On the age validation of supercentenarians

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Abstract. As age inaccuracy was often observed in past populations, and is still commonly observed today in populations without efficient civil registration, age validation is essential to all scientific research on longevity in demography, genetics, epidemiology, and medicine. Thoms, in 1873, was probably the first scientist who pointed out that the ages of most centenarians were effectively exaggerated. To address this problem, Thoms introduced strict rules for researchers to follow when validating ages. Even today, these strict rules are still not being systematically applied, although some authors have recently proposed precise classifications for the level of age validation. In this chapter, we will look at some of the ways age validation is currently being conducted in different settings, and we will then present details on the age validation of some recent supercentenarians, including several exemplary cases of invalidation.

1 Introduction

The validation of the ages of alleged centenarians is essential for scientific research in demography, genetics, epidemiology, and medicine. Age inaccuracy was often observed in past populations, and is still commonly observed today in populations without efficient civil registration. Studies show that inaccurate reporting of age may be significant, tends to increase with age, is more often observed in illiterate populations, and is more common among males than among females (Bennett and Garson, 1986; Bowerman, 1939; Condran, Himes, and Preston, 1991; Jeune and Vaupel, 1995, 1999; Mazess and Forman, 1979; Myers, 1978; Palmore, 1984; Rosenwaike, 1979; Rosenwaike and Stone, 2003).

There are three different attitudes prevalent among researchers facing the age validation problem:

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- A tendency to be too optimistic, and to not consider age validation to be necessary, or to even skip the problem;
- A tendency to be too pessimistic and very sceptical, and, therefore, to disregard the concerned populations for the purposes of research without thorough investigation of the situation; and
- A determination to be positively critical, and to develop adequate age validation exercises before launching larger research projects in order to identify populations with exceptional longevity.

We have chosen to adopt the third attitude, as it is the only acceptable approach from a scientific point of view.

The age validation of centenarians is essential in all longevity studies. However, it comes second after the identification of the potential centenarians. This identification can be done in two different ways: either on a random basis, without ensuring the exhaustive collection of data; or on a systematic basis, while trying to ensure the completeness of the data and the identification of all centenarians in a given population. As we will see later, the way in which centenarians are identified may have some impact on age validation.

Legally speaking, the basic identification criteria are those that can be found on the birth record: full name (family name and all given names), sex, and date and place of birth. Consequently, the validation of the age of a person, centenarian or not, consists of checking if a given birth record is accurately attributed to a specific person, so that his or her age may be calculated without doubt. That is ensured by a perfect administrative and civil registration system, but, in the case of centenarians, that means that this system would have had to have been working perfectly for at least 100 years. In many countries, there are some doubts as to whether the birth registration system was working correctly in the 19th century, resulting in the low quality of the identification of persons[1].

Therefore, a detailed system of age validation is often needed. To perform this exercise, we face two different situations depending upon whether the person is still alive, or if he or she is already dead. If the person is alive, any appropriate administrative sources, such as a

[1] This full registration of persons was first achieved in Sweden in 1749; in Belgium, in 1779; in the UK, in 1837; in 1866 in Italy; in 1872 in Japan; in the U.S., in 1933. Because it takes more than 100 years for the persons born (or claiming to be born) to be counted for the validation of a longevity area, we may consider that the Swedish records achieved accuracy around 1860, at the end of the 19th century in Belgium and mid-20th century in the UK, and more recently, in Italy and Japan; while accuracy has yet to be achieved in the U.S.

population register, a family book, an identification card, or a passport are sufficient to start the age validation process. In no case can a self-declared age be used as a form of proof for the purposes of age validation. If, on the other hand, the person is dead, the death record should provide all the information needed to make a clear identification of the person, and can serve as a starting point in the age validation process.

After a short review of the history of age validation for centenarians, we will detail the validation procedure step by step. We will, therefore, consider different types of basic documents, and discuss the differences between original documents and copies. Whether some contextual factors influence the age validation process, and how best to conclude the validation exercise, are two important questions we intend to address before moving on to present some examples of validation or invalidation of the ages of supercentenarians.

2 Some features of the history of age validation for centenarians

Quételet (1846) was certainly among the first statisticians who used a validation process, having relied upon validation in checking the exact ages of all centenarians identified in the 1846 Belgian census[2]. A quarter of century later, Thoms (1873) was probably the first scientist who pointed out that the ages of most centenarians were effectively exaggerated. As mentioned by Jeune and Vaupel (1995), these are the steps that Thoms proposed for investigating every case of exceptional longevity:

1. Search in register for birth record.
2. Check all births under the same name in the same register.
3. Have the certificate corroborated by other forms of evidence.
4. Lead the conversation with the centenarian so as to learn facts which can be verified through other sources, and which corroborate the birth certificate. The latter assumes that the verification of age is carried out while the person is still alive, and while communication is possible.

In his second book, Thoms (1879) explained why additional corroborative pieces of evidence are essential. These include basic information on parents, brothers and sisters, date and place of marriage, and dates

[2] See the result of this investigation in Poulain, Chambre, and Foulon (1999)

of birth of all children; but also all additional information, like entry into the army, admission to school or acceptance for public employment.

Later, Young (1899, 1905), Bowermann (1939), and Vischer (1945) also pointed out the problem of age exaggeration, and the need for appropriate age validation. However, in a large number of subsequent studies, the age was still based on self-declaration, and no reference was made to the use of the birth records or any administrative registers for the purposes of validating age. In studies of populations in the Caucasus, a region considered as experiencing exceptional longevity, the focus of most of the authors when validating age was on the appearances of elderly people, their physical and labor activities, lifestyles, diet, social environments, etc. (Medvedev 1974). Further studies carried out in the same region attempted to verify the ages of the oldest old by looking at all the main stages of their life histories through the investigation of biographical records of family members, such as an identification of the ages of children and grandchildren, and detailed information about the person's family life, starting with the first marriage, first birth, etc. In a second step, researchers tried to connect the information collected with events of national and local importance that had known dates, like wars and earthquakes, and by reconstructing in a person's memory the relationship between these events and life events. The conclusion reached by Palmore (1984) was that only one-third of all interviewed nonagenarians in this study were effectively aged 90 years and more, while none was found to be a supercentenarian, aged 110 years or more.

Thatcher (1992) mentioned that, during the early years of the 20th century, and, indeed, well before, there were considerable doubts about the accuracy of some of the high ages recorded in both the censuses and the death registrations. This was because of the well-known tendency among old people to overstate their ages and also partly because most of these persons were born before the registration system was established in a given country.

Skytthe and Jeune (1995) introduce four different levels of certainty of age, ranging from the lowest level, D, to the highest level, A:

- Level D : Date and age at death without verification
- Level C : Birth registration
- Level B : Life story
- Level A : Family reconstructed

Accordingly, level D is simply a reported age of 100 years or more and a date of death without any other verification. This is, of course, insufficient. As a minimum, the birth or baptism must be documented

by a record in a parish register or in a civil register (level C). Both authors recognized that it was necessary to have more information in order to verify the age with certainty. The reconstruction of at least part of the life history of the person using data from other sources, such as appearance in the census lists, confirmation, military service, etc., is needed to ensure verification at level B. In addition, it is necessary to find all brothers and sisters because of the fairly common practice of naming a newborn baby after a predeceased brother or sister. Therefore, the full family reconstruction is essential, and achieving that reconstruction will lead to possible validation at level A.

During an IPSEN workshop held in Paris in 1996, Jeune and Vaupel proposed a larger number of levels of credibility for the age validation by splitting the A level into three sub-categories: A++, A+, and A. In addition, Jeune and Vaupel added E and F levels to describe the lower levels of credibility, which may apply in countries where official documents are sparse. Here are the proposed levels of credibility:

- A++ is the highest level of credibility. A case earning this level must be supported by "compelling evidence," and be based on a well-documented life history, including documents proving birth and death, or, if the person is alive, age confirmation through interview. Some plausible documentation of the individual's existence and residence over the life course with no gap exceeding 10 years is also requested. In addition, there should be a well-documented, plausible vital statistics history of the immediate family. This history should give no specific grounds for suspicion, effectively removing any possibility that one individual may have been confused with another individual of same name, or a very similar name.
- A+ is applied to cases for which there is "strong evidence," while A is used when there is "plausible evidence." In these two levels of credibility, some information may be missing or incomplete in the life history or the family reconstitution, gaps between events may be longer than is ideal, and some forms of evidence are plausible, but not as strong as those presented in the A++ level.
- B means that there is "good" evidence of age validation, and, as proposed by Skytthe et al. (1995), no family history is required. At this level of credibility, there can be one or more suspicious indications that cannot be countered by plausible evidence. Taken into account is the statistical evidence that the individual's alleged lifespan is plausible according the level of mortality in the whole population.
- C indicates that "little" evidence is available, and the validation is only based on birth and death information. One or more suspicious

indicators may be accepted, as long as none of these makes it appear likely that the individual's age has been misreported.
- D means "weak" evidence is present, and is based on either birth documentation and assertion of age, or death documentation; in both cases, with at least a 10% chance that the age could be correct.
- E is applied when only "flimsy" evidence offered, such as when no official documentation is available on birth and death, but an assertion of age is made by the individual while alive, or by a knowledgeable relative or official. At this low level of credibility, the statistical evidence should be at least 1% that the age is correct.
- F indicates there is "negative" evidence for age validation, as in cases where the statistical evidence is such that there appears to be less than a 1% chance that the age could be correct.

Following the intentions of the authors, the highest level of validation would be required for the age validation of exceptional cases, and probably for all supercentenarians, while levels B or C may be satisfactory when trying to estimate the level of longevity of a given population by enumerating the number of centenarians in different birth cohorts.

More recently, the International Database on Longevity (IDL), a joint research project of the Institut national de la santé et de la recherche médicale (INSERM, University of Montpellier), the Institut national d'études démographiques (INED, Paris) and the Max Planck Institute, Rostock, initially used a "star" system to rank the accuracy of the age validation for all supercentenarians included. In this system, stars are granted according to the documents available to validate each case:

- "One star" indicates that there are two different documents in existence on the same person with no ambiguity: one testifying to the date of death (a death record), and another testifying to the date of birth, or dating a point in time close to the reported date of birth (for example, a census sheet indicating that the person was 19 years old on a certain date)
- "Two stars" mean that age, date of birth, and date of death are officially communicated by the national authorities in charge of vital statistics of the population, but without any particular verification effort having been made for the supercentenarians.
- "Three stars" indicate that the birth record and the death record (or photocopies) have been brought together and hand-checked, side by side, to verify the exceptional reported age.
- Meanwhile, "four stars" might be used for thoroughly validated cases that include events from the life history.

- Finally, "five stars" are to be awarded only when a full family reconstruction has been obtained and deemed satisfactory.

However, due to difficulties encountered when building the IDL's present structure and content (as presented in Cournil et al., this volume), the project now follows a more pragmatic set of rules, and the supercentenarians are classified in three categories according their validation status:

- "0" means that the case is not validated, as the reported age has not been sufficiently verified;
- "1" corresponds to an in-between situation whereby the case is considered to be validated, but no personal document on the individual is available in the database;
- "2" indicates that the case is considered validated, and the main types of documents which were used to perform the validation are recorded in the database (for this status, the IDL relies on a reference person who is considered to be responsible for the validation in a given country).

3 The age validation procedure

If the person is dead, the age validation should prove that there is a perfect and unambiguous link between the death and the birth records attributed to this person.

If the person is alive, the age validation should consist of attributing a given birth record to a living person based on all elements of identification, which should be without ambiguity.

The ideal validation procedure will consist of the following steps:

1. Identification of an alleged centenarian is based on the declaration of age, on a newspaper article, on a special investigation carried out place by place, or on an available official list of inhabitants or centenarians.
2. If the alleged centenarian is alive, collect all basic information through identity cards, passports, family or household books, or any other pieces of identification that may be available. If the alleged centenarian is dead, locate the death record.
3. In both cases, regardless of whether the alleged centenarian is alive or not, locate the birth record.
4. Collect all documented life events related to the centenarian, including information on marriage(s), characteristics of the spouse, and births of all children.

5. Finally, collect all data on births, marriages, and deaths among the centenarian's parents and brothers and sisters, and identify among the newborns of the period following the birth of centenarian any other newborns with similar names and surnames.

4 Three types of basic documents for validation

1. Some documents, such as birth and death records, are legal documents, and have legal force to prove the existence of a given person. The basic elements for identification are included in these documents: date and place of birth, date and place of death, name and surname, and a notation of marital status in the death record. Issuing of birth or death records is done upon declaration in the presence of witnesses, or is, more recently, based on hospital, maternity, or physician declarations. Marriage and divorce records are documents that prove the civil status of person within the society; these documents, and the rules associated with these type of documents, may, therefore, vary according the basic rules of the respective society (for example, divorce may not be allowed, while polygamy may have an official civil status in a given country). In most countries, before civil registration was organized, church records performed the role of legal records. This situation was still valid in Sweden until 1991[3].
2. Some documents are administrative, such as lists of inhabitants or extracts from the population registration system, family books, passports, identity cards, electoral registers, tax registers, military registers, etc. First, it is essential to understand in detail the purposes of the documents, as well as how they are prepared and updated. The way in which identification elements are introduced is a key question. In any case, because these are secondary sources, the corresponding information may have been transcribed or self-declared, and may not have been systematically checked against the primary source of information.
3. Finally, some documents are statistical documents, like census or specific statistical forms, which are completed when certain events occur (e.g., birth, marriage, divorce, migration, or death). The way in which all the information is introduced in these documents must be very carefully checked: self-declaration by the concerned person, declaration by a close family member or a person of reference for

[3] Please note that church records are not necessarily exhaustive where being member of a church is not compulsory.

the household, transcription from an administrative or legal source, etc.

For all these types of documents, it is essential to investigate the relationship between them. How are marriage, divorce, and death records completed, and what kind of checks are made against the original birth record? How are population registers, passports, identity cards, and census forms completed or issued when it is not possible to verify identification through a direct check of the birth record? To ensure full age validation, only verified documents should be used. Therefore, it is necessary to conduct a preliminary investigation of the rules related to the creation of these documents and their reliability.

5 Original document versus copies

It is important to identify the original document, and make a distinction between copies and certificates issued at a later date. The original document may be unique, or there may be a duplicate made simultaneously that is stored in another safe location. There are basic methods used in history to verify the original character of a document, including type of paper, ink, type of writing, possible overwriting, language used, stamps, method of dating, etc. All this must be taken into consideration and applied in order to identify the original document. Moreover, it is essential to know how and where these original documents are stored: a register in which all records are bonded by the date of occurrence, or are, as is sometimes the case, numbered and indexed, will be favorable for the purposes of age validation; while a separate document is definitively more difficult to validate, and will be less helpful for the age validation.

A clear distinction should be made between the original document, and a certificate copy or extract supplied upon request at a later date, even if the certificate is a photocopy of the original one. Certificates include information probably verified as similar to the information found on the original documents, but some reading or transcription errors may occur. Moreover, there is often no way to check whether all the information has been precisely extracted from the correct original, and that it has not been taken from a similar one with the same name and other common characteristics; this is the most common error found in age validation.

In all cases, the roles of all the actors involved (e.g., concerned person, reporter, recipient of declaration, or a person collecting information

from original records) have to be assessed. All possible errors should be considered, including random misreporting of age or voluntary age exaggeration, and all personal advantages that might accrue to the actors for untrue declaration or transcription should be identified. More precisely, when dealing with age validation, the possible role of some age thresholds should be checked, as some privileges may be granted only to people who have reached some specified age, and, therefore, some concrete incentives may exist for exaggerating age in order to meet the conditions. Besides these voluntary untrue declarations or transcriptions, age may also be overestimated on the declaration simply because of the attraction of rounded ages, or just because older ages and extreme longevity are considered desirable within a family or within the local community.

We must be prepared to imagine what may have occurred at the time when the document in question, whether an original or a copy, was written; and we should try to establish whether somebody might have an interest in falsifying any declaration or writing. Within the same context, we should identify all consistency checks that are foreseen by administrative rules to verify the validation of information.

As a consequence, a personal and critical examination of all documents is definitively needed. Based on our experience, the level of reliability is different according to the type of document. The reliability of original civil records is very high, while it is only high for the birth and death certificates. Other administrative sources, like population registers, passports, identity cards, election registers, and military files have a medium degree of reliability. Finally, census nominative lists are less reliable, and press articles or published lists of centenarians offer a very low level of reliability for the purposes of age validation.

6 How to conclude a validation process?

According to Thoms (1873), when the age of a centenarian is being validated, the proof should be clear, distinct, and beyond dispute. When discussing the probability of finding centenarians before 1800 and supercentenarians before 1950, Hynes (1995) pointed out that the validation process may face a range of difficulties which might be impossible to overcome. As an example, the failure to locate a relevant record should not, in her view, necessarily disqualify the candidate from the list of potentially verifiable centenarians. Hynes argued that, for centenarians of the past, Thoms' criteria are too strict, and suggested that more flexibility is needed. This is also the reason why Skytthe and Je-

une (1995) proposed four levels of evidence. However, Jeune and Vaupel (1995) concluded that it would be more fruitful to discuss the conditions of falsification than to corroborate what may be a false tenet. Like Vincent (1951), they do not believe "jusqu'à preuve du contraire" and therefore support the strong rules proposed by Thoms (1879). If birth and death certificates exist and are consistent, but only a few pieces of evidence of the history and family reconstruction are collected, it cannot be concluded with "no doubt at all" that the same name in the birth and death records in fact refers to the same person, especially when information is lacking from a large part of the life of the alleged centenarian. The richness of information on family reconstruction will often vary depending upon the number of brothers and sisters, marital status, and the number of children. Nevertheless, our opinion is that all necessary investigations have to be consistent in order to prove validity of age. If one important piece of information is missing, we will be unable to proceed to validation with "no doubt at all;" but if one element is wrong, the entire validation process will result negatively. It is definitively easier to prove that this person is not a centenarian than the opposite. In fact, the validation will never be final, while the invalidation is generally final when only one clear ground for invalidation is found.

All information collected through interviews with an alleged centenarian or close family members is influenced by subjective memory and the specific context of interview. The validation of a centenarian cannot be confirmed only on the basis of such interviews. We consider the use of this additional source mainly in order to obtain complementary information about some documents, like photos or letters, but also in order to identify the need for further investigations within administrative data sources, or to help explain any particular situation that appears in administrative data and is not easy to understand without knowing some contextual elements.

The validation process will, in practice, consist of bringing together, piece by piece, information that will improve the probability of the alleged age. When an alleged centenarian is identified, let's consider before starting the validation process that the validation probability is about one chance out of two. But, in fact, all contextual elements relating to the population and the area where the centenarian is living will bring this initial level of validation probability higher or lower. As an example, for an alleged centenarian living in a country with a normal prevalence of centenarians, with normal numbers of people who have reached extreme age at death, and where most other centenarians have

been previously validated, the probability that the age will be validated can be as high as 90%, even before starting any investigations in order to find supporting documents. At the opposite end of the spectrum, the validation probability of an alleged centenarian in a remote area with a deficient registration system, a large prevalence of centenarians, large numbers of people who have reached extreme ages at death, and no other centenarians already validated, will be only 10% when starting the procedure.

Thereafter, any piece of information that fits with previous ones and confirms age validation will increase the probability of age validation, while any information that does not support validation will decrease more or less strongly this probability of validation. By considering documents one by one, we will progressively increase the probability of validation, but a unique negative proof may bring this probability close to zero. However, at the end of the validation procedure, we will never reach a situation were the age of a centenarian will be fully validated with 100% probability, nor can the alleged age be assigned a 0% probability.

As far as life events and the information on parents and siblings are concerned, all corresponding ages will be considered and compared with the normal demographic life pattern for this population, and this specific period of time. Doing so can help us calculate a plausibility index that will tell us how plausible the centenarian's demographic history is. A very plausible demographic history will be an argument in favor of age validation when added to all other positive pieces of information, while a relatively implausible demographic history will argue in favor of invalidation.

In conclusion, a well established argument will be sufficient in order to invalidate with high probability the age of an alleged centenarian, while a large set of fully consistent documents are needed in order to conclude with high probability that an age has been validated.

7 Some examples of validation or invalidation of the age of supercentenarians

7.1 Age validation in Sardinia

For the purposes of validating a centenarian in Sardinia, the following official and administrative registers and documents are available:

1. Civil status registers with birth, marriage, and death records; those registers have been maintained in Sardinia since 1866, and include the following information:

- Birth: These records include the name and surname of the newborn; identification of the parents[4], including, in most cases, the names or surnames of some of the grandparents; and the age of father, if he declared the birth. Marginal notes made on each birth record are very useful, as they provide some information on the marriage (date and place of marriage, and name of the spouse), and on the death (date and place). In the different cases we have studied, the proportion of birth records with marginal information was very high (more than 90%), and this information was found to be reliable and very useful[5].
- Marriage: These records include the names, surnames, and ages of spouses; and names and surnames of both parents, with indication of survival and place of residence. In the records of a few marriages, we found the complete list of children born before the civil marriage, as was the case for Antonio Todde (see below).
- Death: These records include the name and surname of the deceased, age at death, date and place of birth, the names and surnames of the parents of the deceased, and, if the person was married, the name and survival status of the spouse.

2. Parish registers that include baptism, marriage, and death records

These registers are useful if a confirmation of the civil registration is needed, and in tracking information for events that occurred before 1866. It may also be necessary to refer to parish registers in cases in which a civil marriage was celebrated long after the religious marriage. However, age-related information included in parish registers is often less complete and less reliable than that of civil status registers.

3. Population registers: Anagrafe

The Anagrafe is a continuous register that provides permanent information about the composition of the population living in a commune. This register, which was initiated after the 1930 census, is now computerized in all communes we have visited, allowing the local administrations to identify all persons living in their territory by sex, age, and address, including the household composition. Using this system, all

[4] In a few cases, the father is not identified, and this is usual for an illegitimate child. On the other hand, we see a few cases where the mother is not known due to the fact that the father and the mother are not married on a civil basis at the municipality, but are only married on a religious basis at the parish.

[5] On a more general level, marginal information on death may be found for one newborn out of three at the end of the last century. Most of the newborns without marginal information on death are not alive, but died during the first part of this century when no systematic transfer of information was organized between the commune of death and the commune of birth.

communes are able to compile a list of all nonagenarians and centenarians alive, with exact dates of birth and places of residence. Before the Anagrafe was computerized, the register included a sheet with information on each individual living in the commune. Two copies of those individual sheets are still available, with the first copies being classified by name and sex, and the second by household and address. When a person died or emigrated, the corresponding individual sheet was withdrawn from the active Anagrafe and kept separately in a folder called eliminati. These individual sheets have proven very useful, mainly for checking the ages at death of the parents of all validated centenarians. However, access to these eliminati may vary from one commune to another. In the most successful case, we were able to find information on a centenarian's parents, who were born before 1866 and died after 1930. In the same source of information, we were also able to find the dates and places of emigration for persons who left the commune after 1930, and that information was useful in tracing the brothers and sisters of the centenarian. The individual Anagrafe sheet gives the following information: name and surname; date and place of birth; names and surnames of parents, date and place of marriage and widowhood; date, place, and cause of death; date and place of emigration; and return immigration to the commune. Although these forms of information are not primary, but secondary, we have not found any mistake or falsification in the data collected from the Anagrafe.

The complete validation of the age of the five alleged Sardinian supercentenarians has been carried out within the AKEA research project[6]. We will focus specifically on the Antonio Todde and Damiana Sette cases.

7.1.1 The validation of the age of Antonio Todde

Antonio Todde[7] was declared the oldest documented man on earth in July 2001. Antonio was born in Tiana (Nuoro province, Sardinia) on January 22, 1889, and his birth record stated that he was the son of Francesco Maria Todde and "della sua unione con donna non maritata," without giving the name of his mother. The missing name for the mother was a negative element for the validation of the exceptional age of Antonio. Fortunately, the baptism record in the parish register

[6] For a description of the AKEA project see Deiana et al. (1999) and for a more complete description of the age validation of the Sardinian centenarians see Poulain et al. (2006).

[7] All documents used for this age validation are available in the annex to this chapter in the internet version of this book.

provides the missing information, confirming that Antonio was born on January 22, 1889, and was the son of Francesco and Francesca Angela Deiana. At the time of his birth, his parents were married according to the church, but not yet according to the civil registration. Their civil marriage was not celebrated until December 30, 1908, when Antonio was age 18; in the civil marriage record, all brothers and sisters are correctly listed with their ages. Antonio died in Tiana on January 3, 2002, a few days short of his 113th birthday. His death record has been correctly linked with his birth record, to which a marginal note had been added. In July 2001, he was proclaimed to be the oldest men alive on earth. More information about Antonio Todde has been published by Deiana et al. (2002), while the whole genealogical tree has been recently presented by Caselli et al. (2006).

7.1.2 The invalidation of the age of Damiana Sette

The invalidation of the age of Damiana Sette—who was, up until now, considered to be a supercentenarian—is, in our view, a very instructive one. We will present here the documents supporting this invalidation. The death certificate of Maria Angelica Damiana Sette shows that she died in Villagrande at the age of 110 on February 25, 1985. According this document, she was born in Villagrande on August 8, 1874, and was the daughter of Pietro Sette and Monserrata Pirroni. A child named Maria Angelica Damiana Sette was effectively recorded in the birth register as having been born in Villagrande on August 8, 1874, as the daughter of Pietro Sette and Monserrata Pirroni. The death record is wholly compatible with this birth record. We observe in the birth record the marginal note of the death dated February 25, 1985, and, therefore, a unique link has been established by the civil registration officer between both events and records. Consequently, the degree of certainty of the age validation of Damiana Sette was assigned the level C[8]. Moreover, while Damiana Sette never married and appeared only a few times in the Anagrafe starting from 1930, all collected information was consistent in supporting the claim that she was, effectively, a supercentenarian.

At this stage of the validation process, everything would seem to confirm the contention that Damiana Sette really did die at the venerable age of 110, and this information was even transcribed onto her gravestone in the cemetery of Villagrande. However, the meticulous

[8] The level C of validation is reached when birth and death records have been found and are consistent (Skytte and Jeune, 1995).

Table 1. Family reconstruction for Antonio Todde (1889-2002)

Parents
TODDE Francesco Maria (1.1.1857 - 6.12.1945)
DEIANA Francesca Angela (3.2.1863 - 17.11.1961)
Married in Tiana on 30 December 1908.

Brothers and sisters
TODDE Antonio Domenico (30.9.1883 - 3.8.1887)
TODDE Angela Rosa (30.1.1886 - 19.8.1984)
TODDE Antonio (22.1.1889 - 3.1.2002)
TODDE Giuseppe (4.8.1891 - 17.8.1921)
TODDE Maria Agostina (7.12.1893 - 7.12.1893)
TODDE Giovanni (4.3.1895 - 8.1.1966)
TODDE Salvatore (31.1.1898 - 24.2.1944)
TODDE Agostino (26.5.1901 - 13.8.1973)
TODDE Maria Agostina (6.2.1904 - Alive)
TODDE Francesco Angelo (11.11.1906 - 22.3.1967)
TODDE Antioco (11.11.1906 - 20.8.1979)

Spouse
Married on 15 September 1920 to MADDEDDU Maria Antonia (6.12.1899 - 29.5.1987)

Children
TODDE Laura (23.7.1921 - 30.4.2004)
TODDE Angela (13.2.1924 - Alive)
TODDE Giuseppe (27.3.1926 - Alive)
TODDE Isabella (18.11.1928 - 9.9.1930)
TODDE Antonino (5.4.1933 - Alive)

reconstruction of the family composition of Damiana Sette, based on the civil registers and the Anagrafe (Table 2) led us to the discovery that the person who died in 1985 was not Maria Angelica Damiana Sette, born August 8, 1874; but her younger sister, Maria Monserrata Damiana Sette, who was born on May 5, 1877. In a document labelled "Angelica," we found the exact death record of Maria Angelica Damiana Sette, who died on June 10, 1876, at the age of 22 months. This type of error occurs frequently in historical demography when producing family reconstructions, and in the linkage of different data related to births and deaths. This is due to the fact that, when a child dies at a young age, it is customary to believe that a child of the same sex who is born immediately after this death will, in some way, replace the

deceased. Therefore, the next child is given the same forename, or, at the very least, certain identical forenames. This was the case for Maria Angelica Damiana Sette, who died at the young age of 22 months and was replaced by her younger sister, who was called Maria Monserrata Damiana Sette. Damiana Sette was never married, and it was only after consulting the Anagrafe—in particular, the individual sheets that were established after the 1930 census—that we were able find documentary evidence that the birth date of her older sister, who died at a young age, was erroneously attributed to her. This administrative error remained unchanged until her death in 1985, and, consequently, the marginal annotation relating her death appeared on the birth certificate of her older sister. All given names are those of her older sister, although she was usually called Damiana. Accordingly, Damiana Sette was 'only' 107 when she died in 1985.

Table 2. Family composition of Damiana SETTE

Parents
SETTE Pietro (1835 - 2.10.1905)
PIRRONI Monserrata (1844 - 21.11.1913)
Married in Villagrande on 29 November 1866

Brothers and sisters
SETTE, Maria Barbara Lucia (7.5.1867 - 14.8.1945)
SETTE, Maria Agostina (4.2.1870 - 5.4.1898)
SETTE, Maria Luigia Vittoria (7.4.1872 - 16.7.1922)
SETTE, Maria Angelica Damiana (8.8.1874 - 10.6.1876)
SETTE, Maria Monserrata Damiana (5.5.1877 - 25.2.1985)
SETTE, Domenico Antonio Daniele (2.5.1880 - 8.12.1968)
SETTE, Serafino Giovanni Francesco (18.2.1883 - 19.8.1946)
SETTE, Tomaso Salvatore Angelo (12.3.1886 - 17.8.1981)

7.2 The invalidation of the age of Marta Ninashvili's age in Georgia

According to her passport, Marta Ninashvili is supposed to have been born in Kakabeti in 1891. The same information was used in the death record to conclude that she died on August 15, 2002, at age 111. She was the daughter of Aleksei Ninashvili and X. Babale, but no birth record has been found in church books conserved in the Georgian State Archives. She married Dmitri Bazerashvili, but no marriage record has

been found, either. However, through interviews, Marta was said to have been married very young, at age 16. Marta had five children. Nino, who is supposed to be the oldest, was said to have been born in 1915. However, a baptism record found in church books in the Sagaredjo Regional Archive shows that he was effectively born on February 2, 1919. The first daughter, Tamara, is supposed to have been born in 1920 and died in 1999. Mariam, the second daughter, was probably born in 1923 and was still alive when Valerian, the second son, was born on July 18, 1925. Valerian was living with his family in Sagaredjo when we met him. Finally, Georgi, the third son, was born in Manavi on November 10, 1929, and lived with his mother Marta in Tbilisi, where we visited him in July 2002.

No birth record was found for Marta in the central state archive or local archive. On the basis of all the household books kept from 1937 until 1963, and the information given by the family, it was concluded that there is a high probability that her age was only 101 years when she died. In fact, information collected in household books shows a progressive increase in her age as the year of birth switches from 1901 to 1900, then to 1895, and later to 1891. The overwriting of 1891 onto 1895 is clearly visible in the 1945 household book. Table 3 give a summary of all the information collected in household books for Marta's family. We see here that, not only was Marta's year of birth revised from year to year, but her husband's year of birth was revised as well. Further investigation would be needed to establish the reasons for this progressive age exaggeration. A desire to avoid army service during World War II may have contributed to age exaggeration, but this applies to males only.

These investigations confirm that Marta was most probably born in 1901, even if no birth record has been found to prove this up to now. This version of events sounds more plausible when the following life histories are compared:

Marta was born in 1891, when her mother was aged 13 (Babale was born in 1878, according to household books). She married at an unknown date, although it is said that she married very young (at age 16, according to her family). Then she had her children between the ages of 28 and 39, but she and her family did not have an explanation for why she had no children up to age 28. She died at age 111 in August 2002.

Marta was born in 1901, when her mother was aged 23 (Babale was born in 1878, according to household books) She married very young, probably in 1917 or 1918 (when she would have been around 16), but

Table 3. Summary of all information on age and year of birth collected in household books for Marta's family between 1937 and 1963 (Sagaredjo Municipality)

Name of family members	Year of household book										
	1937	1938, 1939	1940, 1941, 1942	1943, 1944	1945, 1946, 1947	1948, 1949, 1950	1951, 1952, 1953	1954, 1955, 1956	1957	1958, 1959, 1960	1961, 1962, 1963
Marta	36 (1901)	1901	1900	1895	1891	1891	1891	1891	1891	1891	1891
Dimitri	45 (1892)	1886	1886	1883	1883	1883	1883	1883	1883	1883	1883 (died in 1960)
Babale	-	-	1878	1878	1878	-	-	-	-	-	-
Tamara	17 (1920)	1921	1920	1920	1920	1920	1920	1920	-	-	-
Mariam	14 (1923)	1924	1923	1923	-	-	-	-	-	-	-
Valerian	12 (1925)	1926	1925	1925	1925	1925	1925	1925	1925	-	-
Georgi	8 (1929)	1930	1930	1930	1930	1930	1930	1930	1930	1930	1930

no marriage record was found. Then she had her children between the ages of 18 and 29. She died at age 101 in August 2002.

As a consequence of this reconstruction, there is a high probability that the official age of Marta is invalidated. In the same study (Biridivashili, Herm, and Poulain, 2003), none of the alleged supercentenarians from the Tbilissi area has been found. We proved that there are centenarians living in Georgia, but finding centenarians in Georgia was not a surprise, as ages above 100 are compatible with the estimated life expectancy[9].

7.3 Joan Riudavets was, with high probability, the oldest validated man alive on earth in 2003

The age of Joan Riudavets, the oldest man on earth after the death of Yukichi Chuganji on September 28, 2003, was among the easiest cases to validate, as all administrative pieces fit perfectly with the reported age. All information obtained through a direct interview of Joan and his younger daughter, Francesca, as well as from additional documentation showing Joan as head of local youth in 1912, when he was 23, are complementary forms of evidence that tend to support the accuracy of the birth record. As we observe quite often, claims by Joan's family about his exceptional longevity increase the probability of the accuracy of his age. Joan Riudavets died on March 5, 2004, some months after he celebrated his 114th birthday.

7.4 Kamato Hongo has probably never been the oldest person on earth

The case of Kamato Hongo[10] is also a very instructive one as far as age validation is concerned. First, it should be noted that the Japanese civil registration is different from the European civil registration system, and an in-depth investigation into how this system works was an essential prerequisite to any attempt of validation. The entire Japanese civil registration system is based on the Koseki, in which all official data related to a given family are transcribed, including births, deaths, marriages, and divorces. The Koseki is an official family register that provides details of all familial and legal relationships between family members.

[9] According to revised figures calculated by Yeganyan et al. (2001), life expectancy was 68.6 for men and 75.6 for women in 1999 for Georgia.

[10] I am very grateful to my colleague Kusuto Naito for helping me when trying to validate the age of Kamato HONGO.

The register lists each individual's date and place of birth, rank in the family (whether, for example, a member is the first or second son, or the third daughter), as well as all information on parents, brothers and sisters, grandparents, and spouse(s). The first Koseki, named Jinshin Koseki (壬申戸籍), was adopted as the standard identity register to be used across Japan on April 4, 1871. However, due to sensitivity problems related to caste membership, Jinshin Koseki was phased out, and a new type of register, Genko Koseki (現行戸籍), was introduced with the enactment of a law known as Koseki ho on December 22, 1947. The most important difference between the Jinshin Koseki and the Genko Koseki is that, under the new system, all members are grouped by immediate family (i.e., only parents and children) while under the old system, the registration was done by family lineages, called Iè[11]. All Koseki were renewed in accordance with the new system. Meanwhile, old registers were to be destroyed, and are no longer available for validation purposes. Duplicates of all Genko Koseki are, however, stored in regional or provincial offices of the Ministry of Justice, called Homukyoku. The Genko Koseki presents a kind of lineage tree of all family members related by blood or marital alliance. After leaving the parental home, an adult child branches out from the parental Koseki, and establishes his or her own Koseki. This is, in part, because it would be difficult to report to a parent's Koseki if the son or daughter were living in a distant location when a birth or death occurred within the adult child's own newly established family. Whereas the older Jinshin Koseki encompassed a larger family with three generations, the new Genko Koseki are limited to two generations. Parallels exist between these two types of registers and the two types of certificates or copies issued from Koseki. The first type, the Koseki tohon (戸籍謄本), provides an exact and complete copy of the Koseki, including information for all family members. The second type of certificate, the Koseki shohon (戸籍抄本), provides the same information, but only for a given person requesting the document. In fact, the Koseki shohon serves as an official birth certificate, as no birth registers or death registers exist in Japan. The place where a person is registered in the Koseki, and the place where he or she may request these certificates or copies, is the

[11] The translation and meaning of "Ié" is not clear and still a subject of discussion in Japan between lawyers, sociologists and historians. The most commonly adopted definition states that "Ié" is a large group of persons linked by family lineages with blood link but also by adoption. Each "Ié" has also an economic signification, and the continuity in time of those groups is essential.

Table 4. Family composition of Joan Riudavets (1889-2004)

Parents
RIUDAVETS MOLL[12] Pedro (1860 - 27.5.1927)

MOLL MERCADAL Catalina (1864 - 31.12.1889), she died as a consequence of childbearing her second child.

RIUDAVETS MOLL Pedro remarried on 20 February 1892 with Catalina
MERCADAL MASCARO.

Brothers and sisters
RIUDAVETS MOLL Lorenzo (26.10.1888 - 30.06.1967)
RIUDAVETS MOLL Joan Jose (15.12.1889 - 5.3.2004)

RIUDAVETS MERCADAL Juana (15.8.1893 - 27.9.1976)
RIUDAVETS MERCADAL Jaime (19.4.1895 - 18.7.1915)
RIUDAVETS MERCADAL Catalina (25.2.1897 - 12.2.1898)
RIUDAVETS MERCADAL Catalina (10.11.1898 - 5.9.1994)
RIUDAVETS MERCADAL Pedro (24.10.1900 - Alive in 2004)
RIUDAVETS MERCADAL Francisca (26.9.1902 - 17.7.1904)
RIUDAVETS MERCADAL Jose (11.1.1907 - Alive in 2004)

Spouse
JORDI SALES Juana (4.1.1889 - 4.12.1975)
Married on 17.11.1917

Children
RIUDAVETS JORDI Catalina (6.9.1918 - 30.5.1969)
RIUDAVETS JORDI Juana (26.9.1920 - Alive in 2004)
RIUDAVETS JORDI Francesca (11.10.1924 - Alive living with her father until he died).

Honseki (本籍), or legal domicile, which is not necessarily the usual place of residence.

In addition to the Koseki, population registers called Kiyori seido (literally, "residence system") were created in 1914. The system was revised by a law which went into effect on July 25, 1967, and is known as Jyumin Kihon Daïcho (住民基本台帳法) (literally, "resident popu-

[12] The mother of Joan's father and the father of his mother were both "Moll," which indicate a possible family link between his parents. A similar homonymy is found between Joan's maternal grandmother and his father's second wife ("Mercadal").

lation registers"). This population register is similar to the Anagrafe in Italy and the population registers in Belgium and Nordic European countries. The register shows all household members presently living together in the same household, with information about their dates and places of birth, sex, marital status, relationships to the head of household, and the precise address of the place of usual residence. The Jyumin Kihon Daïcho therefore serves as the continuous registration of the usual place of residence. This document is held at the individual level, and is grouped by household, and not by family. These documents are used for electoral and other administrative purposes, and are stored by the administration of the place of usual residence. The Jyuminhyo is the certificate serving as official proof of the usual place of residence.

In the case of Kamato Hongo, we were, with the agreement of the family, able to obtain four different documents: her Jyuminhyo; her Koseki shohon; the Koseki tohon of her parents, including all family members with brothers and sisters; and the Koseki tohon of her own family. All information collected in these official documents has been used to reconstruct the whole family, as presented in Table 5.

A careful analysis of these documents related to Kamato Hongo immediately reveals an important error: Kamato is said to be the second daughter and the fifth child in the family, and is listed in the fifth position on the Koseki Shohon; meanwhile, according her official date of birth, she should be in fourth position, with her older sister having been born only seven months before her. At that stage of the validation process, strong arguments can be made in favor of invalidation. The case may still, however, have been validated if, for example, Kamato was shown to have been an adopted child who arrived in the family in fifth position when she was already more than three years old. But the Koseki does not mention this hypothetical adoption, and, moreover, when comparing the two following life histories of Kamato Hongo, it would appear more probable that she was the last child born around 1893, as the average interval between successive births is about three years, and could be even more, assuming that this is the last child.

The Kamato Hongo life history appears as follows according all available documents:

Kamato was born in 1887, when her mother was supposedly aged 43. She had two children before marriage, when she was 22 and 25. She married in 1914, when she was supposedly 27 years old; although she claims she was younger when she married. Then she had five other children between the ages of 29 and 45. She died at age 116 in October 2003.

Table 5. Family composition of Kamato HONGO (1887 ? - 2003)

Parents
KIMURA Yoshimi (or Yoshihiro or Yoshikan) (10.8.1845 - ... 1903)
NAGAHARUSAIMOTO Utokane (or Utokako or Utokama) (16.2.1844 - 25.5.1918)
Married before 1872

Brothers and sisters
KIMURA Mitsunori (First son) (15.7.1877)
KIMURA Katayuki (Mangyo) (Second son) (15.8.1880)
KIMURA Meto (First daughter) (9.2.1887)
KIMURA Fukuyama (Fukusen) (Third son) (26.6.1890 - 14.6.1930)
KIMURA Kamato (Second daughter) (16.9.1887? - 31.10.2003)

Spouse
HONGO Hukuyu (or Fuhusuke) (19.10.1893 - 3.6.1964)
Married on 4.8.1914 in Shimajiri-mura, Inutabu

Children
HONGO Yoshi (First daughter) (15.7.1909, recognized)
HONGO Takeyoshi (First son) (15.2.1912, recognized)
HONGO Oto (Second daughter) (15.10.1916)
HONGO Genryou (Second son) (15.3.1918)
HONGO Shizue (Third daughter) (15.2.1924, was living with mother Kamato until she died)
HONGO Taketada (Third son) (15.1.1929)
HONGO Takejiro (Fourth son) (10.1.1933)

The following life history sounds more probable; however, especially if we consider that, during her interview, she and her daughter confirmed that Kamato did not marry as late as 27:

Kamato was born in 1893, when her mother was supposedly aged 49. She had two children before marriage when she was 16 and 19. She married in 1914, when she was 21, and the two first children were recognized at that time. Then she had her other children up to the age of 39. She died at age 110 in October 2003.

In the second life history, the fact that her mother was 49 when she was born may easily be considered the result of age misreporting, as her father was two years younger, and Koseki were not in use before 1871. We have also to consider the fact that Kamato Hongo was born in the same place as Isumi, the famous Japanese supercentenarian who supposedly died at 120 years of age, but whose exceptional age has

never been validated. Moreover, as mentioned by Saito in the chapter of this book dealing with supercentenarians in Japan, in which he quoted Matsuzaki (1988), there was a custom in Kagoshima prefecture of using the registration of a deceased child for its younger siblings, so that this person registered as an elder sibling may have easily been listed as five or 10 years older than his or her actual age.

Accordingly,

- Considering the fact that Kamato is said to be the second daughter;
- Considering the fact that her older sister, the first daughter, was born on February 9, 1887, and that she would have been born only seven months before Kamato;
- Considering the fact that Kamato is presented in the fifth position, and not in the fourth position, on the Koseki tohon;
- Considering that having two illegitimate children before marriage at ages 16 and 19 is more probable than having them at ages 22 and 25;
- Considering that having her last child at age 39 is more probable than having her last child at age 45;
- Considering that dying at age 110 is about 64 times more probable that dying at age 116 (based on an average annual mortality rate of 0.5);
- Considering that another brother or sister of Kamato was very likely born between 1880 and 1887, and probably died very young, and that Kamato may have been registered as this potential elder sister; and, finally,
- Considering that an error of transcription may have occurred when the Koseki was renewed following the enactment of the 1947 law, which introduced the Genko Koseki;

we may conclude with a very high probability that Kamato Hongo's date of birth, and, consequently, her age, are invalidated. Accordingly, she should never been considered to have been the oldest validated person living on earth, even if she was given that label by the Guiness Book of Records. There is a large probability that Kamato was born around 1893, and, considering that her date of death was October 31, 2003, we may suppose that the chances that she was a supercentenarian to be about one out of two.

8 Conclusion

All the preceding examples of the validation or invalidation of the ages of alleged supercentenarians clearly demonstrate that the validation of an extremely old person is not an easy task, even if a complete set of official documents is available. Based on our experience, any validation process that includes a large number of alleged centenarians, and does not identify some clearly invalidated cases, may not be definitively considered to have been an in-depth validation exercise. Therefore, we encourage all researchers to be very attentive to all potential pieces of information that will lead to a possible invalidation. Living 110 years and more is so improbable that all forms of evidence supporting such claims should be absolutely solid. Even then, an age validation is never definitive, and may always be reconsidered if a new piece of information that seems incompatible with the previous conclusion is discovered. If an age validation is only highly probable, an age invalidation may be definitively established, as we were able to do in the case of Marta Ninashvili (discovery of a false overwriting in the household book), or in the case of Damiana Sette (discovery of the existence of an older sister who died at 22 months before Damiana was born). However, age invalidation may also be highly probable, but not definitive, as was the case for Kamato Hongo. In such cases, additional pieces of information may be needed before age invalidation can be considered definitive.

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