per woman in the 1940s, while Yang and Zhu (1993, cited by Childs, 2008, p. 221) report an average figure below 4.0 children per woman before the 1960s. Such values seem unrealistically low for a pre-transitional population and suggest fertility levels much lower than what has been reported in other local studies of pre-transitional Tibetan fertility.

To the best of our knowledge, only two studies have reconstructed Tibetan fertility during the 1940s and 1950s. Applying the own-children method to census data collected at the local level, Childs proposed one of the only available fertility reconstructions at the micro level for Tibetan communities. Based on a 1958 census for government taxpayer households (Childs, 2003, pp. 429–431), he estimated that Tibetan women in the district of Kyirong had 4.4 children on average for a 15-year reference period from 1943 to 1958 (Childs, 2003). This value is well above the level of 3.0 children per woman found in the existing literature on the pre-1950s level of Tibetan fertility (Zhang, 1990). While useful, the estimated fertility level refers to a 15-year period and does not provide an indication of the fertility trend. In addition, it had not yet been asserted that the conclusion from one local study could be scaled up to the entire Tibetan population in China.

Using data from China's population censuses, Spoorenberg (2019) reconstructed the fertility levels and trends of Tibetan women in China in the 1940s and 1950s, providing more robust evidence on the subject. Based on the number of children ever born classified by the age of women, total fertility can be estimated for women who have reached the end of their reproductive life. The application of this estimation technique to a sample of the 1982 census of China shows Tibetan fertility levels oscillating between 4.5 and 5.0 children per woman in the 1940s and early 1950s (Spoorenberg, 2019). Compared to the reconstruction at the local level (Childs, 2003), the aggregate values for all

Tibetan women in China suggest close, but slightly higher, fertility figures in the 1940s and 1950s. Due to variations in the frequency of polyandry across Tibetan areas (in some places, it was hardly practised at all), it is likely that the fertility estimate for the district of Kyirong (Childs, 2003) was a bit lower than average because polyandry was more common in this district; and, therefore, a higher percentage of women were unmarried and experienced relatively low fertility. In any case, both at the local and total Tibetan levels, reconstructions indicate fertility figures well above the fertility level of 3.0 children per woman mentioned in the literature.

III. Combining mortality and fertility: towards a population decline or increase?

It is now commonly accepted that a level of 2.1 children per woman is required for the replacement of a population. In fact, the level of fertility required for the population to replace itself depends on the mortality level of a population. In populations with high mortality, the fertility level required for the replacement of the population is well above 2.1 children per woman because the probability for women to reach the mean age of maternity is lower (Espenshade et al., 2003).

Examining the combination of mortality and fertility levels for the pre-1950s Tibetan population elucidates whether the Tibetan population was declining, stable, or increasing. Table 1 gives the number of children per woman required for the population to replace itself given different mortality levels in the Coale–Demeny south model life table. The probability of reaching age 25 was used as a gross estimate of the average age at maternity. Replacement levels of fertility at different levels of life expectancy (e_0) were approximated with the formula $TFR_R \approx (1 + SRB)/p(A_M)$, where TFR_R is the replacement value for the total fertility rate (TFR), SRB is the sex ratio at birth expressed as the ratio of the number of male to female births (here, a value of 1.05 was used in the

Table 1. Number of children per woman required for the replacement of a population under various mortality levels in Coale–Demeny south model life table

Life expectancy at birth (e_0)	Infant mortality rate ($_1q_0$)	Under-5 mortality rate ($_5q_0$)	Probability of dying between birth and age 25 ($_{25}q_0$)	Probability of surviving between birth and age 25 ($_{25}p_0$)	Number of children per woman required for the replacement of population (TFR_R)
25.0	0.276	0.486	0.594	0.406	5.0
27.5	0.257	0.453	0.557	0.443	4.6
30.0	0.239	0.421	0.522	0.478	4.3
32.5	0.223	0.391	0.487	0.513	4.0
35.0	0.208	0.363	0.454	0.541	3.8

computation), and $p(A_M)$ is the probability of surviving to the mean age of the fertility schedule (Preston et al., 2001, p. 115).

The values in the last column of Table 1 show the number of children per woman required for the population to replace itself under a given level and pattern of mortality. For example, if the life expectancy at birth (e_0) among the Tibetan population was 25 years and corresponded to the mortality patterns of the Coale–Demeny south model life table, a fertility level of at least 5.0 children per woman would have been required for the population to replace itself.

As noted earlier, a life expectancy at birth of about 32 years was previously estimated for the pre-1950s Tibetan population. Under such mortality conditions, slightly more than 4.0 children per woman would be required for the replacement of the population (see Table 1). Based on the 1982 census, the Tibetan fertility level was estimated to oscillate between 4.5 and 5.0 children per woman in the 1940s. Given the pre-1950s mortality circumstances, even if the lower fertility value of 4.5 children per woman were retained, the pre-1950s Tibetan population would have experienced an increase.

Table 1 also shows that even if the value of 0.430 is taken as the under-5 mortality level for pre-1950s Tibet (as in the 'mutant statistics' scenario), a level of fertility of 4.5 births per woman would have been sufficient to assure the replacement of the Tibetan population and to produce a small population increase.

For the pre-1950s Tibetan population to experience a decline, mortality conditions would have needed to be much worse than what the empirical evidence demonstrates. Such pessimistic views would not only contradict the empirical data but also be at odds with what we know about mortality conditions in neighbouring contexts that share similar cultural and historical circumstances.

Conclusion

The available demographic evidence examined for the whole Tibetan population in China supports the view that the Tibetan population was experiencing an increase before 1950 and corroborates the conclusions based on local data (Goldstein, 1981; Childs, 2003). This analysis has introduced an additional piece into the study of Tibetan historical demography, that is, mortality estimates. While the estimates discussed here have their own limitations, they nevertheless provide an empirical basis to ground the debate on the pre-1950s Tibetan population development in numbers that are explainable, defendable, and reproducible.

In light of the evidence presented here, pre-1950s Tibetan population development can be reinterpreted. The Tibetan population was not declining before the 1950s. The level of fertility, even if moderate, was sufficient to overcome the potential for high mortality that would cause a population decline. The Tibetan population prior to 1950 experienced a small increase as the result

of moderately high fertility tempered by high mortality, especially mortality at young ages. The Tibetan population was in a classical pre-transitional demographic situation.

In regard to the post-1950s period, if it remained difficult to identify the onset of the health transition for the Tibetan population, due to data scarcity and the tumultuous period of the late 1950s in Tibetan regions, e.g. uprisings starting in 1956, failed rebellion in 1959, effect of the famine of the Great Leap Forward (1958–1962) (Fischer, 2008b), the mortality rates estimated indirectly from the 1982 census, despite the limitations discussed in this study, indicate that progress was already under way in the 1950s and 1960s. Without detailed and disinterested studies on the subject, it remains dubious, however, whether the rudimentary development in public health that followed the Chinese intervention was a sufficient condition to explain the onset of the mortality transition among Tibetan populations. More distant historical factors are probably at the origin of this decline.

The Tibetan demographic transition opened with the decline in mortality at some point during the late first half of the 20th century. The level of fertility did not fall before the early 1980s, and therefore the Tibetan population experienced a significant increase. The post-1950s increase illustrates a classic example of a demographic transition. It was further stimulated by a fertility rise of about 1 child per woman between the late 1950s and late 1960s (Spoorenberg, 2019). While the dates of the Tibetan demographic transition are well delineated and generally accepted, further efforts should now be placed on investigating the forces that have driven the onset of the Tibetan demographic transition.

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Thomas SPOORENBERG • **MORTALITY, FERTILITY, AND POPULATION GROWTH IN HISTORICAL TIBET**

Little is known about Tibet's population development before 1950. Because of this lack of data, claims of a decline or an increase in the Tibetan population remain heavily influenced by political considerations. According to two studies based on local data, demographic characteristics in Tibetan villages before the 1950s would have favoured a small population increase. This analysis examines whether the evidence for the whole Tibetan population in China supports a similar conclusion. Prior to 1950, around 4 out of 10 Tibetan children would die before reaching age 5, corresponding to a life expectancy at birth of about 32 years. Fertility oscillated between 4.5 and 5.0 children per woman. The combination of these demographic estimates shows that the level of fertility was sufficient to overcome the potential for high mortality to cause a population decline. The demographic evidence examined for the whole Tibetan population in China supports the view that the Tibetan population was increasing before 1950 and corroborates the conclusions based on local data.

Thomas SPOORENBERG • **MORTALITÉ, FÉCONDITÉ ET CROISSANCE DÉMOGRAPHIQUE AU TIBET AVANT 1950**

L'évolution de la population du Tibet avant 1950 est relativement mal connue. En raison d'un manque de données, les affirmations selon lesquelles la population tibétaine aurait décliné ou augmenté restent fortement influencées par des considérations politiques. Selon deux études basées sur des données locales, les caractéristiques démographiques de villages tibétains avant les années 1950 auraient favorisé un léger accroissement de population. Cet article examine si les niveaux de fécondité et de mortalité de l'ensemble de la population tibétaine en Chine, permettent d'aboutir à une conclusion similaire. Avant 1950, environ 4 enfants tibétains sur 10 mourraient avant l'âge de 5 ans, ce qui correspond à une espérance de vie à la naissance d'environ 32 ans. La fécondité oscillait entre 4,5 et 5,0 enfants par femme. La combinaison de ces estimations démographiques montre que le niveau de fécondité était donc suffisant pour surmonter le risque de déclin causé par une mortalité élevée. Les informations démographiques examinées pour l'ensemble de la population tibétaine en Chine apportent la preuve d'une augmentation de la population tibétaine avant 1950, et corroborent les conclusions basées sur les données locales.

Thomas SPOORENBERG • **MORTALIDAD, FECUNDIDAD Y CRECIMIENTO DEMOGRÁFICO EN EL TIBET ANTES DE 1950**

La evolución de la población del Tíbet antes de 1950 es relativamente mal conocida. Debido a la falta de datos, las afirmaciones según las cuales la población tibetana habría disminuido o aumentado siguen estando fuertemente influidas por consideraciones políticas. Según dos estudios basados en datos locales, las características demográficas de las aldeas tibetanas antes de los años cincuenta favorecían un ligero crecimiento de la población. En este artículo se analizan los niveles de fecundidad y mortalidad de la población tibetana en China, a fin de determinar si permiten llegar a una conclusión similar. Antes de 1950, alrededor de 4 niños tibetanos sobre 10 morían antes de los 5 años de edad, lo que corresponde a una esperanza de vida al nacimiento de más o menos 32 años. La fecundidad se situaba entre 4,5 y 5 hijos por mujer. Este nivel era pues suficiente para compensar el riesgo de un declive de la población causado por una mortalidad elevada. El examen de los datos demográficos sobre el conjunto de la población tibetana en China apunta a un aumento de la población antes de 1950 y confirma las conclusiones basadas en datos locales.

Keywords: Tibet, China, mortality estimation, fertility estimation, population growth, historical population