JASA EXPRESS LETTERS ARTICLE asa.scitation.org/journal/jel

Pre-aspiration and longitudinal voice quality trends in Received Pronunciation: The case of Queen Elizabeth II

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Abstract: No longitudinal studies have reported rates of pre-aspiration across the lifespan of an individual, and few have investigated changes in local breathiness and glottalisation *vis-à-vis* pre-aspiration, though they have been previously shown to feed and block the phenomenon. We examine the speech of Queen Elizabeth II, finding decreasing rates of pre-aspiration over the course of her life alongside decreasing local breathiness and increasing glottalisation. This finding of pre-aspiration in 20th-century Received Pronunciation suggests that its presence in modern Standard Southern British English, first noted recently among young speakers, is not a sudden innovation.

[Editor: Irina A. Shport] https://doi.org/10.1121/10.0042363

Received: 24 September 2025 **Accepted:** 19 January 2026 **Published Online:** 12 March 2026

1. Introduction

Pre-aspiration can be defined as a period of glottal friction that may occur in sequences of sonorants and phonetically voiceless obstruents (e.g., Ní Chasaide, 1985; Gordeeva and Scobbie, 2013; Hejná, 2025). The phenomenon has been noted in an increasing number of accents across the English-speaking world, including in Tyneside (Docherty and Foulkes, 1999), Middlesbrough (Jones and Llamas, 2003), Liverpool (Watson, 2007), Manchester (Hejná and Scanlon, 2015), North America (Clayards and Knowles, 2015; Hejná and Jespersen, 2019; Hejná *et al.*, 2021), New Zealand (Fiasson, 2016), Australia (Jones and McDougall, 2009; Tait and Tabain, 2016; Su, 2007), Ireland (Hejná and Jespersen, 2019), and in a range of Welsh English (Hejná, 2015, 2016, 2021, 2023; Hejná and Jatteau, 2023; Morris, 2010) and Scottish English accents (Clayton, 2017; Gordeeva and Scobbie, 2013). Pre-aspiration has also been noted in Standard Southern British English (SSBE): Kettig (2015) analysed /æ/ production in 21 SSBE speakers aged 18–24 years and found nearly all of them to exhibit pre-aspiration in foot-final position before voiceless fricatives, as well as foot-medially before voiceless fricatives and voiceless plosives.

The proliferation of studies finding pre-aspiration in English raises the question: Is pre-aspiration on the rise, or are we just looking more closely at speech and finding it where it was rarely observed before? Another as-yet unexplored aspect of pre-aspiration more generally is the role of aging. No longitudinal studies have been carried out investigating whether individuals pre-aspirate more or less over the course of their lives. However, without studies on the effects of aging on pre-aspiration, it is difficult to disentangle whether the effects reported in apparent time[1] studies are true changes in community norms over time or age grading patterns (whether physiologically or socially motivated).

Pre-aspiration is often—or in many studies, always—found to be accompanied by localised breathy voice, while it is only rarely accompanied by pre-glottalisation, or creaky voice. Though breathiness and creakiness can both be subject to agentive and/or social variation, they could themselves be subject to physiological aging processes (Rojas *et al.*, 2020). While several studies have investigated the role of aging in voice quality variation (Gittelson *et al.*, 2021; Grama *et al.*, 2023; Iseli *et al.*, 2007; Stathopoulos *et al.*, 2011), few have explored longitudinal change in local phonatory variation, especially with respect to spread-glottis phenomena.

This study aims to contribute to our understanding of whether pre-aspiration is a newly emergent or relatively well-established feature of SSBE's acrolectal precursor, Received Pronunciation (RP). We analyse archival recordings of one speaker (Queen Elizabeth II) longitudinally to observe whether her rates of voiceless pre-aspiration, local breathiness, and glottalisation varied over her lifespan. We investigate breathiness and glottalisation both to contextualise changes found in pre-aspiration and to understand how linguistically meaningful phonation may change as a function of age.

In the rest of this section, we provide essential background and outline our specific research questions in pursuit of the above goals.

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1.1 Pre-aspiration in English

Pre-aspiration has been increasingly, but haphazardly, reported in varieties of English across the globe. Studies focusing on English pre-aspiration have varied in their methodologies, particularly in terms of the age of their subjects. While a more thorough accounting of pre-aspiration studies is outside the scope of this paper, it is worth noting that of the 21 studies we are aware of which find pre-aspiration in English, only four report on speakers above 60 years of age; the group apparently best covered by research is individuals in the 20–40 years age range, and several studies do not mention the age of their participants.

It is unclear how old pre-aspiration might be in English. Its geographical distribution across and within Germanic languages (e.g., Helgason, 2002; Hejná, 2025) would suggest that we may be dealing with a fairly old feature of English inherited from a common Germanic ancestor. However, independent innovation is also a possibility.

Five apparent time studies have looked at English pre-aspiration using acoustic evidence available for the 20th and 21st centuries, with varying results depending on the region. In Tyneside English and the English of Aberystwyth, Wales, pre-aspiration has been found to be more frequent among younger speakers (Docherty and Foulkes, 1999; Hejná, 2015; Hejná and Jatteau, 2023). In contrast, pre-aspiration seems to be receding in Hebrides English in apparent time (Clayton, 2017), which reflects the situation in Scottish Gaelic (Nance and Stuart-Smith. 2013). Fiasson (2016), exploring the changes affecting word-medial /t/ in New Zealand English using both archival and modern recordings (Gordon *et al.*, 2007), reports pre-aspiration to be decreasing among younger speakers in (mostly) apparent time, i.e., patterning with Hebrides English and in the opposite direction from Tyneside and Aberystwyth English. No studies, to our knowledge, have reported on the prevalence of pre-aspiration in archival recordings of any variety of English spoken in the British Isles in the 20th century, nor have any real time studies explored this phenomenon over the lifetime of individual speakers.

In this paper, we are interested in whether the pre-aspiration reported by Kettig (2015) for young, mid-2010s SSBE speakers is also found in older, more conservative RP speech and in a wider range of phonological environments. Because no real time studies of pre-aspiration are available, we cannot exclude the possibility that it is subject to biological or social age grading. At the current state of knowledge, it is difficult to predict how pre-aspiration might change as the laryngeal structures undergo physiological changes associated with aging.

Queen Elizabeth II of the United Kingdom (1926–2022) was perceived as a paragon of 20th century RP, typifying England's acrolectal accent. Following Harrington *et al.* (2000a,b)—who present evidence that the Queen's RP, though conservative, was not static—we choose for analysis a subset of the Queen's Christmas speeches starting with her first address in 1952. These comparable broadcast recordings across 61 years of the Queen's adult life are well suited to investigating her speech production longitudinally, shedding light on not just potential change over time within an individual, but also the presence of pre-aspiration in a geographically and socially wider range of dialects than has previously been investigated.

1.2 Accounting for constraints on pre-aspiration

The speech analysed in this paper includes different segmental contexts (preceding vowel, manner of articulation of the pre-aspiration-inducing consonant, place of articulation of the consonant). We also investigate two prosodic environments (foot-medial, as in *massive*, vs foot-final, as in *mass*). Cross-linguistically, pre-aspiration has been found to most frequently occur in non-high and phonologically short vowel environments, more posterior consonant environments, and more prominent prosodic contexts (Hejná, 2015; Hejná and Jespersen, 2019; Morris and Hejná, 2020). While most pre-aspiration studies target only certain segmental and prosodic environments in their experimental designs, because we are using naturalistic corpus data, we are able to consider here all possible environments previously included in English pre-aspiration studies. We can thus verify whether the Queen followed previously reported phonological environment trends in pre-aspiration variation.

We propose that it is essential to also capture other voice quality phenomena that may feed or block pre-aspiration.

Pre-aspiration has been very frequently reported to include a period of not only voiceless but also voiced glottal friction (e.g., Hejná, 2025 for a more in-depth discussion), with the latter functioning as a transition from the more modal phonation of the segment that precedes the obstruent associated with pre-aspiration. However, Hejná (2015) has shown that pre-aspiration can also be realised as local breathiness, i.e., without voiceless glottal friction. This has led Hejná (2015) and Ní Chasaide (1985) to suggest that local breathiness may function as a historical precursor to voiceless pre-aspiration. More specifically, it has been proposed that local breathiness develops in anticipation of the laryngeal abduction associated with the post-aspiration of the obstruent and/or its abducted laryngeal setting. Thus, voiceless pre-aspiration and local breathiness are known to be positively correlated, and this correlation is fairly strong.

Hejná and Scanlon (2015) and Hejná and Kimper (2019) have found that pre-glottalisation, or glottal enforcement (as in *pat* [$p^ha^?t$]), blocks pre-aspiration in Manchester English. Hejná and Scanlon (2015) also identified allophony between pre-glottalisation and pre-aspiration based on the manner of articulation of the obstruent: Word-final fricatives favour pre-aspiration while word-final plosives favour pre-glottalisation. This fricative–plosive allophony has also been identified in Scottish Standard English by Gordeeva and Scobbie (2013). Hejná (2015) also found one of her English speakers from Aberystwyth, Wales to exhibit this allophony, and Hejná (2021) reports instances of categorical and gradient allophony of this type in Welsh English in general (applicable to those speakers who produce glottalisation to begin with). While Hejná (2023) has shown that pre-aspiration and pre-glottalisation do not have to be mutually exclusive, there seems to be an antagonistic relationship between the two. Collins and Mees (1996) find a notable amount of pre-glottalisation in a sample of RP speakers

born in the second half of the 19th century (though (Wells, 1982, p. 282) claims that in 20th century upper-class RP, "voiceless plosives are... usually not glottalized"). It is thus useful for us to investigate whether the Queen indeed pre-glottalises, and if so, whether pre-aspiration is disfavoured where pre-glottalisation occurs, especially if we observe longitudinal change in pre-glottalisation or differences between prosodic environments. Since pre-glottalisation has been shown to most often block pre-aspiration, it is essential to map the temporal trajectory of both in order to understand any changes observed.

1.3 Research questions

We thus have the following principal research questions regarding the English spoken by Queen Elizabeth II.

(1) RQ1: Is the pre-aspiration observed by Kettig (2015) in a young SSBE sample also observable in a similarly aged RP speaker six decades earlier?
(2) RQ2: Do this speaker's rates of pre-aspiration, breathiness, and glottalisation change as a function of age?
(3) RQ3: What relationships seem to hold between rates of pre-aspiration, breathiness, and glottalisation?
(4) RQ4: In which phonological environments is pre-aspiration most frequent?

2. Materials

2.1 Corpus

Our corpus (Kettig, 2026) is composed of a subset of Queen Elizabeth II's Christmas speeches from 1952 to 2018. Jonathan Harrington and Ulrich Reubold generously provided us with many of these recordings, as well as previously force-aligned Praat (Boersma and Weenink, 2019) TextGrid annotations, spanning the years between 1952 and 2002. To their corpus, we added the Christmas speeches from 2005, 2010, 2015, and 2018, accessed from YouTube via Audio Hijack (Rogue Amoeba, 2018).

It needs to be noted that the quality of the recordings is such that a reliable analysis was not always possible. This might be one of the several reasons (cf. Hejná, 2025) why acoustic studies of pre-aspiration have not been conducted on archival materials (beyond Fiasson, 2016); by nature, the farther back we go in the (audio recorded) historical record, the more compromised the quality of our materials will be. Durational analyses were therefore deemed too unreliable for pre-aspiration and local breathiness with these recordings. Our analysis therefore treats voiceless pre-aspiration, local breathiness (or a voiced component of pre-aspiration), and glottalisation as discrete presence/absence outcomes rather than continuous durations. This is also why we report on ambiguous identifications of the phenomena in our Results section. The identification of these three laryngeal phenomena is described in more detail below in Sec. 2.3.

2.2 Environments

In this study, we focus on environments in which pre-aspiration has been reported in previous studies on English. These environments include sequences of vowels and voiceless obstruents, as in *map*, *happy*, *less*, *messy*, *pest*, and *Christmas*. In addition to plosives and fricatives, we also include the affricate /tʃ/, as in *patch* and *patching*.

All primary- or secondary-stressed vowel phonemes available in the dataset were included as potential carriers of pre-aspiration, with unstressed vowels excluded. Our analysis is limited to lexical words, i.e., grammatical words were excluded, as were some commonly reduced high-frequency words.[2]

There were three metrical contexts in which the pre-aspiration-inducing consonant could appear: foot-initial, foot-medial, or foot-final. Foot-initial examples include *Au**s**tralia*, where the [s] might be preceded by aspiration; we observed only 14 total tokens of possible foot-initial environments, too small of a sample for meaningful analysis, so these are excluded from further consideration. Foot-medial examples include *ha**p**py*, where the [p] might be preceded by aspiration. Foot-finally, pre-aspiration might appear in a word like *be**s**t*, triggered by the [s]. We observed only one token following the vowel /ɔɪ/, which did not enable us to include it in the analysis in a meaningful way. After exclusions, we were left with 2061 observations to code.

2.3 Coding of acoustic data

Pre-aspiration and breathiness were coded manually in Praat (Boersma and Weenink, 2019) by the second author. In line with other pre-aspiration studies (e.g., Hejná, 2025 and the references therein; Morris and Hejná, 2020), we define pre-aspiration as a period of glottal friction found in sequences of sonorants and phonetically voiceless obstruents (though in this study, we only investigate vowel–obstruent sequences). We distinguish two components of pre-aspiration: voiced glottal friction (local breathiness) and voiceless glottal friction (voiceless pre-aspiration, or pre-aspiration in a narrow sense). The identification and segmentation of these two parts of pre-aspiration (in a broader sense) are shown in Fig. 1 (top). Due to occasional difficulty discerning the acoustic signal, we additionally tagged instances of pre-aspiration and breathiness as ambiguous if uncertain about their presence (see Fig. 1, middle).

All environments consisted of a vowel + voiceless obstruent sequence. Voiceless pre-aspiration was identified based on the presence of voiceless friction dispersed across different frequencies. Local breathiness was identified by an increase in glottal friction following the modal part of the vowel, typically accompanied by the attenuation of formant

structures. Another criterion employed to identify breathiness was the presence of glottal energy in higher frequencies. Breathiness could manifest with various types of noise, including slack voice, which includes vocal fold abduction and periodicity but not a particularly noticeable amount of friction (Ladefoged and Maddieson, 1996, p. 63). Breathy-voiced portions of sound waves were typically more sinusoidal than modally voiced portions as well.

We also coded for the presence of glottalisation in each vowel token under investigation. Glottalisation was identified as a period of irregular phonation or a sudden drop in *f*0 (see Fig. 1, bottom). The acoustic properties of glottalisation rendered it much easier to unambiguously identify than breathiness and pre-aspiration, given that temporal glottal pulse irregularities are clearly visible in both the waveform and the spectrogram.

Our approach to the coding of glottalisation is admittedly simplistic, most obviously because we do not distinguish plosive-induced local glottalisation (pre-glottalisation, or glottal enforcement) from phrasal creak. While the two may differ acoustically in cases of glottal replacement (Garellek and Seyfarth, 2016), we do not observe glottal replacement in the Queen's idiolect. For our purposes, we wanted to simply capture the presence of glottalisation since we know it may block pre-aspiration, and from an articulatorily standpoint the domain-status of the glottalisation is perhaps unlikely to be crucial. However, we acknowledge that future researchers of pre-aspiration may wish to distinguish between and control more closely for different types of glottalisation.

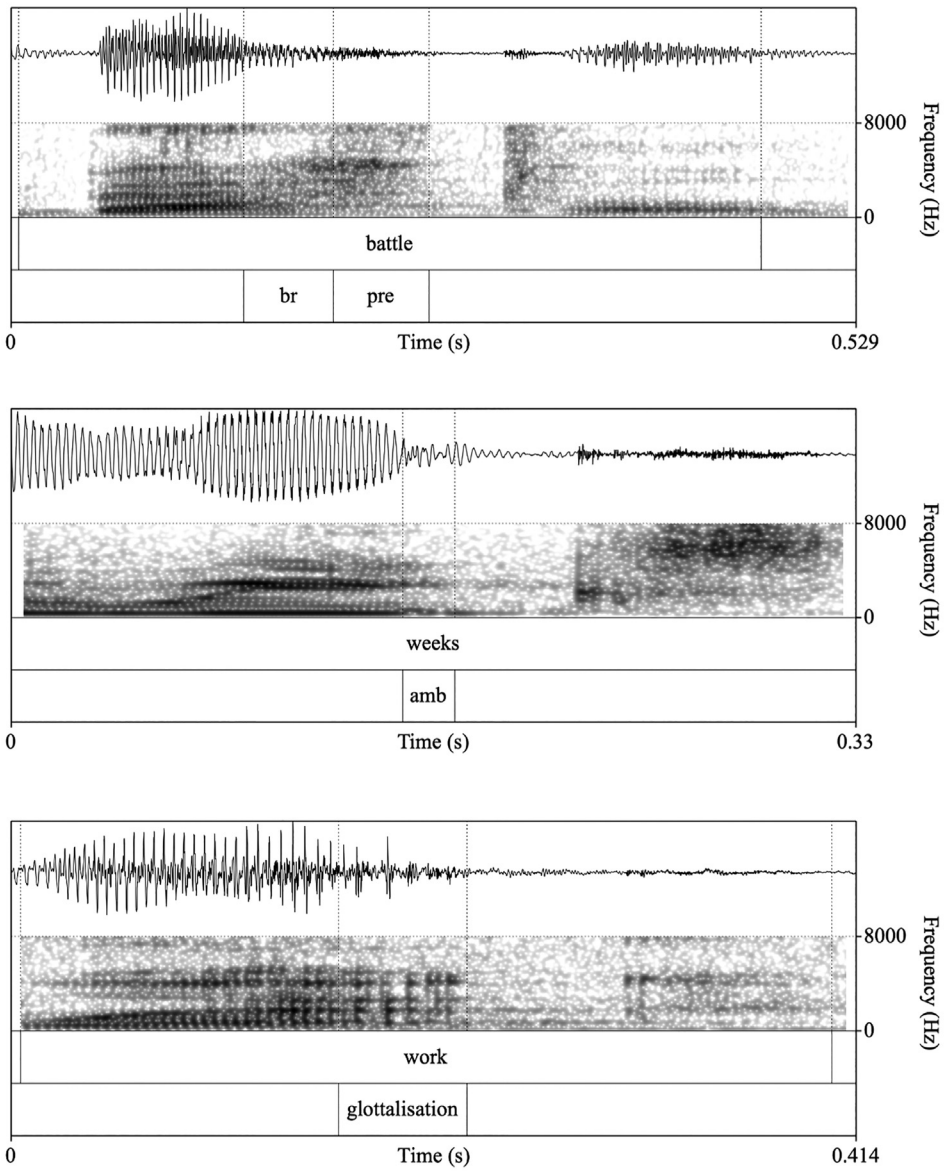

Fig. 1. (Top) Identification of pre-aspiration in a plosive environment; "br" stands for breathiness; "pre" stands for pre-aspiration. (Middle) It was occasionally unclear whether pre-aspiration was present; "amb" stands for ambiguous pre-aspiration. (Bottom) Glottalisation in a vowel–obstruent sequence.

3. Results

Within the 2061 tokens in the corpus, the presence of unambiguous pre-aspiration was noted 108 times (5.2%); with possible but ambiguous cases of pre-aspiration included, this number rises to 181 (8.8%).

We first look at the frequency of (voiceless) pre-aspiration and how this patterns in real time. Next, we report whether pre-aspiration co-occurs with (local) breathiness and how frequently, as well as the frequency of breathiness in real time. Finally, we show which factors other than the year of the recording condition the frequency of occurrence of pre-aspiration and breathiness.

Given the potentially complex and mediated effects of age, voice quality, and phonological environment on rates of pre-aspiration—as well as the relatively small number of pre-aspirated tokens—the sorts of regression models typically employed in phonetic investigations may be unsuitable for modelling the present phenomena. We report below only descriptive statistics and simple Pearson's product-moment correlations between pairs of variables, reserving further inferential statistical analysis for future work.

3.1 Effect of age on rates of pre-aspiration, breathiness, and glottalisation

As shown in Fig. 2, the Queen pre-aspirated less frequently the more advanced her age, with a relatively strong negative correlation between year and rate of pre-aspiration [$r(17) = -0.57$, $p = 0.011$]. The results are similar with ambiguous tokens included [$r(17) = -0.59$, $p = 0.008$]. Her rate of pre-aspiration was highest in 1964, when 19 out of 95 possible environments (20%) definitely contained pre-aspiration (30 tokens, or 31.6%, if ambiguous cases are included); in 2002, no pre-aspiration was noted out of 90 possible instances.

Like voiceless pre-aspiration, local breathiness decreases in frequency of occurrence in real time. The correlation is even stronger for breathiness [$r(17) = -0.80$, $p < 0.001$] than for pre-aspiration; inclusion of ambiguous cases shows a similarly strong correlation [$r(17) = -0.76$, $p < 0.001$]. Local glottalisation increases in frequency in real time, with a strong positive correlation observed [$r(17) = 0.68$, $p = 0.001$].

We thus see an overall pattern where pre-aspiration decreases over the Queen's life, along with breathiness, while glottalisation increases over her lifespan.

3.2 Co-occurrence of pre-aspiration, breathiness, and glottalisation

Table 1 shows all cases of unambiguous occurrences of pre-aspiration, breathiness, and glottalisation. In this sample of 2061 tokens, voiceless pre-aspiration hardly ever occurs on its own ($n = 1$) and very seldom co-occurs with just glottalisation ($n = 8$, all in foot-final position); it also rarely occurs alongside both glottalisation and breathiness ($n = 5$). On the other hand, when pre-aspiration does occur, it is overwhelmingly accompanied by breathiness ($n = 94$). Breathiness also commonly occurs alone ($n = 921$), and rarely co-occurs with glottalisation ($n = 39$); glottalisation occurs alone in 185 tokens. Thus, in this dataset, pre-aspiration and glottalisation are to a large extent complementary, while 87% of tokens with voiceless pre-aspiration are accompanied by breathiness.

3.3 Patterns by phonological environment

In total, we analysed 1159 tokens in foot-medial position and 902 in foot-final position. In foot-medial position, 80 tokens (7%) were definitely pre-aspirated and an additional 43 were ambiguous (totalling 123, or 11%). In foot-final position, 28 tokens (3%) were definitely pre-aspirated and an additional 30 were ambiguous (totalling 58, or 6%).

Table 2 presents rates of occurrence by consonant. In medial position, pre-aspiration is most frequent in the environment of /t/, followed by /θ/. There is no unambiguous pre-aspiration observed in the environments of /p/ and /ʃ/. Including

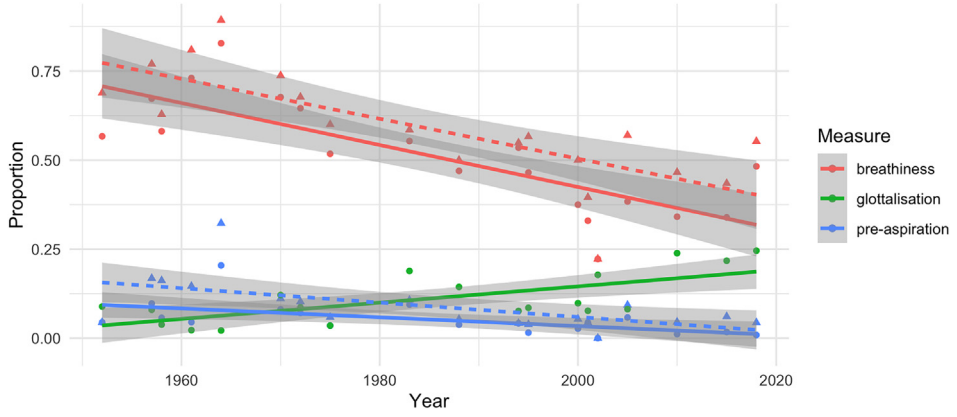

Fig. 2. Pre-aspiration, breathiness, and glottalisation frequency across Queen Elizabeth II's lifespan. Solid lines represent unambiguous tokens only; dashed lines represent unambiguous and ambiguous tokens combined.

Table 1. Co-occurrence of pre-aspiration, breathiness, and glottalisation within unambiguously coded tokens.

Foot	Pre-aspiration alone	Glottalisation alone	Glottalisation with pre-aspiration	Glottalisation, breathiness, and pre-aspiration	Breathiness with pre-aspiration	Breathiness alone	Glottalisation and breathiness, no pre-aspiration	None	Total
Medial	0 (0%)	44 (4%)	0 (0%)	2 (0%)	78 (7%)	602 (52%)	9 (1%)	424 (37%)	1159
Final	1 (0%)	141 (16%)	8 (1%)	3 (0%)	16 (2%)	319 (35%)	30 (3%)	384 (43%)	902

ambiguous cases notably raises the rates observed for /θ/ and /tʃ/; other environments remain at very low rates of pre-aspiration.

In final position, the rate of pre-aspiration for /t/ is greatly reduced; /f/ has the highest rate of pre-aspiration, followed by /θ/. Once again, no pre-aspiration is observed for /p/ and /ʃ/, and other environments also have very low rates.

We also observe effects of the surrounding vowel environment (Table 3). Tense vowels are generally less likely to co-occur with pre-aspiration than lax vowels. Diphthongs are less likely to co-occur with pre-aspiration than monophthongs. Pre-aspiration is most frequent with low vowels: /ʌ/, the lowest lax vowel in the Queen's system (Harrington *et al.*, 2000a), has the highest rate of pre-aspiration, followed by /æ/ and /ɒ/, the next lowest lax vowels. We observe similar vowel environment results whether or not ambiguous cases are excluded, and in both medial and final footing environments.

4. Discussion

We conclude that pre-aspiration is indeed found in Queen Elizabeth II's speech, indicating that it is not a new phenomenon in England's acrolectal accent. Where pre-aspiration occurs, it is overwhelmingly accompanied by breathiness and very seldom accompanied by glottalisation (cf. Hejná, 2023). The Queen's rates of pre-aspiration and breathiness are highest earlier in her adulthood and decline as she ages; glottalisation, in contrast, increases over the course of her life.

In foot-medial environments, pre-aspiration is found the most in /t/. The relatively high amount of contact between the tongue and the alveolar ridge—particularly in a dialect like RP with a high degree of /t/ affrication—provides a large window of opportunity to produce pre-aspiration compared with a sound like /p/ (cf. Morris and Hejná, 2020). Foot-finally, /f/ and /θ/ are the most favourable segments, for reasons that remain unclear (cf. Hejná, 2015, pp. 117–188). Further studies should investigate the relative favourability of these contexts in a larger number of speakers, in other varieties of English, and in other languages.

With respect to why tense vowels should be associated with less pre-aspiration, the reason might be prosodic. The vast majority of pre-aspirating languages show a preference for phonologically short vowels to be associated with pre-aspiration while long vowels disprefer pre-aspiration, although some exceptions have been reported (e.g., Clayton, 2010; Hejná, 2015, 2025). However, within phonologically short vowels, these studies have found that the longer the vowel duration, the longer the pre-aspiration. Low vowels may thus be articulatorily conducive to pre-aspiration as they are relatively long compared to higher vowels (cf. Lisker, 1974), allowing more time during which aspiration may manifest prior to plosive closure (cf. Hejná, 2015). Furthermore, as discussed in Hejná (2025), pre-aspiration serves as a correlate to the fortis–lenis contrast of plosives. There may thus be a perceptual explanation for why pre-aspiration would be longer and more frequent following low as opposed to high vowels: If what perceptually matters for pre-aspiration to cue the fortis–lenis contrast is its duration expressed as a proportion of the vowel duration, we would predict that low vowels would require longer and more frequent pre-aspiration.

If these age-related results are generalisable to other individuals, it could be that as the vocal folds age, their reduced elasticity creates the conditions for increased glottalisation and reduced breathiness, which in turn lead to

Table 2. Pre-aspiration occurrence by consonant, foot-medial tokens (left), and foot-final tokens (right).

Consonant	Total medial	No. present (including ambiguous)	% present (including ambiguous)	Total final	No. present (including ambiguous)	% present (including ambiguous)
p	165	0 (5)	0% (3%)	67	0 (1)	0% (1.5%)
t	248	61 (74)	24.6% (29.8%)	265	7 (17)	2.6% (6.4%)
tʃ	44	2 (8)	4.5% (18.2%)	19	1 (1)	5.3% (5.3%)
k	148	4 (11)	2.7% (7.4%)	188	2 (5)	1.1% (2.7%)
f	81	4 (6)	4.9% (7.4%)	48	6 (12)	12.5% (25%)
θ	14	1 (4)	7.1% (28.6%)	69	4 (9)	5.8% (13%)
s	299	8 (14)	2.7% (4.7%)	233	8 (13)	3.4% (5.6%)
ʃ	160	0 (1)	0% (0.6%)	13	0 (0)	0% (0%)

Table 3. Pre-aspiration occurrence by vowel environment, foot-medial tokens (left), and foot-final tokens (right).

Vowel	Total medial	No. present (including ambiguous)	% present (including ambiguous)	Total final	No. present (including ambiguous)	% present (including ambiguous)
iː	126	13 (16)	10.3% (12.7%)	80	2 (2)	2.5% (2.5%)
ɪ	252	21 (24)	8.3% (9.5%)	37	0 (1)	0% (2.7%)
eɪ	173	4 (8)	2.3% (4.6%)	151	4 (9)	2.6% (6%)
ɛ	164	6 (12)	3.7% (7.3%)	112	5 (10)	4.5% (8.9%)
ɜː	62	4 (5)	6.5% (8.1%)	78	1 (3)	1.3% (3.8%)
æ	120	14 (24)	11.7% (20%)	36	2 (4)	5.6% (11.1%)
ɑː	37	1 (5)	2.7% (13.5%)	95	3 (6)	3.2% (6.3%)
ɒ	67	7 (10)	10.4% (14.9%)	19	1 (2)	5.3% (10.5%)
ʌ	37	8 (11)	21.6% (29.7%)	18	2 (2)	11.1% (11.1%)
ɔː	44	1 (6)	2.3% (13.6%)	64	1 (2)	1.6% (3.1%)
əʊ	23	0 (0)	0% (0%)	43	0 (2)	0% (4.7%)
uː	32	1 (2)	3.1% (6.2%)	24	1 (1)	4.2% (4.2%)
ʊ	4	0 (0)	0% (0%)	27	0 (0)	0% (0%)
aɪ	17	0 (0)	0% (0%)	99	6 (13)	6.1% (13.1%)
aʊ	1	0 (0)	0% (0%)	19	0 (1)	0% (5.3%)

decreasing rates of pre-aspiration. It is also conceivable that social age grading plays a role. Research in a larger sample of speakers will be necessary to better understand the effects of aging on voice quality and rates of pre-aspiration.

If younger English speakers do pre-aspirate more, it could explain why Kettig (2015) found nearly all of his subjects to consistently produce pre-aspiration in favourable consonant environments; we further find that the low, lax /æ/ vowel environment explored by Kettig (2015) is particularly favourable in this sample. The task involved may also have had an effect. Kettig (2015)—as in many prior studies that have found pre-aspiration—utilised individual read sentences. Hejná *et al.* (2021) found that pre-aspiration was least common in sociolinguistic interviews when compared to read sentences and passages or words in isolation. It is debatable exactly what experimental style of speech is most comparable to the Queen's highly rehearsed, partially memorised Christmas speech performances. Future research should compare different dialects of English across comparable environments and tasks.

Acknowledgments

We again thank Jonathan Harrington and Ulrich Reubold for their corpus of aligned recordings and TextGrid annotations. We also thank Fabian Tomaschek and Noah Henry for their help with various aspects of the quantitative analysis.

Author Declarations

Conflict of Interest

The authors have no conflicts to disclose.

Data Availability

The data that support the findings of this study are openly available in Github at https://github.com/tkettig/QE2_Preasp (Kettig, 2026).

References

[1]That is, studies that compare different age groups at one point in time, unlike those conducted across the lifespan in real time.

[2]These include *about*, *across*, *after*, *at*, *both*, *but*, *despite*, *each*, *if*, *it*, *itself*, *just* (adverb), *less* (quantifier), *let* (in the imperative *let us*/*let's* construction), *like* (preposition), *might*, *most* (quantifier), *much*, *must*, *not*, *ought*, *out* (particle), past (preposition), *sort* (discourse marker: *sort of*), *St.* (in names), *such*, *that*, *throughout*, *up* (particle, preposition), *upon*, *what*, *whatever*, *which*, *with*.

Boersma, P., and Weenink, D. (**2019**). "Praat: Doing phonetics by computer" (version 6.0.25).

Clayards, M., and Knowles, T. (**2015**). "Prominence enhances voicelessness and not place distinction in English voiceless sibilants," in *Proceedings of the 18th International Congress of Phonetic Sciences*, Glasgow, UK (August 10–14, 2015).

Clayton, I. (**2010**). "On the natural history of preaspirated stops," Ph.D. dissertation, University of North Carolina, Chapel Hill, NC.

Clayton, I. (**2017**). "Preaspiration in Hebrides English," J. Int. Phon. Assoc. **47**(2), 155–181.

Collins, B., and Mees, I. M. (**1996**). "Spreading everwhere?," English World-Wide **17**(2), 175–187.

Docherty, G. J., and Foulkes, P. (**1999**). "Derby and newcastle: Instrumental phonetics and variationist studies," in *Urban Voices: Accent Studies in the British Isles*, edited by P. Foulkes and G. Docherty (Arnold, London, UK), pp. 47–71.

Fiasson, R. (**2016**). "Frication, pre-aspiration and tapping of medial /t/ in New Zealand English," Te Reo **59**, 47–69.

Garellek, M., and Seyfarth, S. (**2016**). "Acoustic differences between English /t/ glottalization and phrasal creak," in *Proceedings of INTERSPEECH 2016*, San Francisco, CA (September 8–12, 2016), pp. 1054–1058.

Gittelson, B., Leemann, A., and Tomaschek, F. (**2021**). "Using crowd-sourced speech data to study socially constrained variation in nonmodal phonation," Front. Artif. Intell. **3**, 565682.
Gordeeva, O., and Scobbie, J. M. (**2013**). "A phonetically versatile contrast: Pulmonic and glottalic voicelessness in Scottish English obstruents and voice quality," J. Int. Phon. Assoc. **43**, 249–271.
Gordon, E., Maclagan, M., and Hay, J. (**2007**). "The ONZE corpus," in *Creating and Digitizing Language Corpora: Diachronic Databases*, edited by J. C. Beal, K. P. Corrigan, and H. Moisl (Palgrave Macmillan, Basingstoke, UK), Vol. 2, pp. 82–104.
Grama, J., Eiswirth, M. E., Buchstaller, I., Skarnitzl, R., and Volín, J. (**2023**). "Tracking creak from early to late adulthood: A panel study from the North East of England," in *Proceedings of the 20th International Congress of Phonetic Sciences*, Prague, Czechia (August 7–11, 2023), pp. 2049–2053.
Harrington, J., Palethorpe, S., and Watson, C. (**2000a**). "Monophthongal vowel changes in Received Pronunciation: An acoustic analysis of the Queen's Christmas broadcasts," J. Int. Phon. Assoc. **30**(1–2), 63–78.
Harrington, J., Palethorpe, S., and Watson, C. (**2000b**). "Does the Queen speak the Queen's English?," Nature **408**, 927–928.
Hejná, M. (**2015**). "Pre-aspiration in Welsh English: A case study of Aberystwyth," Ph.D. dissertation, University of Manchester, Manchester, UK.
Hejná, M. (**2016**). "Multiplicity of the acoustic correlates of the fortis-lenis contrast: Plosives in Aberystwyth English," in *Proceedings of INTERSPEECH 2016*, San Francisco, CA (September 8–12, 2016), pp. 3147–3151.
Hejná, M. (**2021**). "Exploration of Welsh English pre-aspiration: How wide-spread is it?," in *Proceedings of INTERSPEECH 2021*, Brno, Czechia (August 30–September 3, 2021), pp. 3974–3978.
Hejná, M. (**2023**). "I can be both? (pre-)aspiration and (pre-)glottalisation do not have to be mutually exclusive," in *Proceedings of the 20th International Congress of Phonetic Sciences*, Prague, Czechia (August 7–11, 2023), pp. 1875–1879.
Hejná, M. (**2025**). "On the rarity of pre-aspirated consonants," in *Rarities in Phonetics and Phonology: Evolutionary, Structural, Typological and Social Dimensions*, edited by N. Kuznetsova, C. Anderson, and S. Easterday (Language Science Press, Berlin, Germany), pp. 641–694.
Hejná, M., and Jatteau, A. (**2023**). "Aberystwyth English pre-aspiration in apparent time," in *Proceedings of INTERSPEECH 2023*, Dublin, Ireland (August 20–24), pp. 3532–3536.
Hejná, M., and Jespersen, A. (**2019**). "Focus on consonants: Prosodic prominence and the fortis-lenis contrast in English," in *A Sound Approach to Language Matters. In Honor of Ocke-Schwen Bohn*, edited by A. Nyvad, M. Hejná, A. Hùjen, A. Jespersen, and M. Sùrensen (Aarhus University, Aarhus, Denmark), pp. 237–270.
Hejná, M., Kaźmierski, K., and Guo, W. (**2021**). "Even Americans pre-aspirate," English World-Wide **42**(2), 200–226.
Hejná, M., and Kimper, W. (**2018**). "Pre-closure laryngeal properties as cues to the fortis-lenis plosive contrast in British varieties of English," Yearb. Poznań Linguist. Mtg. **4**, 179–211.
Hejná, M., and Scanlon, J. (**2015**). "New laryngeal allophony in Manchester English," in *Proceedings of the 18th International Congress of Phonetic Sciences*, Glasgow, UK (August 10–14, 2015).
Helgason, P. (**2002**). "Preaspiration in the nordic languages: Synchronic and diachronic aspects," Ph.D. thesis, Stockholm University, Stockholm, Sweden.
Iseli, M., Shue, Y. L., and Alwan, A. (**2007**). "Age, sex, and vowel dependencies of acoustic measures related to the voice source," J. Acoust. Soc. Am. **121**, 2283–2295.
Jones, M. J., and Llamas, C. (**2003**). "Fricated pre-aspirated /t/ in Middlesbrough English: An acoustic study," in *Proceedings of the 15th International Congress of Phonetic Sciences*, Barcelona, Spain (August 3–9, 2003), pp. 655–658.
Jones, M. J., and McDougall, K. (**2009**). "The acoustic character of fricated /t/ in Australian English: A comparison with /s/ and /ʃ/," J. Int. Phon. Assoc. **39**(3), 265–289.
Kettig, T. (**2015**). "The BAD–LAD split: A phonetic investigation," M. Phil. dissertation, University of Cambridge, Cambridge, UK.
Kettig, T. (**2026**). "QE2_Preasp," Github, https://github.com/tkettig/QE2_Preasp.
Ladefoged, P., and Maddieson, I. (**1996**). *The Sounds of the World's Languages* (Blackwell, Oxford, UK).
Lisker, L. (**1974**). "On 'explaining' vowel duration variation," Status Rep. Speech Res. SR-37/38, 225–232, https://files.eric.ed.gov/fulltext/ED094445.pdf#page=223.
Morris, J. (**2010**). "Phonetic variation in Northern Wales: Preaspiration," in *Proceedings of the Second Summer School of Sociolinguistics*, Edinburgh, UK (June 14–20, 2010).
Morris, J., and Hejná, M. (**2020**). "Pre-aspiration in Bethesda Welsh: A sociophonetic analysis," J. Int. Phon. Assoc. **50**(2), 168–192.
Nance, C., and Stuart-Smith, J. (**2013**). "Pre-aspiration and post-aspiration in Scottish Gaelic stop consonants," J. Int. Phon. Assoc. **43**(2), 129–152.
Ní Chasaide, A. (**1985**). "Preaspiration in phonological stop contrasts," Ph.D. dissertation, University College of North Wales, Bangor, UK.
Rogue Amoeba (**2018**). "Audio Hijack" (version 3.5.6).
Rojas, S., Kefalianos, E., and Vogel, A. (**2020**). "How does our voice change as we age? A systematic review and meta-analysis of acoustic and perceptual voice data from healthy adults over 50 years of age," J. Speech. Lang. Hear. Res. **63**(2), 533–551.
Stathopoulos, E., Huber, J., and Sussman, J. (**2011**). "Changes in acoustic characteristics of the voice across the life span: Measures from individuals 4–93 years of age," J. Speech. Lang. Hear. Res. **54**(4), 1011–1021.
Su, V. W. Y. (**2007**). "The gender variable in Australian English stop consonant production," B.A. thesis, University of Melbourne, Melbourne, Australia.
Tait, C., and Tabain, M. (**2016**). "Patterns of gender variation in the speech of primary school-aged children in Australian English: The case of /ptk/," in *Proceedings of the 16th Australasian International Conference on Speech Science and Technology*, Parramatta, Australia (December 6–9, 2016), pp. 65–68.
Watson, K. (**2007**). "The phonetics and phonology of plosive lenition in Liverpool English," Ph.D. dissertation, University of Lancaster, Edge Hill College, Lancaster, UK.
Wells, J. (**1982**). *Accents of English* (Cambridge University Press, Cambridge, UK), Vol. 2.