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Assessing the impact of tourist flows on emergency department treatment speed for residents and tourists. The case of Sorrento

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ABSTRACT

Tourism is a fundamental lever of the economic and cultural development of a location. Large tourist flows can negatively impact the provision of public services, such as healthcare. This study aims to investigate emergency department (ED) treatment speed under increased demand caused by tourism. The analysis was conducted on data (covering March–October 2018) collected from the ED of a hospital in Sorrento, a renowned coastal tourist destination in Campania, Italy, by using a two-step strategy. First, we resort to the Kaplan-Meier method to compare treatment in the ED between residents and tourists. Second, through the Cox proportional hazards model, we study the impact of group-specific characteristics on the speed of treatment. The main empirical findings highlight that treatment speed is highly influenced by age and by the languages spoken by tourists. Foreign tourists are best served in off-peak periods, while in the peak arrival period, the healthcare system experiences difficulties, especially for those facing higher language barriers. What emerges is the necessity for a tourism destination to adopt measures to cope with the language heterogeneity of tourists. In a multi-cultural touristic context, healthcare providers and institutions should address the challenge of language barriers by using specialist interpreter services.

1. Introduction

Tourism is considered one of the most relevant sectors in stimulating the development of a destination [22]. However, tourism development has varying degrees of impact on destination environments and in particular on local residents, who act as 'hosts' to tourists [47]. Scholars have paid attention to the economic, socio-cultural and environmental dimensions of the impact of tourism [4,10]. With specific regard to negative outcomes, previous studies have mainly identified the crowding of fundamental public services, increase in crime and in the cost of living, and changes in residents' way of life [4,21]. The majority of these studies have been conducted in the USA, revealing a lack of attention to Mediterranean destinations, particularly Italian destinations [25].

In the case of the crowding of fundamental public services, a reduction in the performance of such services has been observed [7,28,35,37]. This is particularly true in the public healthcare system because the level of its services does not vary according to the demand. The public healthcare system, in fact, generally operates with limited resources and budget [8]. The crowding of fundamental public services is considered one of the main negative outcomes of tourism development [7,28,35,37]. The reason is that tourism can generate an increase in the demand for some public services, which can lead to a reduction in their accessibility, quality, and quantity [3,45]. More specifically, the additional demand for healthcare services generated by tourism can cause an increase in the hospitalisation rate [36]. In fact, public service providers may be unable to adapt their supply to the increased demand generated by tourism, and consequently, their performance may decline. The problem of the crowding of public services is particularly relevant for healthcare providers, who could find it difficult to assure the same level of service during the months with the highest numbers of tourists, due mainly to organisational, financial and institutional limitations [22].

With specific regard to the emergency department (ED), the increase in patient arrivals generated by tourism can negatively influence treatment speed. In fact, the ED serves a critical function in healthcare

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systems by providing emergency care to patients in need. As a consequence, the increase in patient arrivals can undermine service timeliness, thus putting patients with severe conditions at risk [49]. Over the last several decades, different studies have been conducted on the impact of tourism on the healthcare system and especially on EDs [36]. Investigated the impact of tourism on emergency admission rates in orthopaedic health service areas in Switzerland and found that hospital admission rates were up to 4 times higher in winter than in other seasons, almost entirely due to tourist admissions [40]. Investigated the imbalance in demand and supply for injury admissions caused by tourism in the hospital of Kerkyra (Greece) and found that the extra demand generated by tourists was reflected in the seasonality of injury admissions.

The present work contributes to the literature on ED treatment speed (EDTS) by proposing an empirical investigation of the representative case study of Sorrento (southern Italy). The analysis rests on data on ED admissions from March to October 2018 – the months of greater tourism numbers in Sorrento – which allow us to evaluate the EDTS through a two-step strategy. In the first step, we compare EDTS between residents and tourists by using the Kaplan-Meier (KM) method [33]. In the second step, we study the determinant of treatment speed through the Cox proportional hazards model [17,18]. While these methods have been extensively used in epidemiological studies [2,31], this work is one of the first to use them to evaluate the speed of treatment in an ED.

The remainder of the paper is organised as follows. The next section describes tourism in Sorrento. Section 3 shows the methodology. Section 4 reports and discusses the results. Finally, Section 5 presents the conclusions, implications, and limitations of the study.

2. Tourism in Sorrento: past and present

Sorrento is located in the Campania region (in southern Italy) 46.5 km south of the city of Naples and on the north-western side of the Sorrento Peninsula. Although it is a small municipality with an area of 9.96 km^2, Sorrento is characterised by a high population density, with 1639 inhabitants per square kilometre.[1] The town extends harmoniously over a high tuff terrace that is rich in verdant vegetation and characterised by cliffs with an average elevation of 47 m above sea level (see Fig. 1).

Sorrento is and has been one of the most successful destinations for international tourism. The myth of the Sorrento Peninsula owes much to the ancient Roman nobles who chose this stretch of coast as their residence during the imperial age (1st to 5th century C.E.), as evidenced by the remains of patrician houses scattered at the most suggestive points. During the early stages of the Roman Empire, the area was very popular as a holiday resort for the wealthy patricians, who selected the entire arch of the Gulf of Naples – from the Campi Flegrei to Sorrento – as an ideal place to spend the summer and periods of *otium*. Several *Villae Maritimae* thus arose in this area: magnificent residences that each had their own access to the sea. They were situated in large private neighbourhoods and sometimes even rustic neighbourhoods, where oil and wine were produced with the fruits of the lands owned by the *dominus*. From Vico Equense to Punta Campanella and beyond – as indeed throughout the Gulf of Naples – massive construction work took place at all the most panoramic points of the coast, where wonderful villas of Roman aristocratic families arose. The fame of Sorrento is also commemorated by the Roman poets Horatius and Statius. In Statius's Silvae, the author praises the beauty of such places, in particular the villa of his friend Pollio Felix.

The myth of Sorrento was consolidated above all at the end of the 18th century, when aristocratic Europe was fascinated by antiquity and classicism. It is very near Pompei and Ercolano. European nobles were the first travellers of the modern age to know and promote the beauty of Sorrento and of the entire Sorrento Peninsula. In their travel diaries and letters, they told the rest of the world about the wonderful adventures they experienced and described the enchantment of the nature that surrounded them: the endless citrus and fruit crops, abundant in every season; the ever-gentle climate; and the delights of a cuisine made of simple dishes that appeared precious and exotic to them. The 18th century therefore represents the beginning of a period of cultural, economic, and social rebirth for the entire Sorrento Peninsula that reached its peak during the 19th century, when the tourist vocation of the town was consolidated. Sorrento was thus included in the so-called Grand Tour (see Ref. [20], a journey to the most significant places in Italy that every noble European scion of the time had to undertake in order to complete his cultural, historical and literary education. Thus, illustrious guests such as Byron, Keats, Scott, Dickens, Goethe, Wagner, Ibsen, and Nietzsche (to mention only the best known) came to stay in Sorrento, searching for sun and inspiration.

In the same period, more traditional work activities intensified, such as agriculture, maritime trade and eventually the tourist industry, which currently represents the leading sector of the local economy. The most recent data confirm this trend; in particular, tourism in 2014 granted employment to 86% of the workers in the town of Sorrento, with an increase in employment of 3% expected for 2020, meaning an anticipated employment rate in the tourism sector of 89%[2] (obviously, these predictions are no longer reliable due to Covid-19[3]). In addition, tourism contributes 90% of the total added value in Sorrento, followed by other substantially marginal productive activities (0.7% agriculture, 5% industry and 3% construction). Fig. 2 shows the monthly series of the added value of tourism with forecasts for 2019 (red dots). In general, a slightly increasing trend emerges, with higher values in the summer and spring months (from April to September) and a positive spike in July. In this case, the value increases from approximately 77 million euros in July 2018 to approximately 79 million euros in the same month in 2020, an expected increase of 2 million euros.

Sorrento has always been a tourist destination, especially for foreign tourists. In this regard, ISTAT noted that foreigners constituted 89.1% of the tourists in Sorrento in 2018. This figure ranks Sorrento among the top 20 Italian municipalities with the largest numbers of foreign tourists [29]. Fig. 3 shows an increasing trend in the arrivals of both Italian and foreign tourists. In particular, a massive arrival of foreign tourists for most months of the year clearly emerges, while national tourists show only one peak in July and a constant and rather modest trend in the other months of the year. For the rest of the months chosen to spend holidays (from March to October), a dominance of foreign tourists over Italian tourists may be observed. Moreover, it is evident that the presence of foreign tourists does not fade after the hottest months of the year (July and August) but also extends through the spring and autumn months. This result indicates the different preferences and different economic possibilities of national and foreign tourists. Finally, we note that the forecasts for the months of 2019 confirm a positive trend in the arrivals of foreign and Italian tourists, with slight increases compared to the arrivals recorded in 2018.

When distinguishing tourists by nationality, it is important to stress

[1] In comparison, Naples (the capital of the Campania region) has a population density of 8065 inhabitants per km^2, while the other main regional municipalities, i.e., Salerno (2,228), Avellino (1,768), Caserta (1,395), and Benevento (452), have densities similar to Sorrento's.

[2] http://www.ilmegliodisorrento.com/banco-di-napoli-e-turismo-sorrentino/(last accessed April 27, 2020).

[3] The COVID-19 (where "CO" stands for corona, "VI" for virus, "D" for disease and "19" for the year that it began) pandemic that broke out at the beginning of 2020 led the governments of affected countries to declare lockdowns, i.e., to adopt an emergency protocol that prevented people from entering or leaving a particular place for their safety. This policy adversely affected all sectors of production, and particularly that of tourism, by completely resetting the economic effects.

Fig. 1. Geographical position of Sorrento.

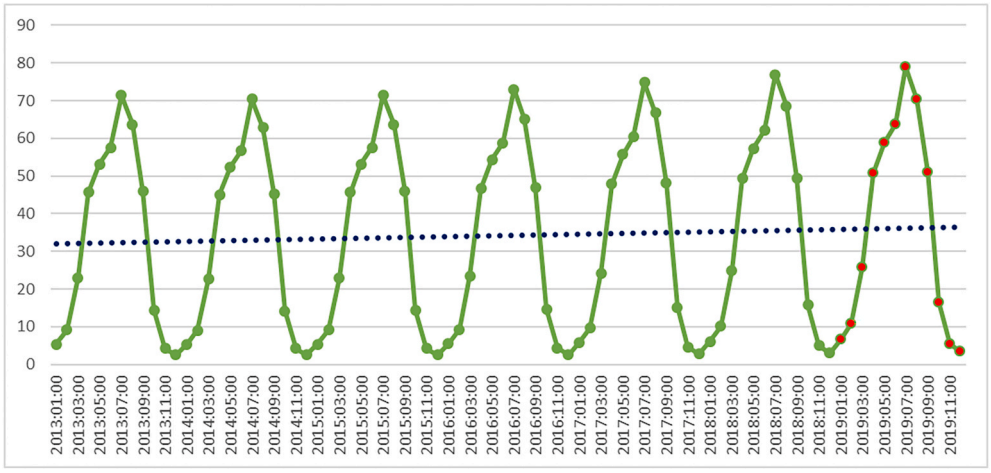


Fig. 2. Added value of Sorrento's tourism sector, 2013–2019.
Source: Our elaboration on data from Ref. [11] and http://www.ilmegliodisorrento.com/banco-di-napoli-e-turismo-sorrentino/ (last accessed April 27th, 2020). Value added is expressed in millions of euros. The red dots represent the forecast values.

that Sorrento has always been a primary tourist destination for British travellers [20]. Over the years and to the present day, other English-speaking tourists (Americans, Australians, etc.) have grown more numerous, representing the largest portion of tourists, followed by French-speaking, German-speaking, Spanish-speaking, and other tourists. Dividing foreign tourists by their mother tongue, Fig. 4 shows two monthly historical series of tourist flows divided for simplicity between classic tourists (English-, French-, Spanish-, and German-speaking tourists) – who have historically adopted Sorrento as a tourist destination – and new tourists (Russian, Chinese and East European visitors) –who have adopted Sorrento as a primary tourist destination only in recent years and for whom substantial increases are expected in future years, as shown by the arrival forecasts for 2019 (yellow series). In addition, a high number of arrivals for both series in the central four months of the series (April–July) is observed. The expected increase in arrivals of the so-called new tourists must be taken into consideration because they represent a new tourist segment that will positively influence the added value of the local tourism sector. Unfortunately, in terms of tourist satisfaction, new tourists are most likely to complain about the inadequacy of hotel facilities and about facing difficulties in Italy due to the lack of services provided in languages other than English as well as the lack of available informational and promotional material in their mother tongues [9]. The problem is amplified in reference to languages such as Chinese, as Chinese tourists frequently complain about the lack of assistance and promotional materials in their language [9].

In addition to language, which influences the accommodation capacity of structures operating in the tourism sector, it is necessary to distinguish tourists by age group. Fig. 5 (a) and **(b)** show the series of arrivals of classic and new tourists by different age groups, revealing a different concentration during the months of highest tourist inflow in Sorrento (April–October). In general, we observe that the highest peak for both classic and new tourists is recorded in the 35–44 age group and in March. Both graphs interestingly display a significant and rather

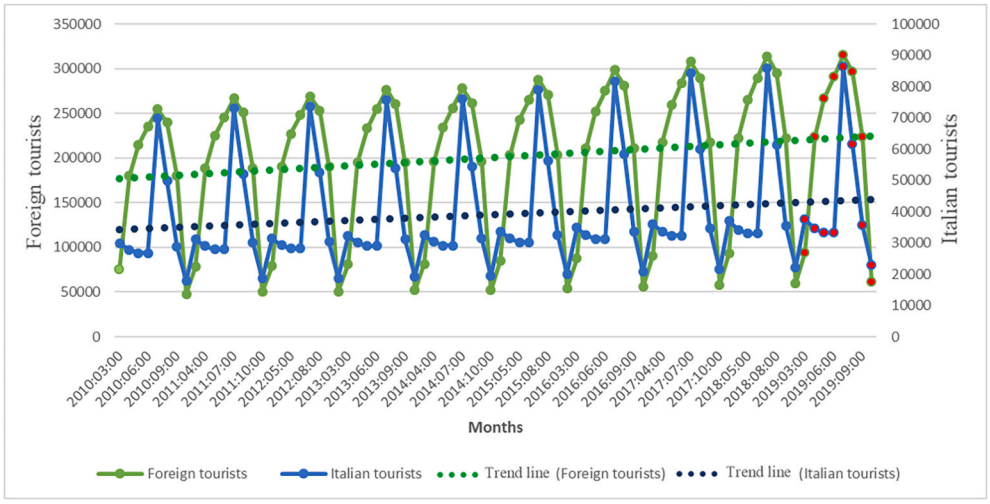


Fig. 3. Number of arrivals of Italian and foreign tourists in Sorrento, 2013–2019.
Source: Our elaboration on data from Ref. [11] and http://www.ilmegliodisorrento.com/banco-di-napoli-e-turismo-sorrentino/ (last accessed April 27, 2020).
Note: We consider the arrivals (the number of tourists who have a place as their destination) and not the presences (the number of arrivals multiplied by the number of stays). The red dots represent the forecasts.

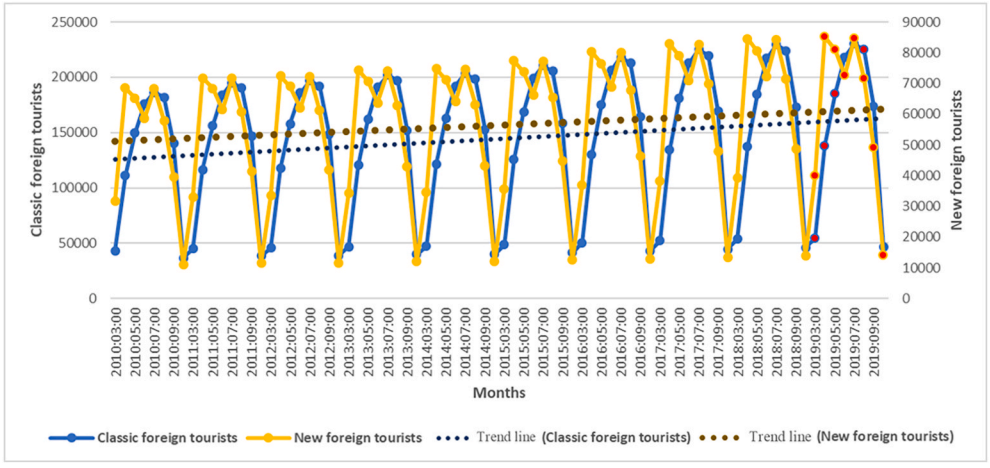


Fig. 4. Number of arrivals of classic and new foreign tourists to Sorrento, 2013–2019.
Source: Our elaboration on data from Ref. [11] and http://www.ilmegliodisorrento.com/banco-di-napoli-e-turismo-sorrentino/ (last accessed April 27, 2020).
Note: We consider the arrivals (the number of tourists who have a place as their destination) and not the presences (the number of arrivals multiplied by the number of stays). The red dots represent the forecasts.

constant presence of tourists aged 65+ during the different months of the year. In particular, we observe that classic tourists aged 65+ prefer the period between April and June and the month of September, whereas new tourists aged 65+ prefer the period from April to May, the least warm months of the year. The low preference of older tourists for the hottest months (July and August) depends mostly on negative effect of excessive heat on the health of elderly people, resulting in a preference on the part of these tourists not to travel or at least not to stay in very hot places. Furthermore, it is useful to remember that the probability of developing a disability is higher among older people (51.5% of people aged 75+ versus 5% of people in the 11–34 age group) [1]. This makes it necessary to provide ancillary services needed by older people facing potential health problems and disabilities. In addition, the local hospital needs to meet the needs of tourists who – in addition to age-related difficulties – face greater communication problems, especially elderly tourists who speak neither English nor French (i.e. new tourists; for more details, see Refs. [13,14,20] [4]). In Sorrento, older tourists represent a very significant segment of tourism with a constantly growing potential demand (see Refs. [6,41]. This target group offers high market potential that could guarantee significant economic advantages for tourism operators and strengthen the role of the tourism sector as a significant source of job creation and income inflow from abroad (see Ref. [1].

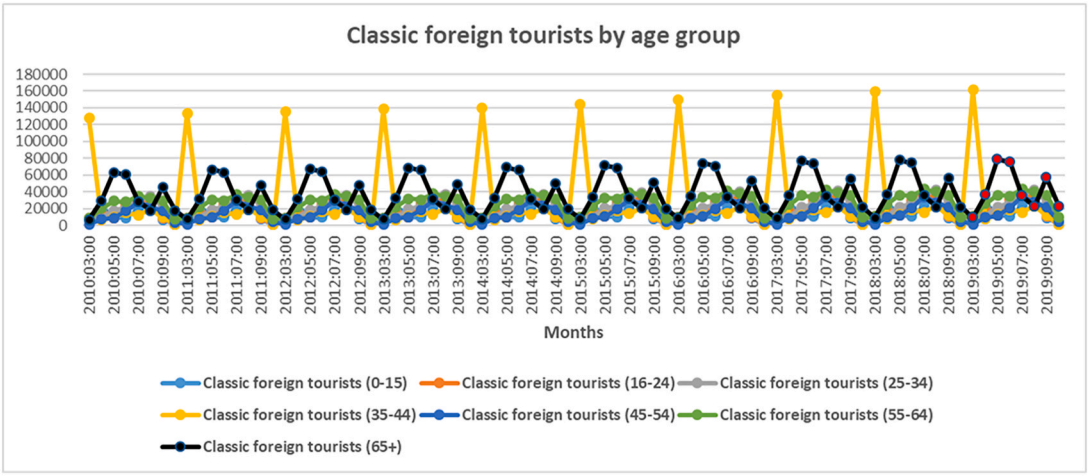
3. Empirical strategy

In the present section, we provide an overview of our empirical strategy and a description of the data used to perform the analysis. Sub-section 4.1 deals with the theoretical presentation of survival analysis, the KM method, and the Cox proportional hazards model. Sub-section 4.2 provides a description of the dataset.

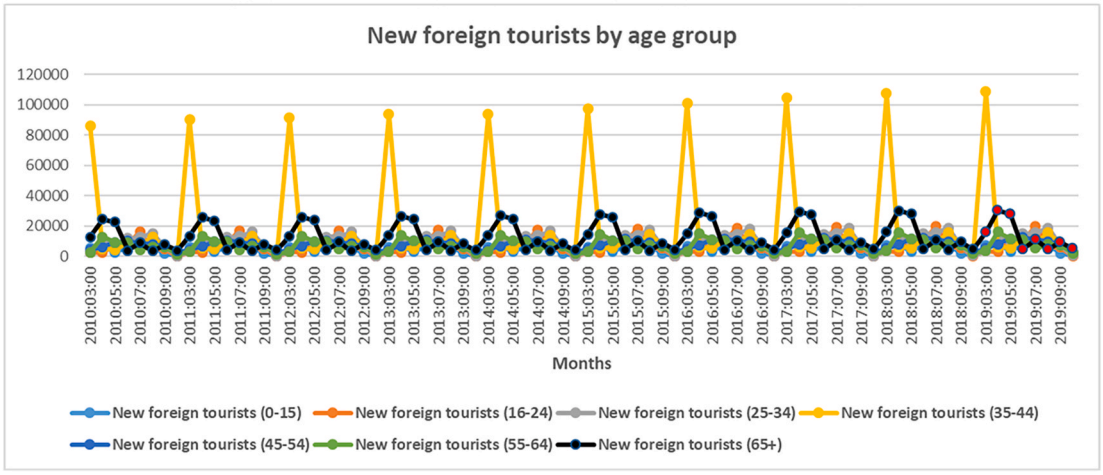
4. Method

This paper aims to analyse the impact of increased demand caused by tourism on ED performance in the Sorrento hospital. Since the ED has been divided into two wards (separating residents and tourists), we aim to test whether this organisation can lead to significant improvements in ED performance. For this purpose, we resort to a two-step strategy. First, through the KM method, we compare EDTS between tourists and residents. Second, we use the Cox proportional hazards model to analyse the effects of group characteristics (e.g., age, gender and language spoken) on EDTS. Both models are associated with survival analysis [34] methods. These methods are a family of statistical procedures widely used in epidemiological studies and in clinical trials (see, for example, [2,23,31]. To the best of our knowledge, this work represents one of the first attempts to use survival analysis to evaluate EDTS and its impact on

[4] As early as 1995, Dawes and D'Elia found a problem of the Neapolitan health system having a bad reputation, which discouraged the arrival of tourists, especially those who were not yet 'loyal' (i.e., new tourists).



(a)



(b)

Fig. 5. Numbers of arrivals of classic and new foreign tourists to Sorrento, 2013–2019.
Source: Our elaboration on data from Ref. [11] and http://www.ilmegliodisorrento.com/banco-di-napoli-e-turismo-sorrentino/ (last accessed April 27, 2020). Note: We consider the arrivals (the number of tourists who have a place as their destination) and not the presences (the number of arrivals multiplied by the number of stays). The red dots are the forecasts.

the quality of healthcare services for residents and tourists.

The main characteristic of survival analysis is the study of 'time-to-event' data, i.e., data featuring durations that end when a certain event occurs. In the clinical field, an event can be a death, disease incidence, relapse from remission, or any designated experience of interest. By broadening the perspective, we can refer to the time variable as survival time and to the event as a failure. In other words, it is possible to generalise and to consider any kind of outcome characterised by an end point as an event. This generalisation allows the extension of survival analysis beyond the classic fields of application. In the specific case of this work, the time event is represented by EDTS, and a failure occurs when EDTS is higher than the daily average.

The first step of the analysis is based on the KM method, which is one of the popular procedures used in the field of survival analysis [31]. The KM method first estimates the survival probabilities at any time t of the whole period under evaluation and then estimates the survival curve by computing the survival fraction at each time point. From a methodological point of view, the KM estimation procedure of the survival function is as follows [33]:

$$\widehat{S}_{KM}(t) = \prod_{t_i<T} \frac{n_i - d_i}{n_i},\ t_1 \le t_2 \le \ldots \le t_n \tag{1}$$

where n_i is the number of units that survive until time t_i and d_i is the number of failures (i.e., units that did not survive until time t_i). In other words, for each time interval, the survival probability is calculated as the number of subjects surviving over the number of units at risk. The estimation of total survival probability at time t is calculated by multiplying all the survival probabilities at time $t_i < t$ [34]. For example, let us assume that a sample of units receives a treatment. The probability that a unit will survive for two days after the treatment is the result of the product between the probability of surviving up to the first day and the probability of surviving up to the second day, given that the patient survived up to the first day (i.e., the conditional probability). In this work, the outcome variable is the treatment speed in the ED of Sorrento's hospital. Thus, the n_i units are the patients with an EDTS less than the daily average, while the d_i units are those with an EDTS higher than the daily average. Since the KM method allows us to compare the survival probabilities between two or more groups, whether these

probabilities are significantly different must be controlled. In the KM analysis, the comparison between two survival probabilities is made by the log-rank test [26]. In this test, the expected number of events in each group is compared to those observed. The log-rank test follows a chi-square distribution under the null hypothesis that no significant difference exists between the groups. In sum, the KM method and the log-rank test allow us to estimate survival probabilities and to compare survival rates between groups.

The second step of the analysis is based on the Cox proportional hazards model [17,18]. While the KM and log-rank test allow us to analyse whether there is a cross-group difference in survival probabilities, they do not allow us to study the potential effects of group characteristics on these probabilities. Through the Cox model, we verify whether – and at what magnitude – group characteristics influence the survival probabilities, similar to classic regression models. The model is expressed as follows:

$$h(t|x_i(t)) = h_0(t)e^{x_i'(t)\beta} \quad (2)$$

where $h(t|x_i(t))$ is the hazard function conditional on unit-specific characteristics (e.g., being locals or tourists). $h_0(t)$ is the baseline hazard function, which shapes the group-specific hazard function, keeping the covariates null. The systematic part of the hazard is $e^{x_i'(t)\beta}$, which represents the effects (β) of the covariates (X) on the hazard function. Note that the model clearly separates the effect of time from the effect of the covariates, meaning that the estimated impact of the covariates is the same for all times t [46]. Thus, the hazard ratio $HR = e^{\widehat{\beta_j}}$ measures the changes in hazard function due to a unitary change in the *j-th* covariate. Since the reference value is 1, if $HR < 1$, the hazard decreases by $(1 - HR)$%. In contrast, when $HR > 1$, the hazard increases by $(HR - 1)$% [46].

4.1. Data

The database of the Santa Maria La Misericordia hospital of Sorrento was used to collect data on access to the ED between March and October 2018, the months of greater tourism numbers. As a result, the analysis includes a total of 21,095 ED visits over 243 days (i.e., 35 weeks). The ED is always open, i.e., 24 h a day, 365 days a year. Patients may arrive by ambulance or on their own. After an initial diagnosis, the triage process begins, and patients may be admitted or discharged. EDs face a high demand for services, which increases their cost. Moreover, they generally operate with limited human resources and budgets [44]. The outcome variable of the analysis is EDTS, defined as the time span from admission (patient registration) to discharge. In other words, EDTS is the time span between the start and the end of hospital treatment. Since the empirical analysis requires identifying the failure event at any given time *t*, we compare the EDTS with the corresponding daily average. Thus, if the EDTS is higher than the daily average, then the outcome variable is equal to one (failure). Otherwise, it is equal to zero.

A set of covariates, i.e., age, gender, triage code and language popularity, is used in the empirical analysis. The *age* and *gender* variables allowed us to control for the demographic characteristics of the patients. Regarding *age*, we identified seven age groups: 0–15, 16–24, 25–34, 35–44, 45–54, 55–64, and 65 and more. The *gender* variable is a dummy variable that is equal to one if the patient is female and otherwise is zero. The demographic characteristics are the classic control variable used in epidemiological studies as well as in the ED service evaluation field (see, for example, [5,15,16,38,51].

The *triage code* variable defines the urgency level of the patient's health condition according to criteria set by the Ministry of Health through a ministerial decree issued on May 15, 1992. Four categories of urgency are defined, each of which is identified by a colour: *i)* white – non-urgent condition; *ii)* green – not very critical condition, minor urgency; *iii)* yellow – moderately critical, urgent with no immediately life-threatening condition; *iv)* red – very critical, top priority, failure of vital signs, life-threatening condition, immediate access to treatment. In other words, the triage codes determine the acuity of patient conditions, assigning them a priority level that ensures that patients in need are treated almost immediately, compared to patients with less severe injuries (e.g., white or green codes). Notably, patient conditions may vary (i.e., they can improve or worsen), and a periodic reassessment of codes is part of the triage process. This characteristic might influence EDTS, especially if the waiting time for the first medical examination is too long. The longer the waiting time, the higher the probability of misdiagnoses or condition changes. The epidemiological relevance of triage codes and their impact on EDTS has been validated by previous studies (e.g., Refs. [24,39,43].

The *language popularity* variable acts as a double control. First, it captures patient origin, differentiating between locals (i.e., people resident in Sorrento and neighbouring municipalities), Italian tourists, and foreigners. Regarding foreign tourists, we further distinguish between 'classic' tourists and 'new' tourists. Following the definition provided in Section 3, classic tourists are those who have historically chosen Sorrento as a tourist destination, mainly English, French, Spanish, and German nationals. 'New' tourists are foreigners from countries where Sorrento has more recently become popular. These tourists are mostly from Portugal, Norway, Finland, Denmark, Russia, Romania, Israel, and South Africa. Second, in line with geographical provenance, this variable also controls for language barriers. Apart from Italian native speakers, we have two categories of languages: 'widely known' (WK) and 'poorly known' (PK). The WK class includes English, French, Spanish, and German. Following [30]; in Italy in 2015, over 34 million people knew at least one foreign language in the WK class, accounting for over 90% of the population. PK languages, in contrast, are seldom known in Italy [32]. demonstrated the impact of language barriers and the lack of skilful interpreters in health services. They pointed out the negative impact of these factors on the healthcare system because of the under-utilisation of interpreter services and the interpreters' lack of qualifications.

Tourist presences may impact EDTS due to increased demand for healthcare services and to potential language barriers. Fig. 6 shows the number of ED visits by language during the whole period of analysis. Regarding Italian tourists, the results are in line with the presence peaks highlighted in Fig. 3 (see Section 3). The high level of seasonality for Italian tourists impacts the hospital workload. A substantial peak takes place during the month of August and in early September (i.e., weeks 32–36 of the year) due to greater tourist affluence. Foreign tourists show more constant access to the ED during this period. This is an expected result because of the tourist flows highlighted in Fig. 3. In particular, PK language tourists (also classified as 'new foreign tourists') show a certain regularity in the usage of ED services. However, slightly higher access to the ED in the period April–July/early August emerges, in line with the number of arrivals in Sorrento. Notably, WK language tourists ('classic foreign tourists') display some peaks in ED access, distributed throughout the period analysed, despite their arrivals being almost constant between April and July.

Table 1 shows the main descriptive statistics for the whole period of analysis and by sub-period. The sub-periods are chosen following the directives of the Campania region[5] on tourist seasons. The region defines the following seasons: *i)* first mid-season, March-mid-June; *ii)* high season, mid-June-mid-September; and *iii)* second mid-season, mid-September-October.

[5] Information on the tourist observatory of the Campania region may be found at the following address: http://www.regione.campania.it/regione/it/tematiche/magazine-turismo-e-cultura.

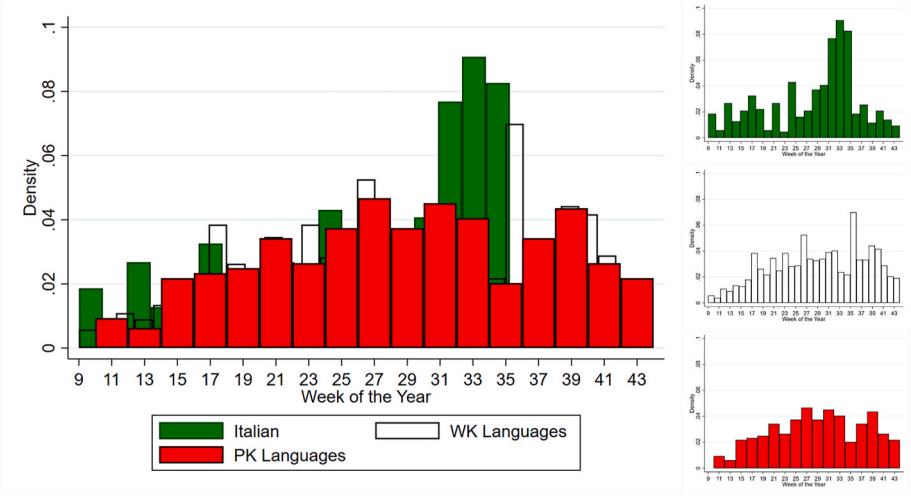


Fig. 6. Number of accesses to Sorrento's ED by language popularity, March–October 2018.

Table 1
Descriptive statistic by sub-periods.

Variables	01 March – 30 October					01 March-20 May			21 May-05 August			06 August-30 October		
	Obs.	Min	Max	Mean	St. Dev.	Obs.	Mean	St. Dev.	Obs.	Mean	St. Dev.	Obs.	Mean	St. Dev.
Age														
0–15	21,095	0	1	0.123	0.329	9253	0.128	0.335	8791	0.123	0.328	3051	0.113	0.316
16–24	21,095	0	1	0.111	0.314	9253	0.109	0.312	8791	0.115	0.319	3051	0.103	0.305
25–34	21,095	0	1	0.143	0.351	9253	0.141	0.348	8791	0.148	0.355	3051	0.134	0.341
35–44	21,095	0	1	0.121	0.325	9253	0.118	0.323	8791	0.124	0.331	3051	0.111	0.313
45–54	21,095	0	1	0.137	0.344	9253	0.133	0.339	8791	0.143	0.351	3051	0.131	0.337
55–64	21,095	0	1	0.121	0.326	9253	0.121	0.327	8791	0.121	0.331	3051	0.128	0.334
65+	21,095	0	1	**0.242**	0.428	9253	**0.247**	0.431	8791	**0.224**	0.417	3051	**0.277**	0.448
Gender														
Male	21,095	0	1	**0.504**	0.499	9253	**0.501**	0.501	8791	0.498	0.5	3051	0.475	0.499
Female	21,095	0	1	0.496	0.499	9253	0.499	0.501	8791	**0.502**	0.5	3051	**0.525**	0.499
Triage code														
White	21,095	0	1	0.032	0.176	9253	0.018	0.134	8791	0.043	0.203	3051	0.047	0.212
Green	21,095	0	1	**0.681**	0.466	9253	**0.677**	0.467	8791	**0.689**	0.462	3051	**0.662**	0.472
Yellow	21,095	0	1	0.281	0.449	9253	0.296	0.456	8791	0.261	0.439	3051	0.281	0.449
Red	21,095	0	1	0.006	0.079	9253	0.007	0.081	8791	0.005	0.072	3051	0.008	0.093
Language popularity														
Residents	21,095	0	1	**0.891**	0.311	9253	**0.905**	0.292	8791	**0.868**	0.337	3051	**0.891**	0.312
Italian tourists	21,095	0	1	0.027	0.164	9253	0.021	0.143	8791	0.041	0.196	3051	0.015	0.124
WK languages	21,095	0	1	0.065	0.247	9253	0.059	0.236	8791	0.073	0.261	3051	0.078	0.269
PK languages	21,095	0	1	0.015	0.122	9253	0.014	0.117	8791	0.017	0.133	3051	0.015	0.121

5. Empirical findings and discussion

This section covers the results of the multi-step analysis, first presenting the survival curves estimated through the KM method and then discussing the results obtained using the Cox proportional hazards model. The KM method allows us to compare the survival probability between groups by examining the curves. Fig. 7(a) plots the KM curves for residents and for all tourists (thus including Italian, classic/WK class, and new/PK class tourists), while Fig. 7(b) distinguishes tourists by origin and language. The *x*-axis displays the weeks of the year, while the *y*-axis shows the survival probability. In the context of this analysis, the survival probability represents the probability of having an EDTS higher than the daily average. In other words, the higher the curve, the faster the ED service. Since the ED of Sorrento has been divided into two tracks, one for residents and the other for tourists, the comparison in Fig. 7(a) provides an evaluation of the ED organisation. What emerges is faster treatment for tourists. The survival curve of tourists (red line) is higher than that of residents (blue line) for almost the whole period, which means that tourists have a higher probability of receiving rapid health services than residents. The only exception is the month of October, when the curves first cross and that of residents then dominates. The log-rank test strongly confirms the significant difference between the probabilities (the null hypothesis is rejected, since the *p-value* = 0.0001). The previous comparison is further examined in Fig. 7(b), where we analyse the KM curves for residents, other Italians, classic/WK language foreigners, and new/PK language tourists. The empirical results highlight a mixed scenario, with curves that intersect along the time intervals. Residents (blue line) experienced the worst ED treatment until early August (i.e., week 32). Afterwards, their curve dominates that of new/PK tourists (yellow line). This seems to suggest that in the peak period of tourist arrivals (in particular of Italian tourists; see Figs. 3 and 6), the difficulties in language understanding counter the advantage of the separate lanes. Italian tourists (red line) face the highest survival probability until their ED affluence peaks (see Fig. 6), highlighting how the heavy tourist workload stresses resident healthcare services. Finally, starting in early August, the classic/WK tourists (red line) face the highest probability of experiencing a fast EDTS. The significant difference between the curves is confirmed by the log-rank test (the null hypothesis is rejected, *p-value* = 0.0003).

Fig. 7(c) highlights the survival curves by triage code.

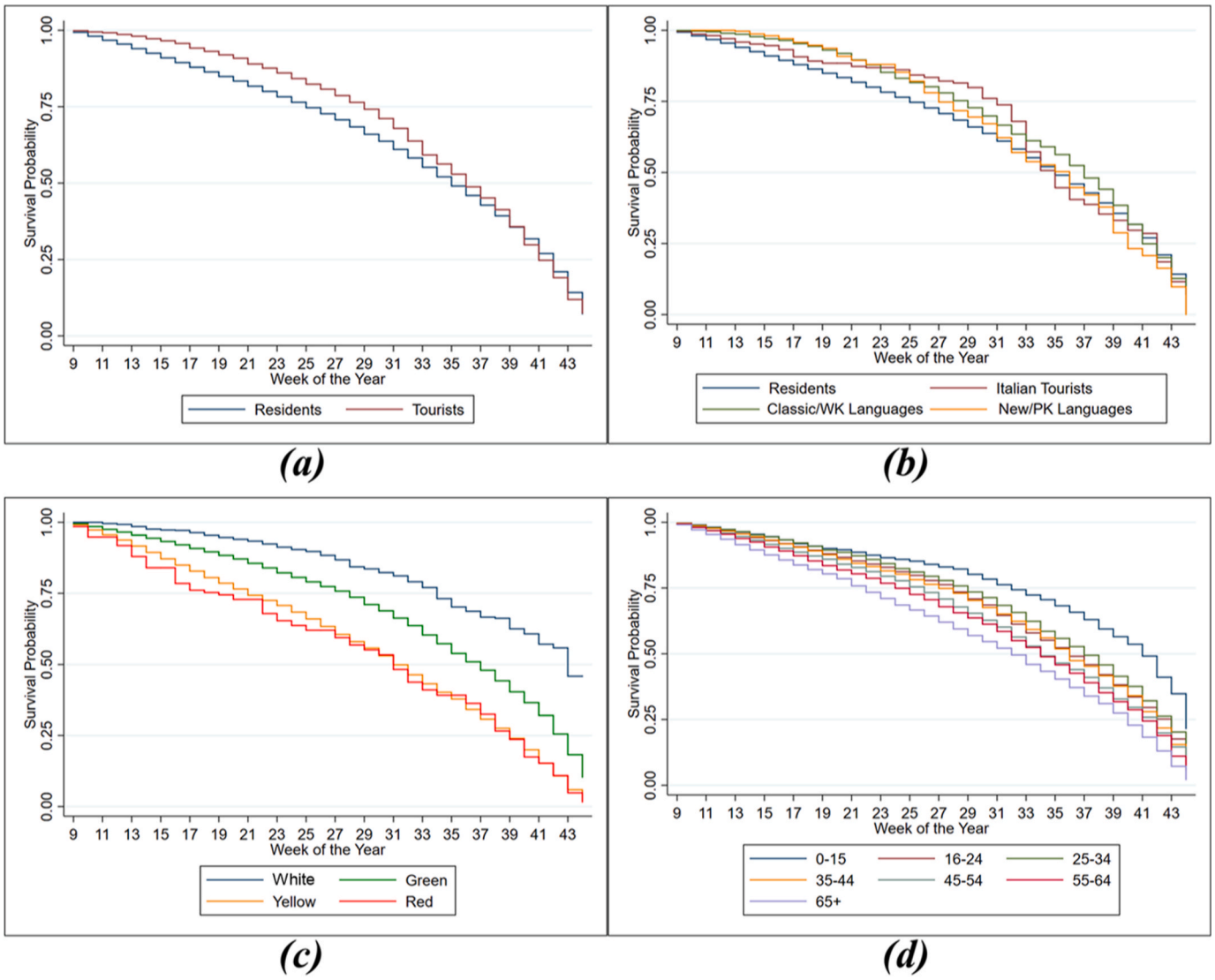


Fig. 7. Kaplan-Meier survival curves, residents *vs* tourists (a), by tourist group (b), by triage code (c), and by age group (d).

Unsurprisingly, the results of the comparison are in line with those expected. The lower the health condition severity, the higher the probability of a fast ED discharge. The significant difference in probabilities is confirmed by the log-rank test (*p-value* = 0.0000). Remarkably, the difference between yellow and red codes is not always clear. In particular, in the summer season (from early July onwards), the curves intersect, highlighting the absence of triage code-related advantages in treatment speed. To test the lack of difference between yellow and red codes, we run the log-rank test with a focus on only these two curves. The results show no significant difference over the whole period of analysis (*p-value* = 0.6162). Finally, Fig. 7(d) shows the age-based comparison. The probability of receiving fast treatment decreases as the patient's age increases. The graph shows that the 0–15 age group faces the highest survival curve, while the 65+ age group features the lowest curve. The comparisons of the survival curves for different age groups were performed using the log-rank test. The *p-value* of the overall comparison is 0.0000 (under the null hypothesis, no difference exists in the population survival curves distinguished by age group), implying that there are differences in survival curves across the age groups. In other words, the probability of an event occurring at any point is different for each sub-sample. The significant difference is also confirmed by comparing two sub-samples. For example, the log-rank test highlights a difference in the survival probability between people aged 55–64 and those aged 65+. Finally, in Figure A1 (see Appendix), we compare the survival probability between residents and tourists by age group. As a first result of interest, the probabilities are not significant for those aged 44 and younger (p-values for these age groups range from 0.213 to 0.547). In other words, between the younger people, there are no differences in ED treatment. According to the log-rank test, the situation is different for the 45–54, 55–64, and 65 and more age groups. For all those groups, the tourists' survival curves are above those of residents for almost the whole period, highlighting that the advantage of tourists in EDTS is attributable to the presence of older people. This confirms reports in the literature that residents, during the tourist season, witness a deterioration in the quality of life in general and specifically in health services.

The model that describes the potential association between covariates and survival probability (i.e., EDTS faster than the daily average) is analysed using the Cox proportional hazards model. In the Cox model, the dependent variable is the 'hazard', which represents the probability of experiencing an event identified as treatment failure, meaning 'slow EDTS' in our context. This model allows us to determine the difference in EDTS considering the explanatory variables. The empirical results are shown in Table 2, where we report the association for the whole period of analysis (March–October) and then by sub-period, i.e., *i)* March-mid-June; *ii)* mid-June-mid-September; *iii)* mid-September-October. As

Table 2
Cox proportional hazards model results by time period.

	01 March-30 October	March-Mid-June	Mid-June-Mid-September	Mid-September-October
	Hazard Ratio	Hazard Ratio	Hazard Ratio	Hazard Ratio
Age (ref. 0–15)				
16–24	1.631***	1.371***	1.721***	1.587***
	(0.083)	(0.109)	(0.130)	(0.214)
25–34	1.424***	1.243***	1.485***	1.518***
	(0.071)	(0.096)	(0.111)	(0.198)
35–44	1.632***	1.409***	1.613***	1.762***
	(0.082)	(0.109)	(0.122)	(0.230)
45–54	1.843***	1.617***	1.913***	1.637***
	(0.089)	(0.121)	(0.138)	(0.211)
55–64	1.975***	1.739***	1.915***	1.735***
	(0.096)	(0.129)	(0.141)	(0.222)
65+	2.16***	2.016***	2.111***	2.112***
	(0.096)	(0.135)	(0.142)	(0.243)
Gender (ref. Male)				
Female	0.944***	0.932**	0.966 (0.029)	1.032 (0.053)
	(0.019)	(0.029)		
Triage code (ref. White)				
Green	2.087***	0.987	1.958***	3.256***
	(0.162)	(0.128)	(0.201)	(0.741)
Yellow	3.129***	1.541***	2.853***	4.924***
	(0.244)	(0.201)	(0.295)	(1.129)
Red	3.164***	1.889***	2.711***	4.661***
	(0.404)	(0.383)	(0.513)	(1.456)
Language popularity (ref. Residents)				
Italian tourists	0.886*	0.886	1.084 (0.091)	0.924 (0.162)
	(0.057)	(0.103)		
WK languages	0.849***	0.718***	1.066 (0.064)	1.546***
	(0.036)	(0.051)		(0.161)
PK languages	0.988	0.755**	1.331***	1.798***
	(0.081)	(0.107)	(0.146)	(0.353)

*Significant at 10%, **Significant at 5%, ***Significant at 1%; Standard errors in brackets.

stated in Section 4.2, the choices of sub-periods follow the directives of the Campania region on tourist seasons. The estimated coefficients are hazard ratio (HR), whose interpretation is the following: values below one indicate a positive relation between the covariate and EDTS, while the relation is negative for values higher than one. In the former case, the covariate improves the probability of experiencing fast EDTS, while in the latter case, it leads to slower ED treatment.

Regarding the whole period of analysis (first column of Table 2), the empirical findings confirm the expected relationships between EDTS and demographic characteristics. The age variable yields a substantial difference in ED treatment, which increases with higher age groups. Indeed, since patients aged 0–15 are the reference category, the value higher than 1 associated with all other groups highlights that patients experience greater difficulties with medical treatment as age increases. The magnitude of the HRs increases from 1.631 for people aged 16–24 to 2.165 for those aged 65 or more. In other words, the oldest age groups face a probability of EDTS more than twice as long as that faced by the youngest age group. This finding is in line with the medical literature, which points to the difficulties in treating older people, highlighting the need for changes in planning and financing medical care to properly treat the elderly [16,38]. In the Sorrento context, this issue is very relevant since people aged 65 or older are among the most frequent tourists, and this age group also represents one of the most significantly increasing arrival trends (see Fig. 5). The gender-based results are also in line with the medical literature, highlighting a slight advantage for females in experiencing faster EDTS than males (Zettersten et sl., 2020). As outlined in medical studies [24,42,48], the impact of the triage code on EDTS is very significant, since its magnitude increases as the priority level for medical intervention grows. While the KM analysis has already highlighted the great differences in treatment with respect to patient emergency condition, the Cox regression allows us to quantify the probability gaps among codes. Compared to patients with a white code, those receiving a green code are twice as likely to face higher EDTS, while for more severe health conditions (i.e., yellow or green), the probability gaps increase by up to three times as much. Finally, the language popularity variable allows us to examine cross-cultural communication in the healthcare setting and its implications for equal access to health services. Based on the regression results, tourists experience faster ED treatment than residents. In particular, Italian-speaking tourists and classic/WK language-speaking patients have significant advantages, while no difference emerges for new/PK tourists. This is an interesting result because the tourists are differentiated only in terms of ease of communication with the medical staff, with all other characteristics remaining constant. Two considerations arise. On the one hand, the Sorrento ED can properly manage flows of 'classic' tourists, i.e., those from countries that have historically selected Sorrento as a primary tourist destination. It seems that the ED has developed appropriate language competences – facilitated by the widespread knowledge of languages such as English or French – either on the part of the medical staff or by using interpreter services. On the other hand, the need for Sorrento's healthcare system to adopt measures to cope with the new geographical heterogeneity of its tourists emerges. Language barriers are indeed the primary challenge that arises when addressing healthcare needs in an increasingly multi-cultural context [32].

Tourism is highly affected by seasonality. As outlined in the previous sections, this seasonality also characterises tourist flows by nationality. For example, Italian tourists tend to visit Sorrento in the summer months, while foreigners display a more constant presence over time, with some peaks in spring/early summer (new/PK language visitors) and summer (classic/WK language visitors). Seasonality also impacts the ED workload, as shown in Fig. 6. To cope with this aspect, we carry out a set of Cox estimates by sub-period according to tourist seasonality. Thus, we define the first mid-season (March-mid-June), high season (mid-June-mid-September), and second mid-season (mid-September-October). The coefficient estimates for age, gender, and triage code remain quite similar between the whole time span and the sub-periods. Regarding the language popularity variable, interesting differences emerge. In the first mid-season (second column of Table 2), no significant difference between residents and Italian tourists is detected. The advantage for foreigners in EDTS is confirmed. This is a period when most tourist flows in Sorrento originate from abroad (see Fig. 3), and the results seem to suggest the better organisation of the ED in coping with the medical needs of foreign tourists. Of course, the limited role of domestic tourism significantly helps the hospital to provide fast treatment – due to the lower number of hospital visits – but it also seems that institutions seek to ensure a sufficient level of communication with patients through proper interpreter services. This is confirmed by similar HRs for WK and PK tourists. While for the former, the good results may depend on the individual healthcare practitioner's own initiative and knowledge, for the latter, the linguistic skills required are less widespread and probably rely on the work and qualifications of interpreters. The scenario changes in the high season (third column in Table 2). On the one hand, there are no significant differences between residents and Italian/WK tourists; on the other hand, PK tourists experience a worsening of healthcare services. This is the season when arrivals peak, and Sorrento's ED shows difficulties in meeting the medical needs of the new group of tourists. In the second mid-season (third column of Table 2), the estimates show worse treatment for foreign tourists. Moreover, in this period, PK tourists experience the worst EDTS, but WK tourists for the first time are treated more slowly than residents. Considering the three sub-periods, a trajectory seems to emerge: in the first stretch, foreign tourists are best served; in the central period, the healthcare system

experiences difficulties, probably due to the peak in arrivals/medical needs, especially for those facing higher language barriers; and in the last period, foreign patients are treated more slowly than Italians (both residents and tourists). It could be that when the tourist season fades, healthcare providers and institutions are less engaged in ensuring proper healthcare for visitors.

6. Concluding remarks

As [45] suggested, "the destination communities face something of a development dilemma because they are, in a sense, required to engage in a trade-off between the benefits they perceive to receive from tourism and the negative social and environmental consequences of its development."

All this is amplified in the case studied for the orographic characteristics of Sorrento's location, as it is a small town that has developed on a narrow cliff between the sea and the mountains.

The paper confirms what is reported in the literature: during the tourist season, residents witness a deterioration in their general quality of life, and specifically in health services. However, the paper identifies other interesting results: the 'old tourists' who speak the best-known languages have a greater survival probability, not only compared to the residents but also compared to the 'new tourists' who speak PK languages. Barriers emerge in the usability of health services by the so-called new tourists: language barriers, communication barriers, and interpretative barriers. In this regard, the old debate arises on the role of linguistic mediators, who are called not to a purely linguistic function but to a more complex one that combines communicative, psychological, sociological, and anthropological attitudes. The linguistic mediators end up representing "hinge" figures that are also intended to facilitate the therapeutic relationship [19].

Another interesting result is the reduction of the probability of the elderly receiving fast treatment. This target group offers a high market potential that is still little known, which could guarantee significant economic advantages for tourism operators and strengthen the role of the tourism sector as a significant source of job creation and income from abroad. It is therefore useful to highlight these economic advantages, which should induce tourism operators to orient themselves towards this type of product. In particular: 1) these advantages arise from the reduction of seasonality (seasonal adjustment of demand), which is one of the problems of tourism in Italy [1]. In fact, elderly tourists with potential disability problems tend to intentionally travel during the low seasons (to avoid the inconvenience of crowding in the high seasons). 2) Further advantages exist in the possibility of diversifying the offerings of tourism operators [50]. 3) Another advantage is obtaining revenue higher than that of conventional tourism, as tourism linked to older people is configured as "multi-client". For each elderly person travelling, an average of 1.5 or 2 people travelling with them is estimated [27,50]. Often, in fact, older people need a carer to accompany them, which makes the potential niche of tourism even wider. Future research developments are aimed at studying the satisfaction levels of tourists who benefited from the emergency room to evaluate how their experience can influence the impact of tourism destination image and reputation on visitor loyalty likelihood.

7. CRediT author statement

All authors have contributed equally to the research development and writing process.

Appendix

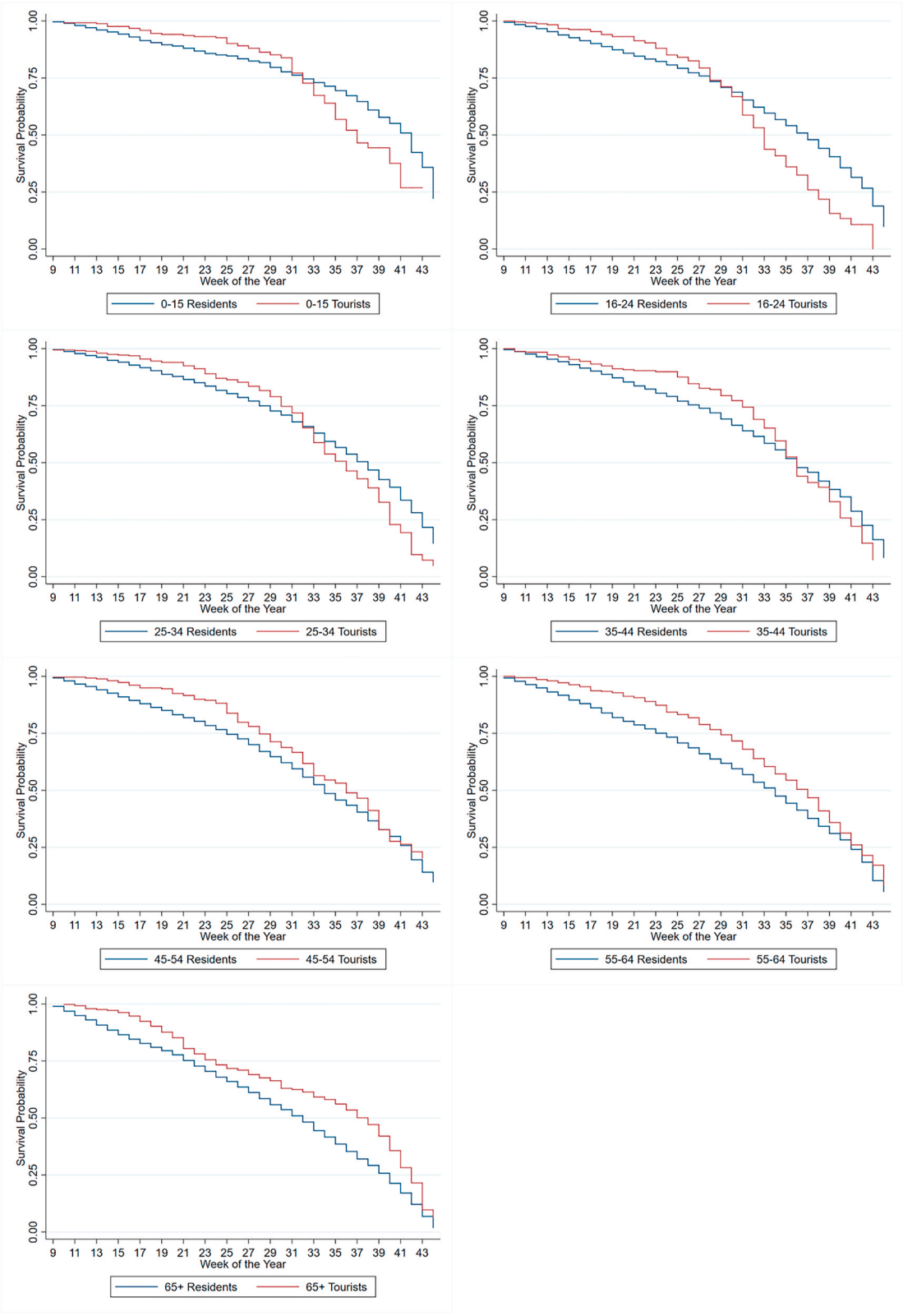


Fig. A1. Kaplan-Meier survival curves, residents *vs* tourists by age group.

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