Table 2 Patients with one ED visit (n = 38,959) compared with patients with high ED utilization (n = 244)

	Patients with one ED visit (n = 38,959)	Patients with high ED utilization (n = 244)	*P* value
Frequent visitors (n = 232)			
Sex, male (n, %)	19,788 (50.8)	128 (55.2)	0.183
Age (mean, standard deviation)	39.0 (23.1)	47.5 (20.5)	<0.001
Highly frequent visitors (n = 12)			
Sex, male (n, %)	19,788 (50.8)	7 (58.3)	0.601
Age (mean, standard deviation)	39.0 (23.1)	48.3 (17.9)	0.161

attended the ED 2,338 times (3.3% of the total number of ED consultations).

Patient characteristics and visit outcomes

Results are presented for both EDs together, since no statistically significant differences in the results were found between the two EDs. Patient characteristics are shown in Table 2. FV were equally likely to be male or female and were significantly older than patients with single visits (mean age 47.5 vs. 39.0 years, P <0.001). Among FV, most patients (n = 75, 32.3%) were in the age category of 45 to 64 years (data not shown). No differences were found in sex and mean age and between the HFV and the patients with single visits.

Visit outcomes are shown in Table 3. Consultations of FV ended in admission significantly more often than consultations of patients with single visits (24.5% vs. 15.9%, P <0.001). LWBS occurred more often during visits of FV. No differences in visit outcomes were found between HFV and patients with single visits. There was no mortality in the patients with frequent or highly frequent ED use.

Factors associated with high ED utilization

Factors associated with high ED utilization are shown in Table 4 (attendances of FV) and Table 5 (attendances of HFV). Because no notable differences were found between the two EDs in factors associated with high ED utilization, results are presented for both EDs combined.

Most of the FV and HFV arrived during the day shift or evening shift. However, when corrected for other variables, arriving during the night shift was indicative for high ED utilization. Self-referral was less likely to occur among FV and HFV compared to the patients with single visits. Several chief complaints were indicative for frequent and highly frequent ED use, namely shortness of breath, abdominal pain, urinary tract problems, and psychiatric disorders. HFV arrived by ambulance more often than patients with single visits.

Both FV and HFV were assigned to the non-urgent or standard triage level significantly less often than patients with single visits (42.1% of the FV were non-urgent or standard and 32.8% of the HVF were non-urgent or standard, compared with 54.9% of the patients with single visits, P <0.001).

The Hosmer-Lemeshow goodness-of-fit test P value for the FV model was significant, indicating that the model is not well calibrated and not useful in predicting FV. The Hosmer-Lemeshow goodness-of-fit test P value for the HFV model was 0.14. Accuracy of the model as obtained by the AUC ROC was 0.79 (95% CI, 0.76–0.82).

Discussion

Since no univocal definition of high ED utilization exists in the literature [2], we used the thresholds recently developed by Doupe et al. [6]. They suggested that patient characteristics changed meaningfully at a breakpoint of 7 ED visits per year, thereby providing an objective threshold [6].

We assessed 244 individual FV and HFV (244 of 51,272 = 0.5% of total ED patients in one year), who presented to the two EDs on 2,338 occasions (2,338 of 71,565 = 3.3% of total ED consultations in one year). FV and HFV together in this study are a low percentage (0.5%) compared to another study using the same thresholds, where FV composed 2.1% of users and 9.9% of ED visits, whereas HFV composed 0.2% and 3.6% of users and visits, respectively [6]. It is possible that the strong primary care network in the Netherlands prevents part of the ED visits. Since practically all Dutch citizens have a general practitioner (GP) and GP services are

Table 3 Disposition of patients with high ED utilization (compared with single visit patients (n = 38,959)

	Visits of patients with a single visit (n = 38,959)	Visits of FV (n = 2,075)	*P* value Single visits – visit of FV*	Visits of HFV (n = 263)	*P* value Single visits – visits of HFV*
Admitted [n (%)]	6,189 (15.9)	509 (24.5)	<0.001	49 (18.6)	0.225
LWBS [n (%)]	404 (1.0)	46 (2.2)	<0.001	1 (0.4)	0.294
Died [n (%)]	31 (0.1)	0	-	0	-

*χ^2 tests.