The effect of a general practice after-hours clinic on emergency department presentations: a regression time series analysis

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ABSTRACT

Objective: To assess the impact of the opening of an after-hours general practice clinic on the number of daily low-urgency presentations to the nearby emergency department.

Design, participants and setting: Retrospective time series analysis of emergency presentation data, from the New South Wales Health Emergency Department Information System, for all patients presenting to the emergency department of Wagga Wagga Base Hospital between January 1998 and October 2008.

Main outcome measures: Daily emergency department presentations, before and after the March 2003 opening of the after-hours clinic, of patients triaged as Australasian Triage Scale (ATS) category 4 or 5 (at any time of day, and during the hours of operation of the clinic), and of patients triaged as ATS category 1, 2 or 3 (at any time of day).

Results: After adjusting for long-term trends and weekly and annual cycles, the opening of the after-hours clinic was associated with a daily reduction of 7.04 patients (95% CI, 5.39–8.70) in emergency department presentations with an ATS category of 4 or 5. This represented an 8.2% reduction in total presentations (95% CI, 6.2%–10.2%). Presentations of ATS category 1, 2 or 3 patients rose by 1.36 patients a day (95% CI, 0.36–2.35), representing 1.6% of total presentations (95% CI, 0.4%–2.7%). The impact of the after-hours clinic was best modelled by a gradual permanent change.

Conclusion: An after-hours general practice clinic was associated with a reduction in low-urgency presentations to the emergency department in Wagga Wagga.

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The demand for emergency department (ED) services is increasing in most developed countries.[1] It has been claimed that a significant cause of this increasing demand is "general practice patients" attending the ED rather than their general practitioner.[2] The demand has led to experimentation with alternative sources of care, including after-hours general practice clinics at or near EDs.[3] Many health services are working to have a general practice clinic in or near public hospitals. Literature on the quantitative effect of general practice clinics is equivocal,[4-13] particularly in Australia.

In March 2003, the Riverina Division of General Practice opened the first after-hours general practice clinic (AHC) in the large inland centre of Wagga Wagga, New South Wales. This is not a bulk-billing clinic. The opening of the clinic presented an opportunity to observe any changes in the number of low-urgency patients presenting to Wagga Wagga Base Hospital's ED. In this study, we used time series analysis to quantify the effect of the AHC, redress a gap in the literature and contribute to informed debate about the effect of AHCs on ED presentations.

METHODS

Wagga Wagga has a population of 58 000 in the city and 116 000 in the surrounding area. The AHC is less than a kilometre from the city's only ED at the Wagga Wagga Base Hospital. As the area was previously poorly serviced for after-hours general practice and the nearest alternative ED is 130 km away, our study could avoid confounders that may be seen in urban centres, where the opening of an AHC in an area that already has adequate after-hours services may have little effect. The opening of the AHC was considered a permanent intervention.

We used regression time series analysis (Box 1) to examine the clinic's impact on the number of low-urgency patients presenting to the ED. Patients were considered low-urgency if they were assigned an Australasian Triage Scale (ATS) category of 4 (potentially serious) or 5 (less urgent).[15] De-identified hospital data for the period January 1998 to October 2008 were retrieved from the NSW Health Emergency Department Information System.

Statistical analysis

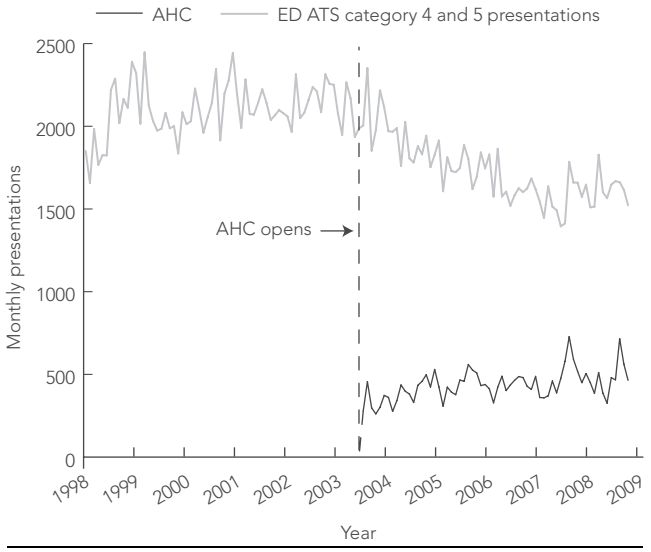
Multiple linear regression using Cochrane–Orcutt transformation[16] was performed in Intercooled Stata 9.0 for Windows (StataCorp, College Station, Tex, USA). The following dependent variables were examined in turn: daily ATS category 4 and 5 presentations to the ED at any time of day, daily ATS category 4 and 5 presentations to the ED during the hours the AHC was open (the AHC was open a total of 27 hours a week), and daily ATS category 1, 2 and 3 (immediately, imminently and potentially life-threatening) presentations to the ED at any time of day.

Explanatory variables coding for a linear trend, day of the week, and month of the year were included. To this statistical model we added an abrupt permanent change intervention variable and then a two-parameter gradual permanent intervention.[17] The abrupt permanent change assumes the number of daily ED presentations changes to a new level from the moment the clinic opens, whereas the gradual permanent intervention model assumes a gradual

1 Time series analysis

- A time series is a set of observations of the same variable through time.
- Many time series, such as daily presentations to an emergency department (ED), demonstrate long-term trends, as well as weekly, seasonal and other cyclical patterns.
- If no allowance is made for these underlying trends and cycles, then pre- and post-intervention testing will often detect changes that may have occurred irrespective of the intervention.[14]
- For example, if the number of ED presentations is examined before and after the opening of a general practice clinic, the value of the clinic may be dismissed if the numbers of presentations to the ED increased after it opened. The clinic may have had an effect, but its effect has been obscured by the underlying trend.
- Time series methods are designed to isolate the impact of an intervention from the underlying trends and cycles. ◆

2 Monthly low-urgency presentations to Wagga Wagga Base Hospital emergency department (ED), and monthly presentations to the after-hours clinic (AHC)



ATS = Australasian Triage Scale. ◆

3 Descriptive statistics for daily presentations to the emergency department (ED) and after-hours clinic (AHC), before adjusting for contemporaneous trends and cycles

	Study days	Daily presentations			
		Range	Mean	SE	SD
Daily ED presentations (ATS category 4 and 5) at any time of day					
Before AHC	2007	35–105	67.9	0.24	10.60
After AHC	1950	23–103	56.0	0.24	10.60
Daily ED presentations (ATS category 4 and 5) during AHC hours					
Before AHC	2007	4–72	20.6	0.25	11.20
After AHC	1950	1–71	15.9	0.22	9.56
Daily ED presentations (ATS category 1, 2 and 3) at any time of day					
Before AHC	2007	5–43	18.4	0.12	5.54
After AHC	1950	7–68	32.4	0.21	9.14
AHC presentations	1950	1–75	14.3	0.24	10.60

ATS = Australasian Triage Scale. ◆

change to reach the same level as observed in the abrupt permanent change.

RESULTS

During the study period, there were 345 465 presentations to the ED. After the opening of the AHC in March 2003, monthly low-urgency presentations appeared to decline, while the number of consultations at the AHC appeared to grow (Box 2).

The mean and range of daily presentations to the ED before and after the opening of the AHC are shown in Box 3. On average, there were 67.9 presentations to the ED per day of patients triaged as ATS category 4 or 5 before the clinic opened, and 56.0 presentations per day after it opened.

After adjusting for the long-term trend and weekly and annual cycles, daily presentations to the ED at any time of day of patients triaged as ATS category 4 and 5 fell by 7.04 patients a day (95% CI, 5.39–8.70) (Box 4) after the opening of the AHC. This represents an 8.2% reduction in total ED presentations (95% CI, 6.2%–10.2%).

During the specific hours that the AHC was open, presentation of patients triaged as ATS category 4 or 5 fell by 2.07 patients a day (95% CI, 1.43–2.72).

The opening of the AHC was also associated with an increase in the number of patients presenting to the ED triaged as ATS category 1, 2 or 3; daily presentations of these patients rose by 1.36 patients a day (95% CI, 0.36–2.35). This represented 1.6% of total presentations (95% CI, 0.4%–2.7%).

Modelling the intervention as a gradual permanent change was a significant improvement over the abrupt permanent change in all the models tested (eg, model of daily ATS category 4 or 5 presentations: F change statistic, $F_{1,3937} = 138.00$, $P < 0.0001$). The parameters for the gradual permanent change models are available from the authors.

DISCUSSION

After allowing for underlying trends and weekly and seasonal cycles, we found strong evidence of an association between the opening of the AHC and a reduction in presentations of low-urgency patients to the ED in Wagga Wagga. After the clinic opened, the number of low-urgency ED presentations fell by seven patients a day. Although this drop should reduce the workload of the ED, the fact that it was only low-urgency presentations that decreased means the reduction in workload would be less than the 8.2% reduction in total daily ED presentations.

The magnitude of the observed change is similar to the 8.9% observed in the Netherlands[7] but greater than the modelled estimates of 2%–3% in Fremantle, Western Australia,[2] and 2.5% (95% CI, 2.4%–2.6%) across the Perth metropolitan area.[5] The larger impact observed in Wagga Wagga could be associated with the antecedent conditions, as a larger impact is likely where there is limited existing after-hours GP

4 Regression parameters for abrupt change intervention time series models of the daily change in emergency department presentations after the opening of the after-hours clinic (AHC)

Model	Presentations per day, coefficient (95% CI)	SE	T*	*P*>t*
ATS category 4 and 5, at any time of day	− 7.04 (− 8.70 to − 5.39)	0.843	− 8.35	< 0.0001
ATS category 4 and 5, during AHC hours	− 2.07 (− 2.72 to − 1.43)	0.33	− 6.33	< 0.0001
ATS category 1, 2 and 3, at any time of day	1.36 (0.36 to 2.35)	0.51	2.67	0.008

ATS = Australasian Triage Scale. * The T value is the test statistic and *P* is the probability of observing such a value due to random chance, assuming the clinic has no effect. ◆

access. Before the clinic opened, after-hours general practice services in Wagga Wagga were extremely limited and the GP to patient ratio relatively low (1 : 1401). Many low-urgency patients may therefore have attended the ED because it was the only available option. Hence, our estimates are likely to be closer to the maximal response that may be expected from AHCs.

This dependence on antecedent conditions will result in variable responses to clinics between sites, and will limit the ability to extrapolate results. To dismiss or promote the value of AHCs on the basis of a study from one geographic region would be ill advised. There are also likely to be differences between the magnitude of the effect in metropolitan and rural centres.

In Australia, the effect of AHCs is often examined in the context of their ability to reduce access block, where their value is often considered limited.[3,4] This approach may undervalue AHCs, if the benefits of diverting low-urgency and general practice patients to primary care are not also considered. In a comparison of the costs and quality of care between primary and specialist care, populations using primary care as their first source of care had lower health expenditures than other groups.[18,19] This is further demonstrated by the observation that employing GPs within the ED to attend to low-acuity patients reduced costs by around 40% relative to hospital doctors.[19,20] This reflected GPs' less frequent requests for investigations and referrals, and was achieved with no differences in patient satisfaction or clinical outcome. General practice clinics may increase patient satisfaction, as the shorter waiting times frequently observed in general practice, compared with the ED, have been associated with increased patient satisfaction.[21]

The aim of this study was to examine the effect of the AHC on low-urgency ED presentations. Clearly, not all patients with an ATS category of 4 or 5 will be suitable for general practice (eg, a patient with broken digits).[3] The aim is to direct the maximum number of people to the most appropriate care. Patients that chose to attend the AHC were not diverted away from care but rather offered an alternative service. As it is not a bulk-billing clinic, the patients attending the AHC showed, by their willingness to purchase the service, that they believed the net benefits were greater than the benefits of attending the ED. Even in the presence of substantial costs to patients, the AHC had an effect. All else being equal, the effect of bulk-billing clinics may be even greater.

The use of time series analysis assisted in adjusting the effect of the intervention for underlying trends and cycles. The estimate of the intervention effect depends heavily on the statistical model's ability to remove the trends in the data and reduce the residuals to "white noise". This is often achieved by using autoregressive integrated moving average (ARIMA) models,[22] but our data could not be modelled satisfactorily by standard or seasonal ARIMA models. However, the use of indicator variables gave a high level of flexibility to the cyclical adjustment, and the Cochrane–Orcutt estimation[16] adjusted the linear model for serial correlation in the error terms.

We found that the impact of the AHC was gradual and permanent. The gradual changes presumably arose as the community became aware of the facility. This is an important finding for future studies on the effect of AHCs, as short-period analyses may fail to demonstrate any effects.

With intervention studies such as this, it is important to try to account for contemporaneous changes, such as alterations in bulk-billing rates or GP or after-hours service availability. Our time series model included a long-term trend component that provided some protection against gradual contemporaneous processes. During the study period, the city's health care, with the exception of the AHC opening, remained largely unchanged. Bulk-billing rates were relatively constant, and the number of GPs increased gradually. This trend was also being observed before the opening of the clinic. When GP numbers were included as a linear trend, it was not significant. It appears that the long-term trend component of the model already adequately described the slow increase in GPs and probably other slow-change processes.

This study clearly demonstrates that the opening of an AHC can be associated with substantial reductions in the number of low-urgency presentations to nearby EDs. The challenge now remains to identify the geographical, demographic and institutional factors that may affect the magnitude of this response. Areas with low availability of after-hours general practice services and few alternatives to the ED will likely see a larger response from the opening of an AHC.

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COMPETING INTERESTS

None identified.

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