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The medieval biological clock? Gendered reproductive aging in medieval western medicine

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ABSTRACT

This paper examines discussions of women's and men's reproductive aging in a series of western European medical texts written in the period 1100–1300. It uses the modern image of the biological clock to explore how far physicians in earlier periods understood reproductive aging to be a process of slow decline before a final age at which fertility ended (menopause for women, or a less defined 'old age' for men), and how far they viewed women's reproductive aging as different from men's. The article argues that, in contrast to modern medical and popular understandings, medieval physicians assumed men and women were broadly fertile up to a final cut-off point, and had little interest in viewing age-related fertility decline as a slow process beginning well before menopause. This was true in part because there was no realistic prospect of treatment for age-related reproductive disorders. The article also argues that in many respects – although not all – medieval writers viewed men's and women's reproductive aging as similar processes. Overall the model of reproductive aging they offered was flexible and offered room for individual variation. In this way the article demonstrates how changing understandings of the body, reproduction, and aging, demographic and social change, and changing medical treatments influence concepts of reproductive aging.

Introduction

Medical professionals and the wider media often stress the importance of time in reproduction. The image of the 'biological clock', which emerged in the 1970s and became widespread in the 1980s has dominated popular discussions of reproductive aging, especially (but not only) in Europe and North America (Friese, Becker, & Nachtigall, 2006, p. 1551; Healey, 2016, pp. 90–91; Jensen, 2016, pp. 146–152). Several scholars have argued that this image is strongly gendered. It presents women's fertility as especially limited by time (Friese et al., 2006, pp. 1551–1552; Healey, 2016, pp. 18–19). It also views the phenomenon of older parenthood in terms of delayed motherhood – even though men, too, are delaying parenthood (Marsh & Ronner, 1996, pp. 246–247; May, 1997, pp. 213–217; Friese, Becker, & Nachtigall, 2008, p. 66). However, researchers have noted less often that as well as being gendered, the image of the biological clock depicts a decline in women's fertility that begins well before menopause. It suggests that time is ticking away from a woman's thirties or even twenties, and imparts a growing sense of urgency as she grows older; several studies have found that age 35 is often mentioned by women as the start of a sharp decline in fertility (Healey, 2016, p. 17; Yopo Díaz, 2021, p. 770).

The biological clock offers one way to think about gender and reproductive aging, but it is not the only possible model. Medical historians have shown that ideas about reproductive aging have changed significantly over time, responding to social and demographic changes, and to developments in medical knowledge and treatment. In part, as mentioned above, the image of the biological clock reflects a demographic trend towards older parenthood. Women and men are having children at later ages in many western countries, sometimes with the aid of assisted reproductive technologies developed in recent decades such as IVF (Friese et al., 2008, p. 66). This is not to say that a pattern of delaying marriage and childbirth until well into a person's reproductive years is purely a late twentieth- and twenty-first century phenomenon. Rachel Chrastil has recently summed up a range of historical studies to argue that from the sixteenth century onwards many men and women married in their twenties, and some well into their thirties. As in more modern times this was often done for economic reasons, so that couples could accumulate enough money to set up a household, and the effect was to push many people's childbearing years later and increase the chance of some not conceiving at all (Chrastil, 2019, pp. 20–22). Medical writers in the past, as now, sometimes linked this pattern of older marriage to declining fertility. For example Lisa Smith has shown how

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eighteenth-century medical writers criticized men who left it too late and found they could not father children (Smith, 2010, p. 76). For the USA Jenna Healey has argued that a resurgence of medical interest in 'older' mothers in the 1870s coincided with a period when middle-class white women were marrying relatively late (Healey, 2016, pp. 32–33). There is therefore a longer history of delayed parenthood behind the idea of the biological clock but the trend towards later parenthood has accelerated in recent decades and this has shaped the ways in which fertility decline is discussed.

The image of a ticking biological clock also coincides with the development and marketing of treatments that offer medical solutions to this 'problem', such as IVF, egg freezing, and the use of donor eggs (Friese et al., 2006, pp. 1551–1552; Healey, 2016, pp. 18–19). Many of these technologies are focused on women, but on occasion, medical historians have explored how ideas about men's reproductive aging have also been influenced by the development and marketing of treatments. Thus Elizabeth Siegel Watkins argues that discussions of the 'male menopause' in the USA have become more prominent in medical literature and the popular press since the 1960s, in part because hormone treatments and Viagra have been developed that can reverse some of the signs of men's reproductive aging (Watkins, 2007, pp. 370–371, 380). Watkins also argues that ideas about reproductive aging in one gender can influence how it is discussed in the other. In the case of the 'male menopause', concepts of women's reproductive aging (most notably the idea of menopause itself) have shaped views of this process in men (Watkins, 2007, p. 383). Occasionally popular writers even refer to a 'male biological clock' (Jensen, 2016, pp. 160–161).

Scholars who have looked further back, into the seventeenth and eighteenth centuries and the medieval period, have focused more often on how medicine identified similarities between reproductive aging in men and women. They suggest that reproductive aging may not always have been gendered as sharply as in modern times. Sarah Toulalan and Jennifer Evans have described how medical writers talked about old men's 'seed' as being weak, as well as discussing menopause and the end of fertility in women, while as noted above Lisa Smith has described references to men's age-related infertility in the eighteenth century (Evans, 2014, p. 76; Smith, 2010, p. 76; Toulalan, 2016, pp. 342–344). My recent work on medieval medicine has argued that medieval physicians viewed both men's and women's reproductive years as finite, although they believed fertility ended earlier and more definitively in women than in men (Rider, 2020).

This article will build on this work, and extend the timescale used to think about the biological clock and gendered reproductive aging, by examining a series of medieval European medical texts that discuss conception and infertility. In an earlier study I outlined some of the key comments that medieval medical writers made about the end of fertility in old age, in men and women (Rider, 2020). This article will revisit some of these influential medical texts, and others, to examine how they thought about fertility decline *before* the final end point of menopause. The physiological models of aging that underlay medieval medicine could have encouraged medical writers to see reproductive aging as a process of gradual decline over many years, and so to offer similar images to the modern ones of the biological clock for women, men, or both. However, what these texts offer instead is a picture of fertility that varied across a person's reproductive life span, sometimes increasing as well as decreasing, before it reached a clearly defined end point. For many medical writers this pattern held true for both men's and women's fertility, although the timescales involved were different.

Context: medieval medical texts and theories

The texts which set out these ideas were written from the late eleventh century onwards, a period which saw a large expansion in medical writing and education in western Europe. This was prompted by the translation of Arabic and Greek medical and scientific texts into Latin (the language of education) in the late eleventh and twelfth centuries. For medicine these works included Arabic texts, such as the *Canon of Medicine* by the philosopher and physician Ibn Sina (d. 1037, known in Latin as Avicenna). They also included ancient Greek texts that had been translated into Arabic, most notably the works of Aristotle, which were a key influence on medicine as well as philosophy. These texts offered medieval European physicians a more detailed model of how the human body worked than had been available before. They discussed at length not only how to treat particular conditions, but also why illnesses happened, and how treatments could address specific physical causes.

Although much of the detail in these texts was new to Latin-reading audiences, it built on older understandings of how the body worked which would already have been familiar. Medieval Arabic medicine, and the Latin medicine that followed it, was based on the theory of the humours, which was developed in ancient Greece. Humoral medicine held that the body contained four substances, the humours: blood, phlegm, yellow bile and black bile. Each of these humours contained a mixture of four qualities: heat, cold, moisture and dryness. Every person had their own unique balance of humours (known as a 'complexion') so some people might naturally be hotter or moister than others. Women were held generally to be colder and moister than men. If the humours became too unbalanced, illness was the result, and this could include reproductive conditions such as sexual dysfunction or infertility (both often, but not always, linked to a lack of heat). Medical treatments therefore sought to adjust the humours to a more balanced state, using food, medicines, bathing, or procedures such as bloodletting. This humoral medicine began to be challenged in the sixteenth and seventeenth centuries but it remained an important way of understanding reproduction into the eighteenth century (Toulalan, 2016, p. 340).

Alongside the theory of the humours, medieval reproductive medicine also drew on ancient theories relating to conception. Ancient Greek writers had offered various theories about what men and women contributed to the formation of an embryo (Flemming, 2018). In particular there were widely differing views about whether women contributed a 'seed' equivalent to the man's sperm, and whether this seed made as much contribution to the embryo as the man's. This is not the place to discuss these ideas in detail, but in general many (although not all) medieval medical writers argued that both men and women contributed 'seed' or 'sperm' to the child. Many of them nonetheless believed women's seed was different from, and weaker or less active than men's: Ibn Sina took this view in his *Canon of Medicine*, which was translated into Latin in the 1180s, and many Latin writers followed him (Fancy, 2018, p. 133).

As well as the translation of new texts, schools that taught medicine also began to emerge. One of the earliest was at Salerno in southern Italy, which was an early adopter of the medical works newly translated from Arabic. Over the course of the twelfth and thirteenth centuries several of these schools became universities: Montpellier, in the south of France, was particularly renowned for its medical teaching. Universities taught medicine, based on Latin texts, to a small elite of male, well-educated medical practitioners who often went on to treat wealthy patients. They also created the conditions for writing medical texts: several of the works discussed in this article were written by physicians who were also university teachers.

The key translations from Arabic discussed in this article include two translations by Constantine the African (d. 1099): the *Pantegni* (based on an Arabic medical encyclopedia written in the tenth century by Ali ibn al-Abbas al-Magusi) and the *Viaticum* (translated from a tenth-century work by Ibn al-Jazzar). These were widely read by educated readers, especially in the twelfth century, and other works written in Europe reproduced their information. For example the early twelfth-century *Book of the Conditions of Women*, written at Salerno, which circulated widely in the Middle Ages as part of the *Trotula* compendium on women's medicine, drew much of its material on fertility and menstruation from the *Viaticum* (Green, 2008, p. 49). From the mid thirteenth century onwards Constantine's works were superseded in universities by the Latin translation of Ibn Sina's *Canon of Medicine* but

they continued to be read and copied, as did the Latin texts that drew on them like the *Trotula* compendium. University physicians also wrote many new works that discussed reproduction, drawing material from all these earlier texts. Infertility formed a part of broader encyclopedias that discussed practical medicine, such as the *Compendium of Medicine* by Gilbert the Englishman (c. 1250) and the *Lily of Medicine* by the Montpellier university teacher and physician Bernard of Gordon (1305) (see Demaitre, 2013, pp. 300–321). It was also the subject of dedicated treatises: several were written at Montpellier in the early fourteenth century (Green, 2008, pp. 85–91).

Changes in the body and reproductive aging

These medieval medical texts discussed a range of reproductive disorders in men and women, and they became increasingly long and detailed as time went on (Cadden, 1995, pp. 241–243; Demaitre, 2013, p. 300). They said comparatively little about reproductive aging, compared with other fertility problems, such as imbalances of the humours or deformities in the reproductive organs, and they rarely suggested treatments for age-related infertility. Nonetheless, their comments tell us about how they conceptualized reproductive aging, in men and women. They were interested primarily in when fertility ended. As early as the eleventh century Constantine the African's *Viaticum* discussed the age at which women stopped menstruating, placing this at around 50, but allowing for individual variation (Constantinus Africanus, 1515b, book 6, ch. 9, f. 164v). They also noted that old age could impede fertility in men and they mentioned ages at which men might no longer be fertile: around 70 or older, again with room for variation (Rider, 2020, pp. 280–282). However, these writers did not talk about reproductive aging as a process that began significantly before these final cut-off points. This is interesting because they could have done so. Humoral theory held that a person's humoral balance changed throughout their life. As a person grew into adulthood, their complexion was relatively warm, but as the body approached old age it became gradually cooler and dryer. This was true of both men and women (Shahar, 1997, pp. 38–40; Toulalan, 2016, p. 340). In theory, then, medical writers could have written about reproductive aging as the result of this gradual cooling and drying of the body, leading to a slow decline in fertility that began well before menopause. Instead they offered different models for discussing reproductive change over time.

Constantine the African's translation of the *Pantegni* offered a much more varied picture of how a man's fertility might change across the course of his reproductive years. This was linked to changes in the humours as he aged, but the results of this process manifested themselves very differently in different people. First, Constantine established some final cut-off points for fertility, for men and women, noting that these depended on the amount of heat in their complexion: 'It is understood that a woman conceives until her periods stop, and a male up to his 60s, and often up to 70, according to the strength of natural heat in each person, and according to the heat in the testicles' (Constantinus Africanus, 1515a, 'Theorica', book 9, ch. 42, f. 50v).

However, the picture for men then became much more complicated. Constantine noted that some men were not fertile when they were young (*iuvenes*), but were fertile in old age (*in senectutem*). He explained this in terms of their complexion: 'Men who have a cold and moist complexion in their testicles do not generate much before they have reached the end of their youth (*iuventutem*). But afterwards they are suitable for generation, because their natural heat is strengthened, and their testicles become warmer. Sometimes the same thing happens because of a change from a cold and moist diet to a warm and dry one.' As this cold, moist man grew from adolescence to adulthood, then, his heat increased and made him fertile. The opposite scenario could also occur: some men could father children in their 'adolescence' (*adolescentia*), but not in youth (which came after adolescence). Again the explanation was humoral: 'These men have a warm and moist complexion in their testicles in their adolescence. In youth and old age the heat is increased and dried out, and is no good for generation.' Thus although heat was necessary for fertility, too much heat at too young an age, combined with the dryness which came as a person grew older, could cause infertility. Men who started with a hot and dry complexion would also experience changing fertility across their lives. They did not generate much in adolescence because they were too hot and dry, but 'when they come of age the heat is lessened and tempered, or they change to a cold complexion by changing diet.' As well as influencing whether a man could conceive at all, changing humoral balances affected whether he fathered boys or girls. Some men fathered girls in adolescence and boys when they were adult: 'the cause is their complexion and their testicles, which are cold and moist in adolescence; it becomes warmer in youth and old age, and slowly dries out, therefore they can generate males' (Constantinus Africanus, 1515a, 'Theorica', book 9, ch. 42, f. 50v).

I have given the Latin words for adolescence, youth and old age, because Constantine does not specify what ages these terms refer to. In fact, medieval writers were often inconsistent about how they used them, and two influential works defined them very differently. The seventh-century encyclopedia of Isidore of Seville stated that 'adolescence' (*adolescentia*) extended to age 21, 'youth' to 49, and *senectus* denoted the period before death. However, Ibn Sina's *Canon of Medicine* suggested adolescence could last to 30. Other writers including Vincent of Beauvais (discussed below) combined the two schemes (Goodich, 1989, pp. 59–62). For our purposes, the exact ages that Constantine had in mind are less important than the overall point that he did not paint a clear picture of declining fertility, for men at least. Instead we see change over time based on humoral changes as a man aged. This might mean that for some men fertility actually increased. Moreover, these humoral changes might not be caused by the aging process alone. The references to diet suggest ways in which aging might be accelerated (by eating the 'wrong' foods) or mitigated (by eating the 'right') ones, and texts setting out regimens for health gave guidance for mitigating the effects of old age (Shahar, 1997, p. 40). Many of these were aimed at male readers, but similar texts were also written for women (Shahar, 1997, p. 43; Vaughan, 2020, pp. 80–3).

It is striking, though, that Constantine focuses on male fertility. The basic assumptions made here, that a cooling and drying of the body over time would have different effects on people with different complexions, and might increase fertility (at least for a while) could also apply to women. How did the *Pantegni*'s picture of men's reproductive aging, which suggests a long period of variation before fertility ended at a comparatively late age (60s or even 70s), compare with what medical writers said about women? In some respects the picture is similar. Humoral balance was crucial for women's fertility as well as men's. Medical texts offered detailed discussions of how humoral problems caused infertility in women. Thus in the *Pantegni* Constantine the African explained that a 'bad complexion' of the womb impeded conception: too much heat burned away the seed; too much cold prevented a woman from producing much seed, and also closed up her reproductive organs so that the seed could not move around freely; too much moisture meant that the seed could not stay in the womb; and too much dryness made her seed thick and hard (Constantinus Africanus, 1515a, 'Theorica', book 9, ch. 42, f. 50v).

However, there was one important difference between men's and women's reproductive aging. When they discussed the end of women's fertility, medical writers focused not on changes in the humours caused by the aging process, but on a much clearer cut-off point: the end of menstruation. The *Book of the Conditions of Women* (early twelfth century), which drew on and expanded Constantine the African's translation of the *Viaticum,* was one of many texts that stressed the importance of regular menstruation for women's fertility: "The common people call the menses 'the flowers', because just as trees do not bring forth fruit without flowers, so women without their flowers are cheated of the ability to conceive" (Green, 2001, 66). Before a woman's periods stopped, there was little interest in how age might affect her fertility. The *Pantegni* said as much in the passage quoted above: 'a woman

conceives until her periods stop.' This focus on the end of menstruation continued into the thirteenth century: Gilbert the Englishman, writing a medical encyclopedia in around 1250, stated that the ages before 12 and after 50 were not 'natural' times for menstruation, but 'the time in the middle is for conception, and periods are naturally appointed as purgations.' (Anglicus, 1510). Both texts imply that before menstruation ends, women are fertile.

Despite the focus on menstruation rather than humoral balance for women, however, there was a key similarity between women's and men's reproductive aging. In both sexes the signs associated with reproductive aging (coldness, dryness, a lack of menstruation) also had many other possible causes. Imbalances in the humours (of the sort described in the *Pantegni*) went well beyond the ones caused by old age. For women menstrual problems could affect fertility throughout the reproductive years. Thus the *Pantegni,* the *Viaticum*, the *Book of the Conditions of Women*, and many other medical texts into the seventeenth and eighteenth centuries stressed the importance of regular menstruation for fertility, and included many remedies to bring on menstruation if it had ceased, as well as to reduce excessively heavy periods. (See for example Green, 2001, 67–71, (Constantinus Africanus, 1515a, 'Practica', book 8, chs. 15-16, ff. 115v-116r),(Constantinus Africanus, 1515b, book 6, chs. 9-10, ff. 164v-165r; Evans, 2014, 71–2). Age was therefore presented as one among many factors that affected humoral balance and menstruation, and so fertility. It is likely that this is why these eleventh- and twelfth-century works show little interest in discussing a slow decline in fertility. They saw fertility as variable throughout the reproductive years, and potentially threatened by humoral or menstrual problems at any time, but only with the end of menstruation in women – or at a later age in men - did it definitively end.

Seed unsuitable for generation

The idea that humoral balance and menstruation were crucial for fertility remained important for the rest of the Middle Ages and beyond, but in the thirteenth century it was joined by another, related, way of thinking about reproductive aging. This was drawn from Ibn Sina's *Canon of Medicine* and it focused not on the humoral balance as such but on the quality of a person's 'seed'. The Latin translation of the *Canon* called this substance *sperma*, but it was not the equivalent of the modern English 'sperm': both men and women had *sperma*, although the two substances were not exactly the same (Fancy, 2018, p. 133). For Ibn Sina age was one of several factors that rendered 'sperm' infertile in both men and women. First, in his discussion of male generative problems he stated that the seed [*sperma*] 'of a drunk, and a decrepit man and an infant and a man who has a great deal of sex does not generate' (trans. Rider, 2020, p. 274). In his later discussion of women's generative illnesses, Ibn Sina returned to this idea with some different details: once again the *sperma* of an old person was unable to generate, and so too was the seed of an infant, a person suffering from nausea, a drunk, someone who had too much sex, or someone who was generally unhealthy (Rider, 2020, p. 274). The quality of a person's seed thus reflected the overall health of their bodies. This was the case because many medieval medical writers argued that, for men especially, seed was generated from the heart, liver and brain rather than only in the reproductive organs (Lindgren, 2005, p. 53).

Later Latin medical writers often quoted Ibn Sina's information about age and seed (Rider, 2020, p. 275). For example Bernard of Gordon, whose medical encyclopedia, the *Lily of Medicine*, was widely copied, followed Ibn Sina in stating that 'decrepit' people rarely or never had children, along with boys, drunks, men whose penises were too long, and those who have sex a lot. Bernard also went on to add some additional moralizing: 'Sexual intercourse in the open air, and without shame, sterilizes honest men' – although less 'honest' men might find it arousing (Bernard of Gordon, 1550). Several treatises on infertility written at Montpellier at about the same time as the *Lily* also said old age affected the 'seed' – in men, women, or both. Thus the *Compilation on Conception* attributed to the physician Arnold of Villanova listed under problems affecting the seed 'absence or defects, as in old age' (Cartelle, 2010, p. 220). The *Compilation* did not link this to either men or women specifically but two other Montpellier sterility treatises saw poor seed as a problem for older women in particular. An anonymous *Treatise on Sterility* described how 'it happens that women are too old and they lack their periods and the ability to generate seed that is suitable for conception' (Cartelle, 1993, p. 84). More briefly, an anonymous list of questions for a physician to ask in cases of infertility included, as question two, for women, 'If she is old or young' (Cartelle & Ingelmo, 2003, p. 93). There is no equivalent question in the list for men. For Ibn Sina and the physicians who followed him, then, reproductive aging was described not explicitly in terms of complexion, but in terms of quality of seed, in both sexes but perhaps especially in women.

These discussions of poor quality seed built on humoral theory because humoral imbalances were one possible cause of this poor quality. As we have seen, as early as the eleventh century Constantine the African had noted that too much heat or cold in a man's or woman's complexion affected the quality of their seed. Jennifer Evans has stressed how sixteenth- and seventeenth-century writers saw heat as crucial for both sexual potency and the quality of the seed, and so the cooling and drying processes of old age would have affected men's and women's seeds (Evans, 2014, pp. 72–81, Evans, 2016, p. 320). The references to ill health and lifestyle factors, such as poor diet, leading to poor quality seed, should also be seen in the context of humoral theory. Poor diet and lifestyle were problematic in part because they affected a person's humoral balance (Evans, 2014, pp. 70, 76). Nonetheless, the ways in which Ibn Sina, and the writers that followed him, wrote about age presented it as a distinct cause of unsuitable seed, rather than explicitly describing it as part of a gradual process of cooling and drying.

There are nevertheless similarities between discussions of poor quality seed and the models of reproductive aging based more generally on humoral change that were offered in Constantine the African's earlier translations. First, both men's and women's fertility are presented as changing with age. Second there is little interest in presenting reproductive aging as a continuous decline that might start some years before a person became infertile, even though humoral understandings of the body would have made it possible to understand infertility in that way. Sara Read has argued that some sixteenth- and seventeenth-century women did see menopause as a slow and gradual process, sometimes ending as late as 60 (Read, 2013, pp. 172–173). These medieval medical writers, however, simply stated that when a person was 'old' their seed was unsuitable. Third, old age is not the only possible cause of the problem: younger people might render their seed unsuitable through poor lifestyle choices such as too much food, alcohol, or sex (or sex outdoors, for Bernard of Gordon). In contrast to aging, these references to diet, alcohol, or 'immoral' sexual practices conveyed an element of moral judgement. Drunkenness, gluttony and lust were regarded as sins as well as causes of humoral imbalances (Cadden, 1995, p. 244; Oren-Magidor, 2017, pp. 61–64). However, unlike these lifestyle factors, the effects of old age could not be reversed: the early fourteenth-century *Treatise on Sterility* stated that for 'old' women 'the work of the act of generation is lost' (Cartelle, 1993, p. 84).

Older parenthood in practice

Latin medical texts were written for well-educated readers, who made up a small proportion of medieval society and were mostly men. As such they describe an elite way of thinking about reproduction and reproductive aging. At times this could appear divorced from practice. For example Shulamith Shahar has argued that the assumption that women could conceive up to menopause did not fit with the fact that in practice many medieval women seem to have stopped having children much earlier (Shahar, 1997, pp. 18–19). It is worth exploring the relationship between the theory of the medical texts, and practice in more detail, however. Monica Green has shown that the educated medical

practitioners who wrote and read these Latin texts also treated reproductive disorders, particularly for wealthy patients, from at least the twelfth century onwards (Green, 2008, pp. 85–87). Comments about how in old age 'generation is lost' suggest physicians did not regularly seek to treat age-related infertility, and medical texts did not offer cures specifically targeted at reproductive aging. However, they do not tell us whether age-related infertility was seen as a common problem or one that medical practitioners were likely to encounter (even if they did not treat it). Were medieval men and women regularly seeking to have children in their later reproductive years?

This is difficult to determine because we have very little information about the ages at which medieval men and women stopped having children. The situation is likely to have been very varied. Some elite women did give birth in their forties: in 1165 and 1166 Eleanor of Aquitaine, wife of King Henry II of England, had her youngest children, Joan and John, at the ages of 41 and 42 respectively. Medieval queens such as Eleanor are the women whose fertility or infertility is most often noted in surviving sources, but often the evidence for when they stopped having children is fragmentary. Even if queens appear to have been childless in their later reproductive years we know little about royal stillbirths, miscarriages, and children who died in infancy, so it is difficult to know when active attempts to have children might have stopped (Earenfight, 2012, p. 180).

The evidence from demographic studies, which look at a broader range of people, suggests several possible patterns. On the one hand, it was not uncommon for medieval men and women to die childless, either because of infertility, or because their children had predeceased them. For example a study of wills from fourteenth-century Languedoc, in the south of France (an area which included the city and medical school of Montpellier), found high rates of childlessness among testators. On average 36.5% of once-married testators died childless before the Black Death, and the figure increased substantially in the years after the plague (Laumonier, 2020, p. 364). Childlessness, or the fear of being left childless, might therefore have encouraged couples to keep trying for children for as long as possible. On the other hand, it may not have been typical to try to conceive right up to menopause if a couple already had children. David Herlihy and Christiane Klapisch-Zuber's study of the unusually detailed Tuscan tax records of 1427 argues that although some Tuscan women did conceive in their forties, many stopped having children earlier. On average most women married in their late teens and their fertile years extended from around age 20 to their mid to late 30s. Tuscan men had children later (reflecting a later age of marriage), and their most fertile years extended from ages 30 to 50, but this still placed them within what medieval medical writers deemed to be a man's fertile years. For Herlihy and Klapisch-Zuber these figures suggest couples deliberately tried to limit family size, although malnutrition is also likely to have affected fertility, especially among poorer women (Herlihy & Klapisch-Zuber, 1985, pp. 247–248, 253). The Tuscan pattern was not shared all over Europe and in other places women married later, which in turn pushed the age of childbearing later, but there is no specific data on when people stopped having children (Bennett, 2019). Overall, it seems likely that some men and women did seek to have children at older ages, and wealthier couples with access to university-trained physicians may well have sought their advice; but it is impossible to know from the surviving evidence how common this was.

Conclusion

Although it can be hard to tell how far their comments on reproductive aging reflected practice, the view of reproduction found in these Latin medical texts is nonetheless important. One reason for this is that over time it reached a wider audience than highly educated men. By the later thirteenth century encyclopedias that collected information about the natural world (and other topics) for readers without a specialist medical education were popularizing medical ideas about reproduction. The encyclopedia of Thomas of Cantimpré, a Dominican friar writing in the 1240s–50s, stated that men could generate seed up to the age of 70 (although Thomas noted that other authors said up to age 90), while women could conceive up to 50. Thomas also specified that three kinds of men could not generate: the sick, the young, and the old (Thomas of Cantimpré, 2022, book 1, ch. 71). He drew this information from the newly available medical and philosophical texts and it was compatible with what medical writers were saying at the same time. A later thirteenth-century encyclopedia by another Dominican friar, Vincent of Beauvais, reproduced Thomas's information, and also copied in full the *Pantegni's* description, quoted above, of how men's fertility varied with age (Vincent of Beauvais, 2022, book 31, chs. 25 and 30). Works such as these were written as reference books for preaching, so that preachers could find interesting facts and anecdotes for their sermons. They therefore show one way in which the ideas found in Latin medical texts could reach a wider range of readers, and potentially also listeners. The reach of medical texts also increased further over time: the fourteenth and fifteenth centuries saw many Latin works translated into vernacular languages for a wider pool of literate medical practitioners and lay people (see Green, 2008, pp. 163–203). Studies of individual manuscripts have shown that these lay readers might include elite families who were concerned about their own reproductive potential (Tyers, 2016; Tyers, 2018).

These views of reproductive aging are also interesting for scholars outside medieval studies because they differ from the ones often popularized today. In contrast to the modern image of the biological clock, medieval texts present reproductive aging as a variable process which depended on humoral balance, but ended suddenly, with menopause for women, or at a later and less defined 'old age' for men. This model was flexible and resisted generalizations about when women's, or men's, fertility started to decline (a point also made by Toulalan, 2016, p. 343). These texts also made men's reproductive aging more prominent, and highlighted some similarities between men's and women's fertility, grounded in the theory of the humours which viewed the changes in men's and women's bodies in similar terms. This does not mean they viewed the two sexes in completely the same way. Men were thought to remain fertile longer than women, and there was more flexibility in how men's old age was defined: 60, or 70, or 90, compared to a woman's 45–50. However, it was a model that viewed men's and women's reproductive aging as operating broadly in parallel. These differences from more modern understandings of the biological clock highlight the ways in which different theories of the body and its physiology affect understandings of reproductive aging. In this case humoral theory offered a model which was less gendered, and more individually tailored, than some later models.

The medical theories outlined by medieval writers also show how age-related infertility might be ascribed to other, non-age-related causes that were deemed to be treatable. There were few real solutions to age-related infertility in the Middle Ages and as we have seen several medical writers admitted this. However, variations in fertility before the final period of 'old age' could be interpreted as the result of imbalances in the humours or menstrual problems rather than as an age-related fertility decline. In this way they could be covered by the many treatments that were designed for these conditions. There was thus little to be gained by presenting reproductive aging as an urgent problem in need of tailored medical solutions.

Medieval medical writers knew that fertility ended – especially for women – but they saw less urgency around that decline. They remind us that there have been many possible ways of thinking about reproductive aging, and of conceptualizing the process in men and women. These are shaped over time by a range of factors, and changing medical understandings and treatments are key. The theories offered by humoral medicine have not stood up to the more powerful explanatory models and treatments offered by modern biomedicine, and many of the humoral treatments offered by medieval medical writers are likely to have been ineffective. Nonetheless they show that it is possible to focus on similarities between the sexes, as well as differences, and to focus on

individual variability across a person's reproductive years rather than seeing a gradual decline in fertility as common to many women. In this way they prompt us to think about the ways in which the gendering of reproductive aging varies, linking medical theories, treatments, and social change.

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Declarations of interest

None.

Data availability

Data will be made available on request.

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