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No-shows in appointment scheduling – a systematic literature review

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ABSTRACT

No-show appointments significantly impact the functioning of healthcare institutions, and much research has been performed to uncover and analyze the factors that influence no-show behavior. In spite of the growing body of literature on this issue, no synthesis of the state-of-the-art is presently available and no systematic literature review (SLR) exists that encompasses all medical specialties. This paper provides a SLR of no-shows in appointment scheduling in which the characteristics of existing studies are analyzed, results regarding which factors have a higher impact on missed appointment rates are synthetized, and comparisons with previous findings are performed. A total of 727 articles and review papers were retrieved from the Scopus database (which includes MEDLINE), 105 of which were selected for identification and analysis. The results indicate that the average no-show rate is of the order of 23%, being highest in the African continent (43.0%) and lowest in Oceania (13.2%). Our analysis also identified patient characteristics that were more frequently associated with no-show behavior: adults of younger age; lower socioeconomic status; place of residence is distant from the clinic; no private insurance. Furthermore, the most commonly reported significant determinants of no-show were high lead time and prior no-show history.

1. Introduction

No-show appointments (also commonly referred to as broken or missed appointments) are a burden to essentially all healthcare systems, significantly impacting revenue, cost and use of resources [1,2]. It is a well-known fact that no-show decreases the provider's productivity and efficiency, increases healthcare costs, and limits the health clinic's effective capacity [3,4]. Negative effects are also felt by patients who keep their appointments, such as dissatisfaction with high waiting time and perception of overall decrease in service quality [2,5,6]. In addition to creating financial costs for providers, non-attendance generates social costs related with unused staff time, ineffective use of equipment and possible misuse of patients' time [6].

There is a general consensus in literature regarding the fact that no-show does not occur arbitrarily and several studies have identified the need to statistically analyze the factors that influence its behavior in order to improve healthcare processes and dampen the effects of missed appointments. A number of the most recent of such studies attest to the existence of a relationship between no-show rates and patient behavior [4,7–10]. By evaluating this relationship through univariate and/or multivariate statistical methods, several works have proposed interventions to mitigate the negative effects of missed appointments [2,4], such as: overbooking [11–14], open access [15], appointment reminders [5], best management practices, among others.

There is a markedly growing interest from the healthcare community in uncovering and understanding the issues involved in no-show behavior. However, given the variability in context and specificities of health care delivery and systems, it is unlikely that a general agreement may be reached regarding the variables that statistically influence no-show behavior. Nevertheless, by aggregating studies that report on a range of different medical specialties and continents, and make use of distinct methodologies for data analysis, it is possible to identify the determinants that have been most frequently considered significant and their effect on no-show. Moreover, although a comprehensive synthesis of the state-of-the-art in this field would be of great value to researchers, practitioners, and hospital administrators alike, to the best of our knowledge, no updated systematic literature review (SLR) exists.

This paper addresses the aforementioned shortcomings by providing a SLR of no-show in appointment scheduling. The goals are

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Table 1
Query used for data collection.

	Keywords
(i)	*no-show OR non-attendance OR missed appointment OR failed appointment OR fail* to attend*
(ii)	*appointments*
(iii)	*facto* OR variabl* OR determinan* OR reaso* OR characteristic* OR predic**
(iv)	*(i) AND (ii) AND (iii)*
(v)	*only reviews/articles in English*
(vi)	*(iv) AND (v)*

threefold: for one, we provide an overview of the characteristics of existing studies in terms of their methodology, continent where the study was undertaken, medical specialties involved, dependent variables considered, and values of no-show rates. In addition to that, we report on the most common tendencies across surveyed studies and detect patterns that emerge. Finally, we discuss our findings in light of previous literature reviews [16–18].

Of note, we adopt the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines [19] and organize the remainder of this paper as follows. In Section 2 we detail how data collection and study selection were performed, and report on the methods used for handling such data. Section 3 contains a complete account of the studies screened, assessed for eligibility, and included in this review, with reasons for exclusions at each stage, along with the results of our analysis. Finally, we summarize our main findings and present a general interpretation of the results with implications for future research in Section 4.

2. Methods

This work entails a SLR of existing studies on no-show in appointment scheduling. As such, we rely on qualitative, non-statistical tools for integrating, evaluating and interpreting results currently available in literature [20]. In what follows we describe our search strategy, recount eligibility criteria for study selection, and elaborate on our methodology for analyzing the surveyed studies.

2.1. Data collection

For data collection we used Scopus database [21], which is the largest online database of peer-reviewed literature, including MEDLINE, and performed a keyword-driven search strategy. The keywords were selected so as to yield a unified query for our systematic search, as shown in Table 1. In order to ensure that the results of our search would not be unduly constrained, synonyms for "no-show" were used as keywords (see item (i) in Table 1). Moreover; given that this review focuses on studies dealing with statistical analysis of determinants for no-show; synonyms for "determinants" were also added to the query (see item (iii) in Table 1). Our search spanned publications from 1980 until July of 2016 and comprised the fields "title"; "abstracts"; and "keywords" with no limitations with regards to the field "journals". Finally; it is worthwhile to mention that an advanced search was performed so as to retrieve different spelling occurrences of the keywords (e.g.; "no show" instead of "no-show") in both the singular and plural forms. We note that in the query; the asterisk (*) is used as a substitute for a variable number of characters.

2.2. Study selection

The first step in study selection was formulating eligibility criteria, which we defined in terms of desirable characteristics of the study. The list of criteria comprised the following items: (1) Study does not deal strictly with research in the medical field related to clinical treatment or diseases; (2) Study deals with no-show in the health sector; (3) No-show analysis is one of the study's research goals, and no-show is not merely cited as a problem or outcome; (4) Study does not deal exclusively with methods for intervention that improve no-show, including interventions with appointment reminders; (5) In the study, no-show is treated as a dependent variable, not as an explicative variable; (6) Study's research method is not based solely on descriptive statistics; study does not recount only self-reported or disease-related reasons for no-show; (7) Study does not deal with appointment making systems without analyzing factors that lead to no-show; (8) Study does not perform no-show analysis for other purposes (e.g., lean service, no-show with quality control, etc.). The studies whose abstract did not meet any number of the above criteria were excluded from further analysis.

The second step consisted of reading the studies that both passed the eligibility criteria and were available online, at which time we verified the need to define two additional constraints. The first such constraint (C1) had to do with the fact that some papers described no-show as an interruption in the patient's treatment, instead of as an appointment that had been scheduled and was not attended. The second constraint (C2) related to our assessment of the quality of the research documented in the paper, which we deemed to be poor in cases where statistical results were shown without any mention of the statistical test and/or model used, as well as in cases when a statistical technique was cited, but no results were presented.

As a final step, we manually screened the references of selected papers and were able to identify a small number of relevant studies that had not been previously retrieved, but nonetheless warranted consideration in our analysis.

2.3. Analysis of surveyed studies

The analysis of surveyed studies followed a stepwise approach that included pre-analysis, material exploration, and treatment, inference and interpretation of results [22]. Pre-analysis consisted of skimming the selected papers with the intent of identifying the general idea conveyed by each study. During this step, we identified relevant study components, from which the following units of analysis were selected: characteristics of the patient, appointment, clinic and provider; medical specialty analyzed in the study; continent where the study was performed; year when the study appeared; choice of statistical method and dependent variable; and reported value of no-show rate.

The second step, material exploration, entailed a structured exploration of the documents. Information on the units of analysis was collected and data were organized using a concept matrix. The last step of our analysis consisted of interpreting the results. The determinants of no-show that were more frequently considered significant were identified and their reported effects on no-show rates synthetized. In addition, average no-show rates were computed considering different continents, specialties, and publication dates.

3. Results and discussion

Our search using the Scopus database yielded a total of 727 papers, three of which were duplicates, so that 724 papers were screened for eligibility based on their title and/or abstract. The remaining 230 papers were screened based on their complete text using eligibility criteria as well as the additional constraints defined in Section 2.2. A total of 105 papers and three literature reviews on the subject of interest were retained. Although these review papers

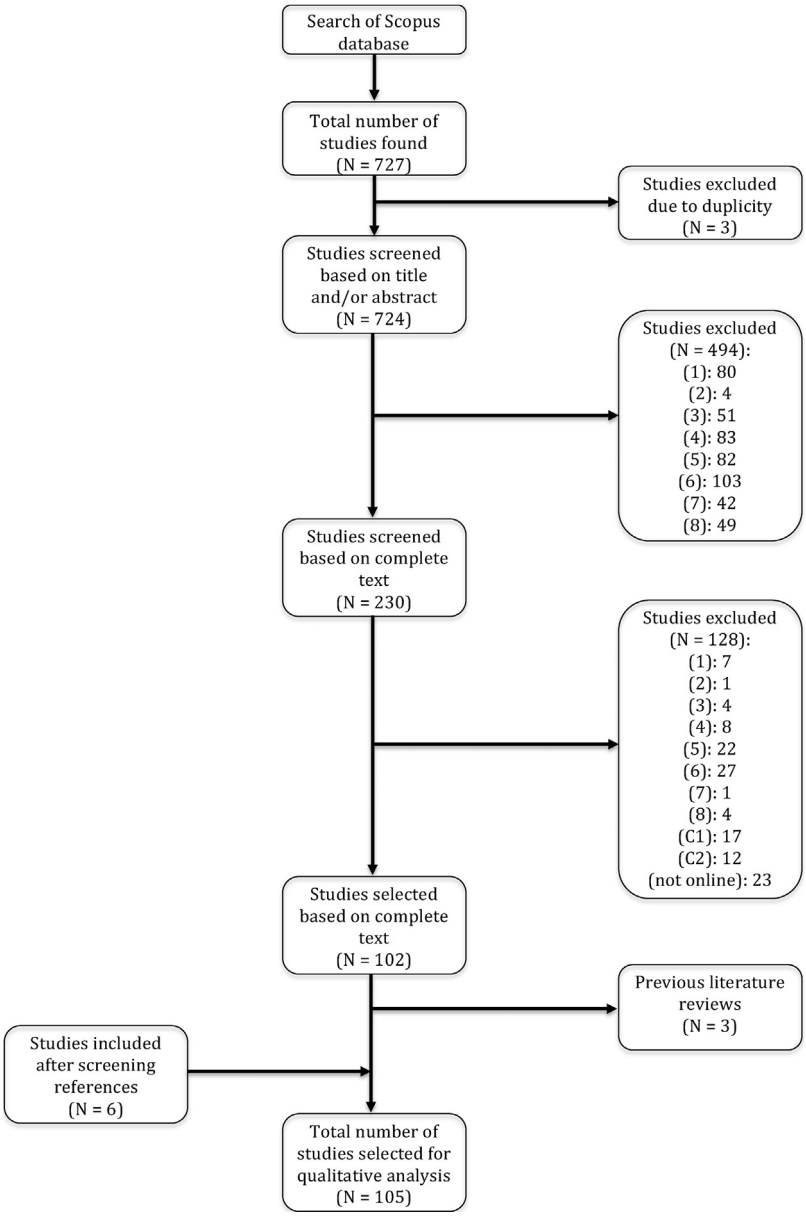

Fig. 1. Stepwise data collection process.

were not SLR, they offer a basis of comparison for our results, and were thus excluded from our analysis. Fig. 1 details the number of studies screened, assessed for eligibility, and included in the review, with reasons for exclusion at each stage.

Once study selection had been performed, the following characteristics were examined: continent where study was performed; medical specialties contemplated; number of cases analyzed; average no-show rate computed; basis for computing no-show rate; methodology for statistical analysis (see Appendix A.1 in Supplementary material for a summary of study characteristics, ordered by increasing publication year). Of note, although the number of cases varies considerably among studies, this variation does not affect the results of our systematic review, given that we do not perform a statistical analysis of effect sizes.

Significant variability was verified with regards to the basis for computing the no-show rate among the studies investigated: while some researchers computed it across all appointments available in record for each patient, others took into consideration only new patient or follow-up appointments. We found the overall average no-show rate across all studies to be 23.0%, with a minimum rate of 4.0% at intravenous therapy clinics and a maximum rate of 79.2% at physiotherapy clinics. These values are in good agreement with previous reports in which the no-show rates were found to vary from 3% to 80%, depending on the patient population and type of clinic [23].

The value of the average no-show rate also varied with regards to the continent where the study was performed, the year the study appeared, and the medical specialty considered in the study. The highest average no-show rate was reported in studies from the African continent (43.0%), followed by those in South America (27.8%), Asia (25.1%), North America (23.5%), Europe (19.3%) and Oceania (13.2%). The median no-show rate, considering all continents and medical specialties, has also decreased over time, as can be seen in Fig. 2, which shows the boxplot of no-show rates by decades.

In Fig. 3, no-show rates for different medical specialties are shown in boxplot. The term “Others” encompasses pulmonary tuberculosis, intravenous therapy, rheumatology, hand surgery,

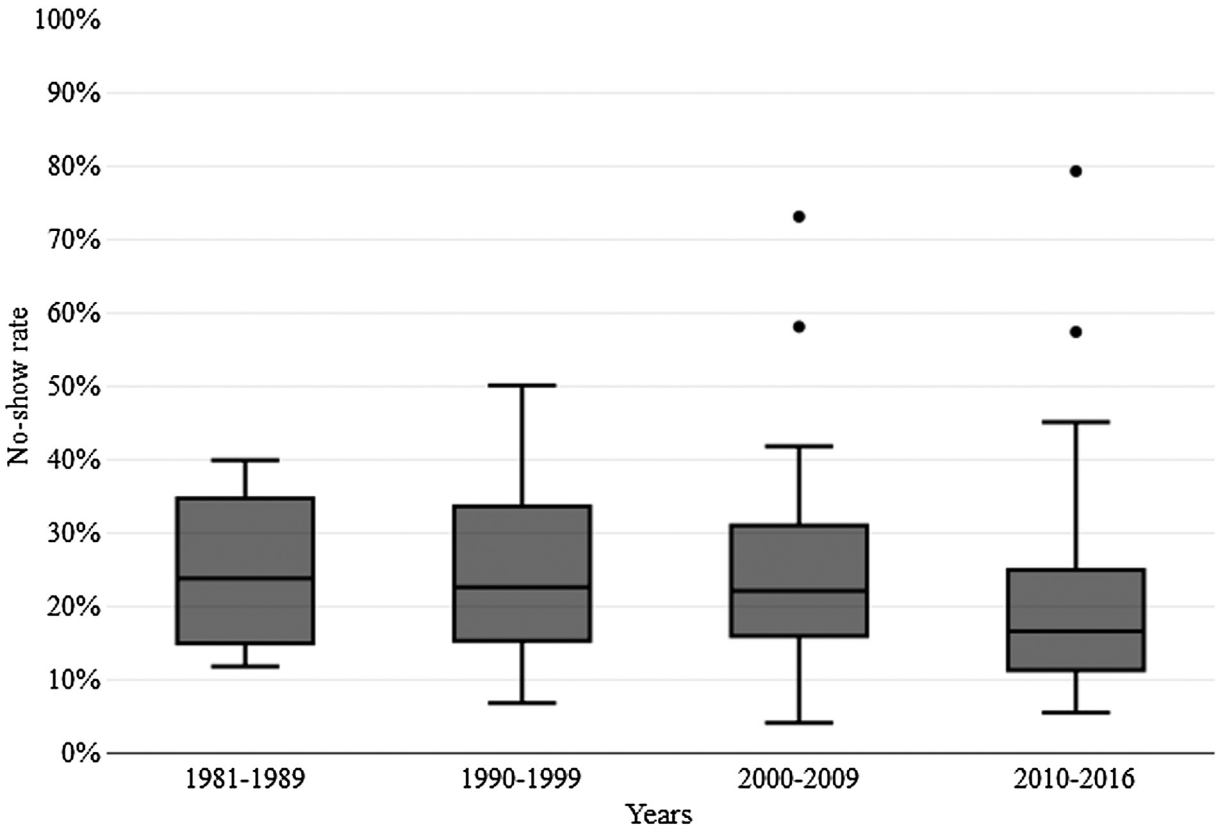

Fig. 2. Boxplot of no-show rates grouped by decades.

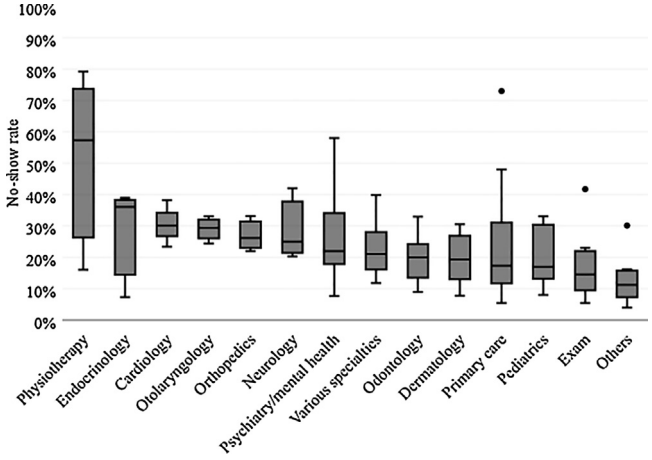

Fig. 3. Boxplot of no-show rates grouped by medical specialty.

urology, ophthalmology, obstetrics/gynecology, and oncology, while the term "Various specialties" refers to studies that analyzed several different types of clinics. The lowest median no-show rates were associated with other specialties (11.2%), followed by medical examination clinics (14.6%) and pediatrics (17.0%). In contrast, physiotherapy had the highest median no-show rates (57.3%), followed by endocrinology (36.0%) and cardiology (30.0%).

It is worthwhile to highlight the variability in the number of papers across different medical specialties and continents. In effect, psychiatry and primary care were the most investigated specialties in papers dealing with determinants of no-show in appointment scheduling. Furthermore, more papers reported on studies performed in North America than in all other continents combined. Of note, while a minority of primary care studies consider all age groups, studies listed under "Pediatrics" account only for child patients, but comprise pediatric primary care as well as other pediatric subspecialties (pulmonology, allergology, autism, dermatology).

In addition to the aforementioned characteristics, we also compared the type of dependent variable used in the studies, as well as how researchers defined such variable. In over half of the surveyed studies, the dependent variable of choice was show vs. no-show taking into account all appointments or patients, but a smaller number of studies specifically analyzed missed first appointments or missed follow-up appointments or missed most recent appointments. The dependent variable's definition was also not consistent across studies [17]. In most cases, no-show was defined as a missed appointment that was not previously cancelled by the patient [17,24–28]. However, some researchers considered that appointments rescheduled [9] or cancelled belatedly by the patient [10,29] also constituted no-show. Moreover, while in some cases the unit of analysis corresponded to all appointments made at the clinic [10,30,31], in other cases only the first [7,32,33], or most recent [8,9], or follow-up [29,35,36] appointment was taken into consideration.

With regards to the methodology for statistical analysis, the great majority of studies performed some type of univariate analysis and in most cases a multivariate analysis ensued. Of note, the most common types of univariate analysis were chi-squared tests (for categorical variables) and *t*-tests (for continuous variables). Over half of the surveyed studies performed multivariate analysis in the form of Multiple Logistic Regression (MLR) models. Interestingly, the number of studies that conducted this type of analysis increased with time. In fact, only 11 out of the 32 studies that appeared between 1981 to 2004 produced MLR models, but the numbers jump to 45 out of 73 between 2005 and 2016. This trend reveals a shift from descriptive towards inferential statis-

tical models and is unsurprising given the limitations associated with the former, such as the inability to establish relationships between different factors. Recent studies have increasingly sought to simultaneously account for more than one factor and thus report a more comprehensive analysis (see Appendix A.2 in Supplementary material for a comprehensive account of the type of dependent variable and statistical analysis performed in each study, ordered by increasing publication year).

Finally, we contrasted the determinants of no-show as well as their effect on no-show. We begin by reporting on factors related to patient demographics, namely age, gender, race, socioeconomic status, marital status, and level of education. The majority of studies found age to be inversely proportional to the probability of appointment no-show: young adults were the most likely to miss their appointments [4,7–10,12,24,28,32,37–72] and, in pediatrics, the likelihood of no-show increased with the child's age [30,34,73–75]. Most studies found gender not to be a statistically significant predictor of no-show, but a few studies reported that men were more likely to miss their appointments than women [4,8,25,32,33,40,41,45,63,72,76–78]. Minority groups were consistently associated with increased no-show, but not surprisingly different groups were considered minorities in different countries (e.g., indigenous population in Australia; Hispanics and Afro-Americans in the United States) [7,9,25,26,28,30,34,43,46,52,57,66,68,70,71,75,79–85]. Lower socioeconomic status [9,28,41,50,58,66,86] was also found to correlate with increased no-show, and although marital status was not found to be a significant predictor in most studies, some studies suggested that married patients have a lower risk of no-show [4,7,12,44,64,85,89]. The great majority of studies that analyzed the patient's education level did not find significance in this factor [33,46,49,53,58,66,90,93,100,114,115,120]. However, one study reported that lack of formal education increased the risk of a patient missing an appointment by 30% when compared to patients with any level of education, and by almost 60% when compared to patients with a university degree [65]. For pediatric appointments, lower parental educational level was associated with increased no-show behavior [87].

Next we report on characteristics of the appointment, such as lead time (time interval between the date when the appointment is registered in the clinic's scheduling system and the actual appointment date), prior no-show history (existence of previously missed appointments by the patient), date and time of appointment, source of referral, type of visit, and number of previously scheduled visits. In the majority of studies, lead time was found to be the most important predictor of no-show: the greater the number of days between the date of appointment scheduling and that of the appointment, the greater the risk of no-show [4,8,12,26,27,31,32,34,37,40,45,47,52,55,57,58,64,67,70,79,81–85,88,90–99]. Prior no-show history was also found to be a strong predictor: patients who had missed previous appointments were more likely to miss their next one [8,9,12,34,37,41,52,67,75,88,96,100–102], but findings were not consistent with regards to the specific number of previously missed appointments. In most studies, day of the week [12,54,56,60,62,67,77,81,84,93,94,96,98,105,107,108] and month of appointment [57,72,79,84,91,93,103–106,113], as well as appointment time [8,12,56,57,59,60,62,63,67,75,77,80,91,93,98,103,109] were not found to be significant predictors of no-show. Nevertheless, among the studies that found significance for day of the week, approximately half reported highest nonattendance rates on Mondays [8,10,47,67,72,102], while almost one third claimed that no-show peaked on Fridays [34,39,42,75]. Appointments scheduled through referral of another provider were at a lower risk of no-show when compared with appointments scheduled by the patients themselves or through other sources [47,86,95]. Furthermore, most studies found the type of visit to be significant, but while some reported that new patient visits [52,60,93,105] were at an increased risk of no-show, others verified that follow-up visits [56,64,75,96,104] were more prone to be missed. The great majority of studies that analyzed the number of previously scheduled visits found this factor to be a significant determinant of no-show. However, there were mixed reports with regards to the effect: four out of seven studies concluded that the number of previously scheduled visits was inversely proportional to the number of missed appointments [36,50,71,84], while the opposite effect was observed in the remaining three studies [12,43,48].

Finally, we report on other characteristics. The form of payment for medical services was found to be a significant predictor of no-show in most studies. Insured patients were more likely to attend their appointments than those responsible for paying their own medical expenses [4,24,29,50,66–68,82–84,102,110,111]. Several studies reported that patients with private health insurance were less likely to miss their appointments than patients with public insurance [24,29,51,66,68,69,83,84,98,102,108,110,115,121]. In the USA, no-show behavior was more common among Medicaid patients than among Medicare patients (note that Medicaid and Medicare are social health programs funded by the USA federal government, but for the purposes of our study, they were treated as public health insurance) [24,51,68].

Most studies that analyzed the distance to/from the clinic also reported this factor to be predictive of no-show behavior with a directly proportional effect on the likelihood of no-show [12,29,30,34,35,37,75,83,97,98,106,109,112,113]. The estimated distance between the clinic and the patient's home was evaluated through information on the zip codes of the clinic and the patient's place of residence. Additionally, the majority of studies that found significance for provider type reported that greater experience on the part of the provider (e.g., physicians vs. residents or residents vs. medical students) was linked with decreased no-show behavior [8,24,27,31,54,60,84]. All of the studies that analyzed different specialties found the type of specialty to be a significant predictor of no-show behavior [10,26,32,52,115]. Moreover, patients with a registered contact number at the clinic were less likely to miss their appointments [52,69,91].

Factors such as the patient's medical history, clinical diagnosis and use of medication were also found to influence no-show behavior. The patient's medical history (i.e., whether the patient had a medical condition) was found to significantly affect no-show behavior by the great majority of studies that analyzed this factor [12,29,36,59,66,78,101,112]. Its effect was found to be dependent on the type of condition, e.g., HIV patients were less likely to miss their appointments [78], while patients diagnosed with depression were more likely to no-show [66]. Different studies analyzed the effect of distinct clinical diagnoses on no-show behavior. Patients diagnosed with either low glycemic blood sugar [44], psychiatric disturbances [38,48,107] or arterial coronary disease [25] were found to be more likely to miss their appointments. Moreover, use of psychiatric medication and/or anti-depressants [33,46,50,73], as well as substance abuse (tobacco, drugs and/or alcohol) [29,33,36,49,59,64,65,85,91] were also associated with an increased risk of no-show.

Of note, the above discussion contemplates the most frequently analyzed determinants, but other factors were also reported in a limited number of studies. Table 2 summarizes our findings related to determinants of no-show and provides a complete account of all factors assessed in the studies we reviewed. The number of studies that found each determinant to be significant (or not significant) and the corresponding relative percentage are given under the header "N (%)". The references associated with studies that found (or did not find) significance are provided under the header "Refer-

Table 2
Number of studies that found (or did not find) significance in determinants.

Determinants	Significant		Not significant		Total
	N (%)	References	N (%)	References	N
Age	55 (55.6)	[4,7–10,12,24,28,30,32,34,37–75,79,82,87,102,113]	44 (44.4)	[25,26,29,33,35,36,76–81,83–86,88,89,92–101,103,106–111,114–122]	99
Gender	20 (22.2)	[4,8,10,25,32,33,40,41,45,55,63,72,75–79,83,88,120]	70 (77.8)	[7,9,24,26,28–30,34–36,38,39,42–44,46–50,52–54,56,57,59–62,67–69, 71,73,79–81,84,85,87,89–93,94–101,103,105,106–117,119,121,122]	90
Lead time	41 (83.7)	[4,8,12,25–27,31,32,34,35,37,40,45,47,52,55,57,58,64,67, 70,79,81–85,88,90–99,102,117,122]	8 (16.3)	[41,75,80,86,100,109,115,119]	49
Health insurance/Form of payment	24 (61.5)	[4,24,26,29,34,43,46,50,51,66–69,75,82–84,98,102,108,110,111,115,121]	15 (38.5)	[8,12,28,38,48,56,58,72,74,86,87,90,95,117,120]	39
Appointment time	17 (47.2)	[4,9,26,30,34,42,54,55,72,79,81,92,96,102,104,107,122]	19 (52.8)	[8,12,56,57,59,60,62,63,67,69,75,77,79,80,91,93,98,103,109]	36
Distance	20 (60.6)	[7,12,29,30,34,35,37,41,52,69,72,75,83,93,97,98,106,109,112,113]	13 (39.4)	[4,9,28,43,48,59,76,85,88,100,108,115,117]	33
Race	17 (56.7)	[7,9,26,28,34,38,43,52,66,68,74,75,82–85,117]	13 (43.3)	[8,29,36,37,58,61,87,88,98,110,112,120,121]	30
Day of the week	14 (48.3)	[7,8,10,34,39,42,54,63,67,71,72,75,102,103]	15 (51.7)	[12,56,60,62,69,77,81,84,93,94,96,98,105,107,108]	29
Ethnicity	11 (52.4)	[7,25,30,46,57,66,70,71,79–81]	10 (47.6)	[8,58,64,65,74,90,97,100,112,121]	21
Marital status	8 (38.1)	[4,7,12,44,64,73,85,89]	13 (61.9)	[8,33,53,58,65,66,82,87,97,100,109,114,120]	21
Type of visit	11 (55.0)	[4,26,34,56,60,64,75,93,96,104,105]	9 (45.0)	[26,27,30,36,37,67,72,98,108]	20
Source of referral	11 (57.9)	[40,45,[47,86,89,94,95,97,106,113,116]	8 (42.1)	[26,42,64,83,90,107,118,119]	19
Month of appointment	7 (38.9)	[10,34,54,69,75,96,108]	11 (61.1)	[57,72,79,84,91,93,103–106,113]	18
Clinical diagnosis	10 (55.6)	[25,35,44,48,73,76,89,107,113,114]	8 (44.4)	[9,42,46,62,97,106,112,117]	18
Prior no show history	15 (88.2)	[8,9,12,34,37,38,41,52,67,75,88,96,100–102]	2 (11.8)	[73,98]	17
Educational level	3 (20.0)	[65,87,88]	12 (80.0)	[33,46,49,53,58,66,90,93,100,114,115,120]	15
Provider type	9 (60.0)	[8,24,27,31,39,54,60,63,84]	6 (40.0)	[25,43,48,82,92,111]	15
Substance abuse	9 (69.2)	[29,33,36,49,59,64,65,85,91]	4 (30.8)	[12,48,93,109]	13
Medical history	9 (75.0)	[12,29,36,38,59,66,78,101,112]	3 (25.0)	[41,61,65]	12
Employment status	4 (36.4)	[53,65,73,88]	7 (63.6)	[38,46,49,58,89,100,109]	11
Language proficiency	5 (45.5)	[8,34,51,56,67]	6 (54.5)	[36,64,68,75,90,110]	11
Socioeconomic status	7 (63.6)	[9,28,41,50,58,66,86]	4 (36.4)	[36,49,87,114]	11
Season of the year	4 (40.0)	[8,12,85,80]	6 (60.0)	[7,26,27,59,62,81]	10
Type of procedure	5 (55.6)	[36,55,79,99,121]	4 (44.4)	[35,78,94,114]	9
Number of previously scheduled visits	7 (77.8)	[12,36,43,48,50,71,84]	2 (22.2)	[42,49]	9
Characteristics of the clinic	2 (28.6)	[10,51]	5 (71.4)	[27,30,78,96,108]	7
Weather	1 (14.3)	[96]	6 (85.7)	[4,42,77,98,102,105]	7
Symptoms	5 (100.0)	[40,58,90,93,97]	0 (0.0)		5
Specialty	5 (100.0)	[10,26,32,52,115]	0 (0.0)		5
Citizenship	2 (40.0)	[56,76]	3 (60.0)	[64,93,114]	5
Use of medication	4 (80.0)	[33,46,50,73]	1 (20.0)	[90]	5
Telephone number recorded	3 (75.0)	[52,69,91]	1 (25.0)	[87]	4
Transportation to/from clinic	2 (50.0)	[87,118]	2 (50.0)	[38,100]	4
Religion	1 (25.0)	[53]	3 (75.0)	[34,75,100]	4
Residence (Urban/rural)	3 (75.0)	[40,85,117]	1 (25.0)	[111]	4
Year of appointment	3 (75.0)	[30,75,106]	1 (25.0)	[54]	4
Hospital admissions	1 (33.3)	[12]	2 (66.7)	[44,52]	3
Referral method	1 (33.3)	[30]	2 (66.7)	[96,119]	3
Family support	2 (100.0)	[46,61]	0 (0.0)		2
Days since last appointment	1 (50.0)	[12]	1 (50.0)	[42]	2
Provider gender	0 (0.0)		2 (100.0)	[60,82]	2
Residency status	0 (0.0)		2 (100.0)	[56,101]	2
Season of birth	1 (100.0)	[56]	0 (0.0)		1
Family physician	0 (0.0)		1 (100.0)	[56]	1
Provider age	1 (100.0)	[60]	0 (0.0)		1

ences". The total number of studies that analyzed each determinant is also shown.

We end this section with a discussion of our findings in light of previous literature reviews [16–18]. Of note, the three review papers considered in this comparison are traditional literature reviews, and, to the best of our knowledge, no systematic reviews exist that deal with no-show predictors without limiting the type of medical specialty under analysis. Ordered by increasing publication year, the first review paper we examine, henceforth referred to as P1, appeared in 1980 [16]. It scrutinized 83 studies published between 1953 and 1979, most of which focused on psychiatric and pediatric patients, and only a number of which dealt with predictors of no-show. P1 also found that patients who were more likely to miss their appointment were young adults with lower socioeconomic status and education level, psychiatric disturbances, alcohol and/or drug dependency, as well as a history of previously missed appointments. Increased lead time was also found to correlated with increased no-show.

The second review paper we examine, referred to as P2, appeared in 1992 and screened approximately 40 studies published between 1977 and 1990 [17]. P2 found higher lead time to be the most significant predictor of increased no-show. Additionally, patients who were young adults with less critical medical conditions and prior no-show history were more likely to miss their appointments. The form of payment for medical services was also deemed a significant predictor, with insured patients incurring in less no-show than those paying their expenses out-of-pocket. Increased no-show was also associated with psychiatric disturbances and substance abuse.

The third and most recent review paper we examine, which we will refer to as P3, appeared in 1998 [18]. P3 investigated 26 studies published between 1985 and 1995, and assessed thirteen predictors of no-show. Unlike P1, P2 and our work, P3 focused on analyzing the relative significance of these predictors, instead of verifying how they affect no-show behavior. It reported that factors such as waiting time, form of payment for medical services, number of previous visits, previous no-show behavior, source of referral, and date/time of appointment were consistent predictors of no-show. Additional factors such as transportation, socioeconomic status, and education level were deemed reasonably good predictors of no-show. In contrast, age, gender and race were found to have questionable predictive power.

Contrasting the findings of P1, P2 and P3 with those of this work, there is concordance with regards to the significance of lead time in predicting no-show behavior, in that higher lead times have been consistently associated with an increased risk of missed appointments. All reviews also agree on the discovery that patients with prior no-show history are more likely to miss their next appointment. Furthermore, P1, P2 and P3 have attested to the significance of socioeconomic status in predicting no-show behavior, in agreement with this work. There is less consistency, however, in accounting for other factors. For one, P1 and P2 reported that younger adults miss their appointments with more frequency than other age groups, a finding that is consistent with this work, but not with P3. In addition, P3 did not find race to be a significant predictor of no-show, unlike P1, P2 and this work. Moreover, the form of payment for medical services was not deemed significant in P1, while P2 and this work propose that insured patients are less likely to miss their appointments than uninsured ones. This work also suggests that day/time of appointment have little influence on no-show behavior, in accordance with P1. In contrast, patients with psychiatric disturbances were found to be more likely to miss their appointments both in P1 and in this work, and all reviews, including this work, have associated substance abuse with an increased risk of no-show. Lastly, contradicting P1, P2 and P3, this work found that the distance from the patient's home to the clinic was not only significant, but directly proportional to the likelihood of no-show.

4. Conclusion

This work integrates and summarizes the findings of 105 papers dealing with determinants of no-show in appointment scheduling. The average no-show rate across all studies was found to be 23.0%, and further analysis revealed that this rate was highest in the African continent (43.0%) and lowest in Oceania (13.2%). We also verified that psychiatry and primary care were the most investigated specialties, and that various statistical methods were used in the reviewed papers to identify significant predictors of no-show, among which the most common were chi-squared tests, *t*-tests and multiple logistic regression models. Additionally, in the majority of surveyed studies, the most important factors to influence no-show were found to be lead time and prior no-show history. We also identified patient characteristics that were more frequently associated with no-show behavior: adults of younger age; lower socioeconomic status; place of residence is distant from the clinic; no private insurance. Furthermore, patients with psychiatric disturbances, those taking psychiatric medication and/or making use of tobacco, drugs and/or alcohol were also frequently found to be more likely to miss their appointments.

Our findings are useful to providers, hospital administrators and researchers alike. For one, knowledge of how certain factors impact no-show behavior is important when devising interventions to mitigate the negative effects of missed appointments on provider productivity and hospital efficiency. As such, the results put forth in this review could be used to substantiate changes in scheduling policies and overbooking, as well as to propose improvements in management practices. In addition, this work may be used as guide for researchers who seek to explore literature dealing with determinants of no-show in appointment scheduling in a fast and detailed manner.

Leveraging the fact that appointment cancellations and no-show do not occur randomly, future risks of no-show may be predicted for individual patients. By amassing and organizing up-to-date knowledge of the factors that influence no-show behavior, this work lays the foundation for the design of statistical tools that increase and ultimately maximize productivity in the clinic. Our ongoing research deals with the development of models for predicting patient no-show behavior and their subsequent incorporation into a novel appointment scheduling system, whose use should lead to improved organizational performance.

Conflicts of interest

The authors declare no competing conflicts of interest.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.healthpol.2018.02.002.

References

[1] Alaeddini A, Yang K, Reddy C, Yu S. A probabilistic model for predicting the probability of no-show in hospital appointments. Health Care Management Science 2011;14:146–57.
[2] Gupta D, Wang WY. Patient appointments in ambulatory care. In: Hall R, editor. Handbook of healthcare system scheduling. New York: Springer; 2012.
[3] LaGanga LR, Lawrence SR. Clinic overbooking to improve patient access and increase provider productivity. Decision Sciences 2007;38:251–76.
[4] Peng Y, Erdem E, Shi J, Masek C, Woodbridge P. Large-scale assessment of missed opportunity risks in a complex hospital setting. Informatics for Health and Social Care 2016;41:112–27.
[5] Parikh A, Gupta K, Wilson AC, Fields K, Cosgrove NM, Kostis JB. The effectiveness of outpatient appointment reminder systems in reducing no-show rates. American Journal of Medicine 2010;123:542–8.
[6] Bech M. The economics of non-attendance and the expected effect of charging a fine on non-attendees. Health Policy 2005;74:181–91.
[7] Menendez ME, Ring D. Factors associated with non-attendance at a hand surgery appointment. Hand 2015;10:221–6.
[8] Torres O, Rothberg MB, Garb J, Ogunneye O, Onyema J, Higgins T. Risk factor model to predict a missed clinic appointment in an urban, academic, and underserved setting. Population Health Management 2015;18:131–6.
[9] Kempny A, Diller G, Dimopoulos K, Alonso-Gonzalez R, Uebing A, Li W, et al. Determinants of outpatient clinic attendance amongst adults with congenital heart disease and outcome. International Journal of Cardiology 2016;203:245–50.
[10] Kheirkhah P, Feng Q, Travis LM, Tavakoli-Tabasi S, Sharafkhaneh A. Prevalence, predictors and economic consequences of no-show. BMC Health Services Research 2016;16:1–6.
[11] Muthuraman K, Lawley M. A stochastic overbooking model for outpatient clinical scheduling with no-shows. IIE Transactions 2008;40:820–37.
[12] Daggy J, Lawley M, Willis D, Thayer D, Suelzer C, DeLaurentis PC, et al. Using no-show modeling to improve clinic performance. Health Informatics Journal 2010;16:246–59.
[13] Zeng B, Turkcan A, Lin J, Lawley M. Clinic scheduling models with overbooking for patients with heterogeneous no-show probabilities. Annals of Operations Research 2010;178:121–44.
[14] Samorani M, LaGanga LR. Outpatient appointment scheduling given individual day-dependent no-show predictions. European Journal of Operational Research 2015;240:245–57.
[15] Kopach R, Delaurentis PC, Lawley M, Muthuraman K, Ozsen L, Rardin R, et al. Effects of clinical characteristics on successful open access scheduling. Health Care Management Science 2007;10:111–24.
[16] Deyo RA, Inuit TS. Dropouts and broken appointments: a literature review and agenda for future research. Medical Care 1980;114:6–57.
[17] Bean AG, Talaga J. Appointment breaking: causes and solutions. Marketing Health Services 1992;12:14–25.
[18] Garuda SR, Javalgi RG, Talluri VS. Tackling no-show behavior: a market-driven approach. Health Marketing Quarterly 1998;15:25–44.
[19] Moher D, Liberati A, Tetzlaff J, Altman DG, Prisma Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Medicine 2009;6:e1000097.
[20] Cronin P, Ryan F, Coughlan M. Undertaking a literature review: a step-by-step approach. British Journal of Nursing 2008;17:38–43.
[21] Scopus [database online]. Oxford, United Kingdom: Elsevier; 2017.
[22] Bardin L. Analise de conteudo. Lisbon: Edicoes; 2011. p. 70.
[23] Rust CT, Gallups NH, Clark WS, Jones DS, Wilcox WD. Patient appointment failures in pediatric resident continuity clinics. Archives of Pediatrics & Adolescent Medicine 1995;14:693–5.
[24] Weingarten N, Meyer DL, Schneid JA. Failed appointments in residency practices: who misses them and what providers are most affected? Journal of the American Board of Family Medicine 1997;10:407–11.
[25] Zailinawati AH, Ng CJ, Nik-Sherina H. Why do patients with chronic illnesses fail to keep their appointments? A telephone interview. Asia-Pacific Journal of Public Health 2005;18:10–5.
[26] Kalb LG, Freedman B, Foster C, Menon D, Landa R, Kishfy K, et al. Determinants of appointment absenteeism at an outpatient pediatric autism clinic. Journal of Developmental and Behavioral Pediatrics 2012;33:685–97.
[27] Bush RA, Vemulakonda VM, Corbett ST, Chiang G. Can we predict a national profile of non-attendance pediatric urology patients: a multi-institutional electronic health record study. Journal of Innovation in Health Informatics 2014;21:132–8.
[28] Miller AJ, Chae E, Peterson E, Ko AB. Predictors of repeated no-showing to clinic appointments. American Journal of Otolaryngology 2015;36:411–4.
[29] Whiting PS, Greenberg SE, Thakore RV, Alamanda VK, Ehrenfeld JM, Obremskey WT, et al. What factors influence follow-up in orthopedic trauma surgery? Archives of Orthopaedic and Trauma Surgery 2015;135:321–7.
[30] McLeod H, Heath G, Cameron E, Debelle G, Cummins C. Introducing consultant outpatient clinics to community settings to improve access to pediatrics: an observational impact study. BMJ Quality & Safety 2015;24:377–84.
[31] McMullen MJ, Netland PA. Lead time for appointment and the no-show rate in an ophthalmology clinic. Clinical Ophthalmology 2015;9:513–6.
[32] Machado AT, Werneck MA, Lucas SD, Abreu MH. Who did not appear? First dental visit absences in secondary care on a major Brazilian city: a cross-sectional study. Ciencia & Saude Coletiva 2015;20:289–98.
[33] Cheng KD, Huang CJ, Tsang HY, Lin CH. Factors related to missed first appointments after discharge among patients with schizophrenia in Taiwan. Journal of the Formosan Medical Association 2014;113:436–41.
[34] Huang YL, Hanauer DA. Patient no-show predictive model development using multiple data sources for an effective overbooking approach. Applied Clinical Informatics 2014;5:836–60.
[35] Mark RE, Klarenbeek PL, Rutten GJM, Sitskoorn MM. Why don't neurosurgery patients return for neuropsychological follow-up? Predictors for voluntary appointment keeping and reasons for cancellation. Clinical Neuropsychologist 2014;28:49–64.
[36] Coleman MM, Medford-Davis LN, Atassi OH, Siler-Fisher A, Reitman CA. Injury type and emergency department management of orthopedic patients influences follow-up rates. Journal of Bone and Joint Surgery 2014;96:1650–8.
[37] Dove HG, Schneider KC. The usefulness of patients' individual characteristics in predicting no-shows in outpatient clinics. Medical Care 1981;19:734–40.
[38] Goldman L, Freidin R, Cook EF, Eigner J, Grich P. A multivariate approach to the prediction of no-show behavior in a primary care center. Archives of Internal Medicine 1982;142:563–7.
[39] Bickler CB. Defaulted appointments in general practice. British Journal of General Practice 1985;35:19–22.
[40] Dickey W, Morrow JI. Can outpatient non-attendance be predicted from the referral letter? An audit of default at neurology clinics. Journal of the Royal Society of Medicine 1991;84:662–3.
[41] Farid BT, Alapont E. Patients who fail to attend their first psychiatric outpatient appointment: non-attendance or inappropriate referral? JMH 1993;2:81–3.
[42] Ross JD, McIver A, Blakely A, Dalrymple J, Peacock W, Wallis C. Why do patients default from follow-up at a genitourinary clinic? A multivariate analysis. GUM 1995;71:393–5.
[43] Majeroni BA, Cowan T, Osborne J, Graham RP. Missed appointments and Medicaid managed care. Archives of Family Medicine 1996;5:507–11.
[44] Dyer PH, Lloyd CE, Lancashire RJ, Bain SC, Barnett AH. Factors associated with clinic non-attendance in adults with type 1 diabetes mellitus. Diabetic Medicine 1998;15:339–43.
[45] Hamilton W, Round A, Sharp D. Patient, hospital, and general practitioner characteristics associated with non-attendance: a cohort study. British Journal of General Practice 2002;52:317–9.
[46] Kruse GR, Rohland BM, Wu X. Factors associated with missed first appointments at a psychiatric clinic. Psychiatric Services 2002;53:1173–6.
[47] Adams LA, Pawlik J, Forbes GM. Nonattendance at outpatient endoscopy. Endoscopy 2004;36:402–4.
[48] Cashman SB, Savageau JA, Lemay CA, Ferguson W. Patient health status and appointment keeping in an urban community health center. Journal of Health Care for the Poor and Underserved 2004;15:474–88.
[49] Coodin S, Stanley D, Cortens B, Desrochers R, McLandress S. Patient factors associated with missed appointments in persons with schizophrenia. Canadian Journal of Psychiatry 2004;49:145–8.
[50] Karter AJ, Parker MM, Moffet HH, Ahmed AT, Ferrara A, Liu JY, et al. Missed appointments and poor glycemic control: an opportunity to identify high-risk diabetic patients. Medical Care 2004;42:110–5.
[51] Lasser KE, Mintzer IL, Lambert A, Cabral H, Bor DH. Missed appointment rates in primary care: the importance of site of care. Journal of Health Care for the Poor and Underserved 2005;16:475–86.
[52] Lee VJ, Earnest A, Chen MI, Krishnan B. Predictors of failed attendances in a multi-specialty outpatient centre using electronic databases. BMC Health Services Research 2005:5.
[53] Adeponle AB, Obembe AO, Suleiman GT, Adeyemi OS. Missed first appointments: prevalence and associated factors in first-time attendees at an outpatient psychiatric clinic in Nigeria. Mental Health Religion & Culture 2007;10:609–20.
[54] Chariatte V, Michaud P, Berchtold A, Akré C, Suris J. Missed appointments in an adolescent outpatient clinic: descriptive analyses of consultations over eight years. Swiss Medical Weekly 2007;137:677–81.
[55] Cohen AD, Kaplan DM, Kraus M, Rubinshtein E, Vardy DA. Nonattendance of adult otolaryngology patients for scheduled appointments. Journal of Laryngology & Otology 2007;121:258–61.
[56] Lehmann TN, Aebi A, Lehmann D, Olivet MB, Stalder H. Missed appointments at a Swiss university outpatient clinic. Public Health 2007;121:790–9.
[57] Dreiher J, Froimovici M, Bibi Y, et al. Nonattendance in obstetrics and gynecology patients. Gynecologic and Obstetric Investigation 2008;66:40–3.
[58] Siminoff LA, Hausmann LR, Ibrahim S. Barriers to obtaining diagnostic testing for coronary artery disease among veterans. American Journal of Public Health 2008;98:2207–13.
[59] Daniels MK, Jung S. Missed initial appointments at an outpatient forensic psychiatric clinic. Journal of Forensic Psychiatry & Psychology 2009;20:964–73.
[60] Tseng FY. Non-attendance in endocrinology and metabolism patients. Journal of the Formosan Medical Association 2010;109:895–900.
[61] Bofill L, Waldrop-Valverde D, Metsch L, Pereyra M, Kolber MA. Demographic and psychosocial factors associated with appointment attendance among HIV-positive outpatients. AIDS Care 2011;23:1219–25.
[62] Carlsen KH, Carlsen KM, Serup J. Non-attendance rate in a danish university clinic of dermatology. Journal of the European Academy of Dermatology and Venereology 2011;25:1269–74.
[63] Zirkle MS, McNelles LR. Nonattendance at a hospital-based otolaryngology clinic: a preliminary analysis within a universal healthcare system. Ear, Nose & Throat Journal 2011;90:32–4.

[64] Pillai R, Bhangu N, Narayanan M, Yoong W. A demographic study to profile non-attenders at a gynaecology outpatient clinic. Journal of Obstetrics and Gynaecology 2012;32:156–8.
[65] Sharp L, Cotton S, Thornton A, Gray N, Cruickshank M, Whynes D, et al. Who defaults from colposcopy? A multi-centre, population-based, prospective cohort study of predictors of non-attendance for follow-up among women with low-grade abnormal cervical cytology. European Journal of Obstetrics & Gynecology and Reproductive Biology 2012;165:318–25.
[66] Traeger L, O'Cleirigh C, Skeer MR, Mayer KH, Safren SA. Risk factors for missed HIV primary care visits among men who have sex with men. Journal of Behavioral Medicine 2012;35:548–56.
[67] Cronin PR, DeCoste L, Kimball AB. A multivariate analysis of dermatology missed appointment predictors. JAMA Dermatology 2013;149:1435–7.
[68] Kaplan-Lewis E, Percac-Lima S. No-show to primary care appointments why patients do not come. Journal of Primary Care & Community Health 2013;4:251–5.
[69] Lalloo R, McDonald JM. Appointment attendance at a remote rural dental training facility in Australia. BMC Oral Health 2013:13.
[70] Milne V, Kearns R, Harrison A. Patient age, ethnicity and waiting times determine the likelihood of non-attendance at a first specialist rheumatology assessment. International Journal of Rheumatic Diseases 2014;17:19–25.
[71] Nancarrow S, Bradbury J, Avila C. Factors associated with non-attendance in a general practice super clinic population in regional Australia: a retrospective cohort study. Australasian Medical Journal 2014;7:323–33.
[72] Storrs MJ, Ramov HM, Lalloo R. An investigation into patient non-attendance and use of a short-message reminder system at a university dental clinic. Journal of Dental Education 2016;80:30–9.
[73] Pang AH, Tso S, Ungvari GS, Chiu H, Leung T. An audit study of defaulters of regular psychiatric outpatient appointments in Hong Kong. International Journal of Social Psychiatry 1995;41:103–7.
[74] Samuels RC, Ward VL, Melvin P, Macht-Greenberg M, Wenren LM, Yi J, et al. Missed appointments: factors contributing to high no-show rates in an urban pediatrics primary care clinic. Clinical Pediatrics 2015;54:976–82.
[75] Huang YL, Hanauer DA. Time dependent patient no-show predictive modelling development. International Journal of Health Care Quality Assurance 2016;29:475–88.
[76] Al-Khadra A, Magbool G, Wosornu L, Al-Awdah S, Qutub H, Al-Khatib R. Why do cardiology out-patient appointments fail in Saudi Arabia? International Journal for Quality in Health Care 1992;4:305–10.
[77] Corfield L, Schizas A, Williams A, Noorani A. Non-attendance at the colorectal clinic: a prospective audit. Annals of The Royal College of Surgeons of England 2008;90:377–80.
[78] Ade S, Trébucq A, Harries AD, Ade G, Agodokpessi G, Wachinou P, et al. Follow-up and tracing of tuberculosis patients who fail to attend their scheduled appointments in Cotonou, Benin : a retrospective cohort study. BMC Health Services Research 2016:16.
[79] Cohen AD, Dreiher J, Vardy DA, Weitzman D. Nonattendance in a dermatology clinic-a large sample analysis. Journal of the European Academy of Dermatology and Venereology 2008;22:1178–83.
[80] Dreiher J, Goldbart A, Hershkovich J, Vardy DA, Cohe AD. Factors associated with non-attendance at pediatric allergy clinics. Pediatric Allergy and Immunology 2008;19:559–63.
[81] Goldbart AD, Dreiher J, Vardy DA, Alkrinawi S, Cohe AD. Nonattendance in pediatric pulmonary clinics: an ambulatory survey. BMC Pulmonary Medicine 2009;9:1–6.
[82] Margolis KL, Lurie N, McGovern PG, Slater JS. Predictors of failure to attend scheduled mammography appointments at a public teaching hospital. Journal of General Internal Medicine 1993;8:602–5.
[83] Mugavero MJ, Lin HY, Allison JJ, Willig JH, Chang PW, Marler M, et al. Failure to establish HIV care: characterizing the no show phenomenon. Clinical Infectious Diseases 2007;45:127–30.
[84] Bennett KJ, Baxley EG. The effect of a carve-out advanced access scheduling system on no-show rates. Family Medicine 2009;41:51–6.
[85] Partin MR, Gravely A, Gellad ZF, Nugent S, Burgess JF, Shaukat A, et al. Factors associated with missed and cancelled colonoscopy appointments at Veterans Health Administration facilities. Clinical Gastroenterology and Hepatology 2016;14:259–67.
[86] Hampton-Robb S, Qualls RC, Compton WC. Predicting first-session attendance: the influence of referral source and client income. Psychotherapy Research 2003;13:223–33.
[87] Kavanagh KT, Smith TR, Golden GS, Tate NP, Hinkle WG. Multivariate analysis of family risk factors in predicting appointment attendance in a pediatric otology and communication clinic. Journal of Health & Social Policy 1991;2:85–102.
[88] Lotfi V, Torres E. Improving an outpatient clinic utilization using decision analysis-based patient scheduling. Socio-Economic Planning Sciences 2014;48:115–26.
[89] Matas M, Staley D, Griffin W. A profile of the noncompliant patient: a thirty-month review of outpatient psychiatry referrals. General Hospital Psychiatry 1992;14:124–30.
[90] Grunebaum M, Luber P, Callahan M, Leon AC, Olfson M, Portera L. Predictors of missed appointments for psychiatric consultations in a primary care clinic. Psychiatric Services 1996;47:848–52.
[91] Livianos-Aldana L, Vila-Gomez M, Rojo-Moreno L, Luengo-Lopez MA. Patients who miss initial appointments in community psychiatry? A Spanish community analysis. International Journal of Social Psychiatry 1999;45:198–206.
[92] Cohen AD, Kaplan DM, Shapiro J, Levi I, Vardy DA. Health provider determinants of nonattendance in pediatric otolaryngology patients. Laryngoscope 2005;115:1804–8.
[93] El-Din MMN, Al-Shakhs FN, Al-Oudah SS. Missed appointments at a university hospital in eastern Saudi Arabia: magnitude and association factors. Journal of the Egyptian Public Health Association 2007;83:415–33.
[94] Sola-Vera J, Sáez J, Laveda R, Girona E, Fe garcía-sepulcre M, Cuesta A, et al. Factors associated with non-attendance at outpatient endoscopy. Scandinavian Journal of Gastroenterology 2008;43:202–6.
[95] Sherman ML, Barnum DD, Buhman-Wiggs A, Nyberg E. Clinical intake of child and adolescent consumers in a rural community mental health center: does wait-time predict attendance? Community Mental Health Journal 2009;45:78–84.
[96] Giunta D, Briatore A, Baum A, Luna D, Waisman G, de Quiros FG. Factors associated with nonattendance at clinical medicine scheduled outpatient appointments in a university general hospital. Patient Preference and Adherence 2013;7:1163–70.
[97] Guay MO, Tanzi S, Arregui MT, Chisholm G, de la Cruz M, Bruera E. Characteristics and outcomes of advanced cancer patients who miss outpatient supportive care consult appointments. Supportive Care in Cancer 2014;22:2869–74.
[98] Guzek LM, Fadel WF, Golomb MR. A pilot study of reasons and risk factors for no-show in a pediatric neurology clinic. Journal of Child Neurology 2015;30:1295–9.
[99] Kogan-Liberman D, Rivas Y, Thompson J, Tomer G. Improving nonattendance at outpatient pediatric endoscopy unit of a tertiary center. Journal of Pediatric Gastroenterology and Nutrition 2015;61:234–7.
[100] Collins J, Santamaria N, Clayton L. Why outpatients fail to attend their scheduled appointments: a prospective comparison of differences between attenders and non-attenders. Australian Health Review 2003;26:52–63.
[101] Wang NJ, Aspelund GØ. Children who break dental appointments. European Archives of Paediatric Dentistry 2009;10:11–4.
[102] Norris JB, Kumar C, Chand S, Moskowitz H, Shade SA, Willis DR. An empirical investigation into factors affecting patient cancellations and no-shows at outpatient clinics. Decision Support Systems 2014;57:428–43.
[103] Hermoni D, Mankuta D, Reis S. Failure to keep appointments at a community health centre: analysis of causes. Scandinavian Journal of Primary Health Care 1990;8:107–11.
[104] King A, David D, Jones HS, O'Brien C. Factors affecting non-attendance in an ophthalmic outpatient department. Journal of the Royal Society of Medicine 1995;88:88–90.
[105] Pehr K. No show: incidence of nonattendance at a dermatology practice in a single universal payer model. Journal of Cutaneous Medicine and Surgery 2007;11:53–6.
[106] Mbada CE, Nonvignon J, Ajayi O, Dada OO, Awotidebe TO, Johnson OE, et al. Impact of missed appointments for out-patient physiotherapy on cost, efficiency, and patients' recovery. Hong Kong Physiotherapy Journal 2013;31:30–5.
[107] Weinerman R, Glossop V, Wong R, Robinson L, White K, Kamil R. Time of day influences nonattendance at urgent short-term mental health unit in Victoria, British Columbia. Canadian Journal of Psychiatry 2003;48:342–4.
[108] Yoon EY, Davis MM, Van Cleave J, Maheshwari S, Cabana MD. Factors associated with non-attendance at pediatric subspecialty asthma clinics. Journal of Asthma 2005;42:555–9.
[109] Lester S, Harris SM. Factors associated with first session nonattendance at a university-based family therapy clinic. American Journal of Family Therapy 2007;35:363–76.
[110] Barksdale A, Hackman J, Bonham A, Gratton M. Cardiology clinic follow-up did not decrease return visits to the ED for chest pain patients. American Journal of Emergency Medicine 2014;32:1208–11.
[111] Mathu-Muju KR, Li HF, Hicks J, Nash DA, Kaplan A, Bush HM. Identifying demographic variables related to failed dental appointments in a university hospital-based residency program. Pediatric Dentistry 2014;36:296–301.
[112] Gordon M, Antshel KM, Lewandowski L, Seigers D. Economic grand rounds: predictors of missed appointments over the course of child mental health treatment. Psychiatric Services 2010;61:657–9.
[113] Mbada CE, Ajayi O, Agbeja OB, Mbada KA, Awotidebe TO, Oghumu SN. Non-attendance for out-patient physiotherapy: evaluation, prediction and physiotherapists' perceptions-a cross-sectional study. Journal of Physical Therapy 2013;7:12–22.
[114] Spikmans FJ, Brug J, Doven MM, Kruizenga HM, Hofsteenge GH, Bokhorst-van der Schueren V. Why do diabetic patients not attend appointments with their dietitian? Human Nutrition and Dietetics 2003;16:151–8.
[115] Neinstein LS. Lowering broken appointment rates at a teenage health center. Journal of Adolescent Health Care 1982;3:110–3.
[116] Peeters FP, Bayer H. No-show for initial screening at a community mental health centre: rate, reasons and further help-seeking. Social Psychiatry and Psychiatric Epidemiology 1999;34:323–7.
[117] Kruse GR, Rohland BM. Factors associated with attendance at a first appointment after discharge from a psychiatric hospital. Psychiatric Services 2002;53:473–6.
[118] Minty B, Anderson C. Non-attendance at initial out-patient appointments at a hospital-based child psychiatric clinic. Clinical Child Psychology and Psychiatry 2004;9:403–18.

[119] Hon KL, Leung TF, Wong Y, Ma KC, Fok TF. Reasons for new referral non-attendance at a pediatric dermatology center: a telephone survey. Journal of Dermatological Treatment 2005;16:113–6.
[120] Kane S, Dixon L. Adherence rates with infliximab therapy in Crohn's disease. Alimentary Pharmacology & Therapeutics 2006;24:1099–103.
[121] Kazarian ES, Carreira FS, Toribara NW, Denberg TD. Colonoscopy completion in a large safety net health care system. Clinical Gastroenterology and Hepatology 2008;6:438–42.
[122] Cohen AD, Goldbart AD, Levi I, Shapiro J, Vardy DA. Health provider factors associated with nonattendance in pediatric dermatology ambulatory patients. Pediatric Dermatology 2007;24:113–7.