Characteristics of patients who leave without being seen: comparing with those who do not leave

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Abstract

The percent of patients leaving without been seen by a doctor (LWBS) is often seen as a quality indicator of care. In this longitudinal study, we compare the behaviour over time of two groups of patients: the LWBS group composed by patients who did at least one LWBS visit, with the no-LWBS group containing the remaining individuals. We analysed their low acuity visits over a period of 3.5 years and search for the most frequent sequences of use of the Emergency departments in the city of Sherbrooke, Quebec. The LWBS visits represent a high percent of low acuity visits (14%) but they are generated by a low percent of the population (10.7%). The LWBS group generated 6.68 visits per person versus 3.13 visits in the no-LWBS group. The LWBS patients are young, 36 years old on average, and live in city areas either materially or socially deprived. Analysis of temporal sequences for all users revealed that patients' conditions are being treated in the ED, instead of being followed up with a GP or a family doctor. Temporal sequences also revealed that a member of the LWBS group will likely repeat an LWBS visit within a week. Mental disorders, respiratory and digestive system problems are more frequent in the LWBS group than in the no-LWBS group and this may indicate chronic situations poorly managed. As there is no monetary incentive for the hospitals in Quebec to reduce the LWBS rate, we propose to establish a recall system that will direct chronic patients to external clinics already in service in the hospitals.

1. Introduction

Patients leaving the Emergency department before seeing a doctor have been studied by many all over the world. They have been referred to in the international literature as "did not wait" (DNW) or "left without being seen" (LWBS) patients and their rates vary from 0.36% to 15% or more. These rates may be considered as a performance indicator of quality of service and controversy exists as to whether a high rate of LWBS means high risk of adverse outcomes.

Many studies have reported similar characteristics of an LWBS patient: low triage code, male, young, arriving to the ED at times when waiting times were longest [Goodacre and Webster, 2005; Parekh et al. 2013]; but they also happen during weekends and during night shifts [Jones et al. 2015]. The risk of repeat visits to the ED is found higher in LWBS patients when compared to those who completed their visits [Geirsson et al. 2013; Pham et al. 2009]. In a large USA study of 9.2 million ED visits to 262 hospitals in California [Hsia et al. 2007], visitors to different EDs experienced a large variation in their probability of leaving without being seen, and visitors to hospitals serving a high proportion of low-income and poorly insured patients were at disproportionately higher risk of leaving without being seen. Efforts to reduce waiting time have also reduced LWBS rates (Ducharme et al 2005; Sanchez et al. 2005, Fraser et al, 2016).

In Ireland [Gilligan et al. 2009; O'Keefe et al. 2013], LWBS patients considered to be at risk of adverse outcome were contacted the following day, with chest pain and alcohol/drug overdose as common risk factors, and 9.4% of those recalled required acute admission. Whereas recalling patients seems to reduce the risk of adverse outcome, in Ontario, Canada, LWBS patients were not recalled and were not found at higher risk of short term adverse events compared to those with complete visits [Guttmann et al. 2013]. A similar conclusion was reached in UK, where the most common reason for LWBS was long waiting times with few data to suggest LWBS posed a risk to patient health [Clarey and Cooke, 2012]. Finally, LWBS from a pediatric ED were found unlikely to return for ED care, and those who did were unlikely to either be triaged as urgent or require hospital admission [Kurowski et al. 2013].

In this longitudinal study, we search the diagnostic codes of individuals with at least one LWBS visit, to discover the most frequent patterns of diagnostic codes, including the time between ED visits in order to have a more complete understanding of the use of emergency departments. The next section describes the methodology used, followed by results, discussion, and conclusions.

2. Methodology

The data set contains all low acuity visits (CTAS IV and V) to the EDs during a period of 3.5 years, from June 2006 to December 2009. There were 138,107 records of visits made by individuals whose place of residence is the city of Sherbrooke; besides date and arrival time, each record includes the patient's ID, age, sex, postal code, and diagnostic code(s) for the visit. There were 63,782 individuals visiting the ED during the period studied.

We separated the individuals into two groups: the LWBS group (patients living in

Sherbrooke that had at least one incomplete visit) and the no-LWBS group containing the remaining individuals. Then we divided the records of visits into two groups: those generated by the LWBS group and those generated by the no-LWBS group of individuals. We had values of the material and social deprivation of census tracts in the city of Sherbrooke and used them as a proxy for socio-economic characteristics [Zubieta and Fernandez-Peña, 2014].

Two analyses were performed. The first analysis describes and compares the characteristics of the two groups. The second analysis extracts frequent sequential patterns of diagnostic codes between successive visits. The discovering of sequential patterns in sequences of diagnostic codes was done with an implementation of the PrefixSpan Algorithm [Fourier-Viger et al. 2014]. For discovering sequential patterns with time intervals we first used the Hirate & Yamana's algorithm [Fournier-Viger et al. 2014] and later on, we used the CER algorithm [Gomes et al. 2016] to narrow the sequence of visits by the LWBS group to those occurring within a minimum and a maximum time before a LWBS visit occurs.

3. Results

We find that about 43% of Sherbrooke residents[1] visited the ED at least once during the 3.5 years studied. The LWBS group of users represents 10.7% of the population, 24.7% of users, and 35% of the low acuity visits. The 15,758 individuals in the LWBS group made 48,270 visits to the ED. The most frequent diagnostic code for the LWBS group is LWBS, followed by injury and poisoning, mental disorders and respiratory problems (Table 1).

Table 1. Most frequent diagnostic code for LWBS

Diagnostic Codes	Frequency	%
LWBS	19,301	40%
Injury and poisoning	6,426	13%
Mental disorders	4,973	10%
Respiratory system	4,752	10%
Ill-defined conditions	4,410	9%
Digestive system	3,189	7%
Musculosqueletal	3,094	6%
Nervous System	2182	5%
Genitourinary System	2141	4%
Missing code	1970	4%
Other	6,091	13%

The no-LWBS group made 29,062 visits. The most frequent diagnostic codes for this group are injury and poisoning, ill-defined conditions and diseases of the respiratory system, with mental disorders occupying the 7th place as seen in Table 2 below. The LWBS group generated on average 6.68 visits per person, whereas the no-LWBS group generated 3.13 visits per person, a significant difference of 3.5 more visits in the LWBS group (p<.001).

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[1] Statistics Canada reported that Sherbrooke's population was 147,427 in 2006 and it increased to 154,601 in 2011; we consider that between 2006 and 2009 the population was around 150,000.

Table 2. Most frequent diagnostic codes for no-LWBS

Diagnostic codes	Frequency	%
Injury and poisoning	23,284	26%
Ill-defined conditions	13,384	15%
Respiratory system	13,328	15%
Digestive system	9,491	11%
Musculosqueletal	8,680	10%
Missing code	7,628	8%
Mental disorders	7,127	8%
Nervous System	6,569	7%
Genitourinary System	6,494	7%
Other	14662	16%

If we omit the LWBS visits, the mental disorders become 13% of visits in the LWBS group, almost the double value observed in the no-LWBS group. The percentages showed in Tables 1 and 2 are obtained by dividing the frequency of a code by the total number of visits made by the LWBS and the no-LWBS respectively. We must mention that a visit may have several diagnostic codes, although 91% of the LWBS visits had two or less codes whereas this value is 86% in the no-LWBS group of visits.

3.1. Socioeconomic characteristics

In the LWBS group we found no major differences by sex (women 51%, men 49%), but we found an average age difference between 5.7 and 6.2 years younger in the LWBS group, a result consistent with previous studies of LWBS users. (Goodacre S, Webster A. 2005, Geirsson et al 2013) The average age of the LWBS is 35.8 years and the no-LWBS average age is 41.7 (see Appendix A). Overall, the proxy socioeconomic characteristics of the two groups of individuals are also significantly different. The better off materially and the more socially deprived (SDI=4, 5) the more they are likely to leave the ED before seeing a doctor. It is important to note that 72% of LWSB-visits come from areas having a high level of social deprivation (SDI=4, 5) and 51% live in boroughs with low levels of material deprivation (MDI=1, 2). The above results were significant with a p-value < .005 in chi-square tests, except the 95% confidence interval of age differences.

3.2. Description of visits

The occurrence of LWBS was higher in the city hospital HD (near downtown) than in the larger regional hospital HF located in the outskirts of Sherbrooke. Analysis by weekday shows some differences among the number of LWBS per weekday; Mondays are more frequent in both groups but differences are small (p-value=0.013). Half of the low acuity visits happen from July to November in both groups. The visit's time of the day is more likely to be between 16:00 and midnight for a LWBS visit, and from 9:00-13:00 for a non-LWBS (see Appendix B). The incidence of diagnostic codes present in LWBS patients are different in frequency to those obtained for the no-LWBS group. These results are similar to those obtained by [Jones et al (2015)] in Waterloo, Ontario.

3.3. Sequential patterns of diagnostic codes

The sequence of diagnostic codes registered for each individual during the three and a half years studied were considered in order to find out the most frequent patterns for LWBS and for no-LWBS individuals. A sequence must have at least two events (visits) so we omit from the analysis all individuals who came to an ED only once and kept: 42,750 visits by 10,238 LWBS users and 62,062 visits by 20,314 no-LWBS. These represent 88.56% and 69.13% of the LWBS and no-LWBS groups, respectively. In order to find the patterns only the first diagnostic code was considered.

A first analysis of sequences was completed using the PrefixSpan algorithm [Fournier-Viger et al. 2014]. We found 17 patterns common to both groups and half of them involve the same diagnostic codes (injury and poisoning, LWBS, respiratory problems, mental disorders). It shows that when a person comes to the ED and stays to see a doctor, there are more chances that in his/her next low acuity visit to the ED the person will get the same diagnostic code than the last time (Table 3). For example, the "rule" 24 → 24 indicates that a LWBS visit (code 24) was followed by another LWBS visit in 7.6% of individuals. It is interesting to note that in 45% of these patterns we have the same code and that a LWBS visit appears in 35% of these rules. This states that, on the one hand, the patient's condition is being treated in the ED, instead of being followed up with a GP or a family doctor. On the other hand, ED providers spend time treating probably chronic conditions besides emergency situations which contribute to delays in services and perpetuate the LWBS pattern.

Table 3. Most Frequent Rules to all visits

Rule					Frequency
Injury & poisoning	→	Injury & poisoning			13.0%
Injury & poisoning	→	LWBS			7.7%
LWBS	→	LWBS			7.6%
Repiratory problem	→	Repiratory problems			6.9%
Ill defined condition	→	Ill defined conditions			6.5%
LWBS	→	Injury & poisoning			5.8%
Repiratory problem	→	LWBS			5.1%
Ill defined condition	→	LWBS			4.9%
LWBS	→	Ill defined conditions			4.1%
Injury & poisoning	→	Ill defined conditions			4.1%
Injury & poisoning	→	Repiratory problems			4.0%
LWBS	→	Repiratory problems			4.0%
Repiratory problem	→	Injury & poisoning			4.0%
Mental disorders	→	Mental disorders			3.9%
Digestive system	→	Digestive system			3.9%
Musculoesqueletal	→	Musculoesqueletal			3.8%
Injury & poisoning	→	Injury & poisoning	→	Injury & poisoning	3.6%
Ill defined condition	→	Repiratory problems			3.5%
Injury & poisoning	→	Musculoesqueletal			3.5%
Genitourinary	→	Genitourinary			3.5%

When considering time between visits, a small number of patterns appeared with the same code in two consecutive visits, with one day between them (Table 4). The patterns are different in the LWBS and the no-LWBS groups.

Table 4. Temporal patterns

		Rule		Days	%
LWBS	LWBS	→	Injury & poisoning	1	2.1%
	LWBS	→	Ill defined conditions	1	1.5%
	Ill defined conditions	→	Ill defined conditions	1	1.4%
	LWBS	→	Repiratory problems	1	1.1%
	Injury & poisoning	→	Injury & poisoning	1	1.0%
no LWBS	Genitourinary	→	Genitourinary	1	0.8%
	Skin and subcutaneous	→	Skin and subcutaneous	1	0.8%
	Skin and subcutaneous	→	Skin and subcutaneous	2	0.7%
	Pregnacy childbirth	→	Pregnacy childbirth	1	0.6%
	Musculoesqueletal	→	Musculoesqueletal	1	0.5%

The patterns above were found in less than 2.1% of sequences, so we tried another approach narrowing the sequence of visits to those occurring within a minimum and a maximum time before a LWBS visit occurs. All the previous codes (events) that happen before the "effect" are called "causes" as seen in Figure 1, although no causality can be asserted. The interval retained includes all diagnostic codes given between 1 sec and 7 days before a LWBS visit, here considered the "effect". The patterns unveiled by the CER algorithm are in Table 5 below.
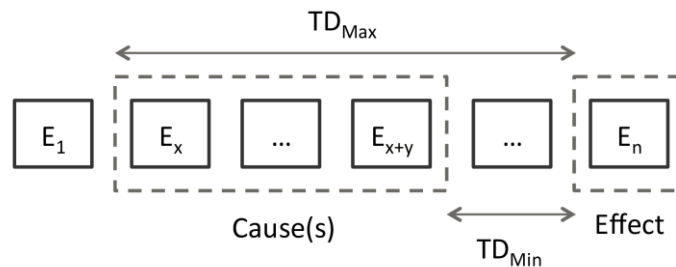
Figure 1. Cause-effect Sequence derived from a sequence of events

Table 5. Cause-effect sequences (1sec – 7days)

Cause		Effect	%
LWBS	→	LWBS	5.1
Injury & poisoning	→	LWBS	4.8
Ill defined conditions	→	LWBS	2.7
Repiratory problems	→	LWBS	2.6
Mental disorders	→	LWBS	1.7
Nervous system	→	LWBS	1.6

We can say that a LWBS visit happened between 1 second and 7 days after the diagnostic code showed as a cause, an insight not available in the previous results. The percent values indicate the frequency of the patterns. Although hospitalization never showed up in a sequential pattern, meaning a very weak relationship with LWBS, we would expect to see some hospitalization rates for respiratory problems but probably not within low triage codes.

4. Discussion

A health policy paper on Canadian and Quebec health systems [Roberge et al, 2010] found that emergency room problems arise from past decisions that gave hospitals a predominant role in the healthcare system, partly modified their original mission, as well as from counterproductive funding modalities. In Quebec, the number of patients seen in an Emergency department has no impact on the hospital funding so we cannot associate a dollar value to the opportunity cost incurred by the LWBS. However, they do cost something to the patient: loss of salary, additional child care expenses, time lost in school, as well as worsened health status.

Many hospitals around the world have adopted strategies aiming to reduce ED waiting times, e.g., adding fast-track areas and mid-level practitioners, adopting flexible nursing and demand-based physician scheduling with mostly positive results in also reducing LWBS rates. However, our findings of frequent use of the ED with high rates of LWBS points to possible chronic disorders being managed at the ED. Mental health disorders, especially those related to alcohol and drug abuse are better served in other kind of services. Similarly, respiratory

problems, which came often in relation to LWBS visits, include some chronic conditions as asthma and OCPD that are best managed by a GP or a family doctor.

Centralized waiting lists are being used in many OCDE countries. In Quebec, since 2011, this practice has slightly increased the number of vulnerable patients being enrolled and largely increased the number of non-vulnerable patients being enrolled with family physicians (Breton et al. 2105). A different strategy is clearly needed, probably best at the hospital level where it is easier to identify patients in need of a better follow-up system. A recall system for all LWBS patients would allow to 1) create and maintain a list of vulnerable users and 2) communicate with these users to find out how they are followed up.

Finding which patients are chronic, showing frequent uses of the ED would help to identify those who most likely may benefit from intervention, particularly by giving them priority to enroll with a family doctor practice and to direct them to join a clinic for chronic and/or mental health ailments if their condition so requires.

5. Conclusion

Some characteristics of our LWBS-group are: young individuals between 35.8 and 41.7 years of age, arriving between 16:00 – midnight, living in materially or socially deprived communities, frequently visiting an ED. However, our study of temporal patterns revealed some original findings:

1. The LWBS group generated 35% of the low acuity visits, twice as much as the no-LWBS group.

2. A member of the LWBS group is more likely to repeat a LWBS visit within a week.

3. The diagnostic codes of the LWBS group include mental disorders more frequently than the no-LWBS group, (8% vs 13% omitting the LWBS visits).

4. High rates of LWBS point to possible chronic disorders being managed at the ED.

Even though LWBS visits in Quebec do not represent an opportunity cost to the hospital, they do cost something to the patient. The high percent of LWBS visits in the hospitals studied (14%) signals an opportunity to improve the offering of health care services to an identifiable group of patients. More research is needed to propose a better process in the ED to direct patients to specific and more appropriate health services.

Acknowledgements

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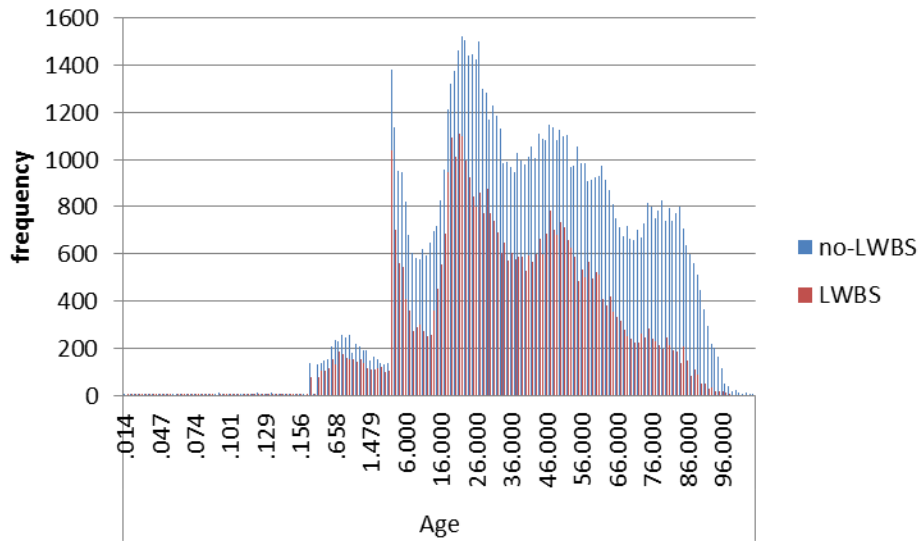
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Appendix A

Users age

Appendix B

Arrival Time