



Inclusion of general physicians in the multidisciplinary treatment team for epilepsy may lead to an economic benefit

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ABSTRACT

Introduction: The purpose of this study was to compare epileptic seizure control and economic impact in patients with epilepsy between when they were seen by general physicians (GPs) versus epilepsy specialists.

Method: We began distributing a booklet we named the “Epi Passport” to patients with epilepsy in December 2014 to share information within the regional epilepsy network of GPs, epilepsy specialists, and patients (Gep). We compared seizure control and household income levels before and after the introduction of this booklet.

Results: There was no significant difference in seizure control between patients who saw specialists or GPs ($P = 0.215$). Significant increases in household income were seen among 134 patients (36.6%) in the post-Epi Passport period who were primarily seen by GPs ($P < 0.001$). However, 35 patients (9.6%) showed a decrease in income between periods, and 197 patients (53.8%) showed no change. Age of 20–39 years old was significantly associated with increases in household income ($P = 0.0287$).

Conclusion: After the introduction of the Epi Passport, about one-third of the patients with epilepsy who were mainly seen by GPs in their community showed an increase in household income. There was no difference in seizure control among those who saw a GP or a specialist. Inclusion of GPs in the multidisciplinary treatment team for epilepsy may lead to increased patient income because of the fact that patients can manage their epilepsy in their community using their GP.

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1. Introduction

A multidisciplinary team is important in the treatment of epilepsy [1]. This multidisciplinary approach has been shown to be valuable in the diagnosis of epilepsy and the development of a treatment strategy, including determining the need for surgery or addressing sociopsychiatric issues. The importance of including the general physician (GP) as part of the care team is gaining attention [2–4]. However, few studies have examined the inclusion of the GP in the multidisciplinary treatment team for patients with epilepsy [5].

The worldwide prevalence of epilepsy is 0.24–1.4% [6,7], although differences may exist between developing and developed countries [8]. Based on this prevalence data, among the 1 million people who live in the western medical service area of Shizuoka, Japan, approximately 10,000 people are estimated to have epilepsy. Because there

are 1000 GPs in this area, it could be estimated that each GP has about 10 patients with epilepsy. This estimate is similar to estimates from a report in the United Kingdom [4]. However, only 106 patients with epilepsy or possible epilepsy were referred from GPs to our epilepsy center in 2010 [9]. Thus, it appears that some patients with epilepsy are only seen by GPs, and some are only seen by specialists [10]. Extrapolating from these figures and a report from the US Commission for the Control of Epilepsy [11], it is possible that many people with epilepsy are not adequately treated because treatment services in their areas are not well-organized [2]. Although some healthcare providers may think that patients with epilepsy should only be seen by specialists [12], a multidisciplinary treatment team that includes both specialists and GPs is ideal [13]. Patients with chronic diseases, such as epilepsy, can save time and money by staying within their community medical services and seeing their local GP [14]. However, to obtain the latest medical care, they may also need to see a specialist [15]. Several tools can be used to share personal information and more efficiently manage care between different physicians, such as vaccination cards [16] and maternal-child handbooks [17]. Although these tools are simple, their efficacy has been shown [18]. Therefore, we introduced a booklet for GPs, epilepsy specialists, and patients' networks to help report a

Abbreviations: GP, general physician; Gep, GPs–epilepsy specialists–patients; ASM, antiseizure medication.

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patient's current condition. We thought that patients with epilepsy may benefit socially while at the same time be able to control their seizures using this type of booklet across healthcare providers.

We hypothesized that the inclusion of GPs in the multidisciplinary team of GPs–epilepsy specialists–patients (Gep) for epilepsy may lead to an economic benefit for patients with good seizure control as they might be able to stay within a healthcare network in their local area and save costs related to transportation. The primary goal of this study was to compare epileptic seizure control and economic benefit to patients before and after the introduction of this booklet. The secondary goal was to count the number of patients referred to specialists, patients referred back to GPs, and the number of GPs referring these patients before and after the introduction of this booklet.

2. Methods

2.1. Study design

Participants in this cross-sectional, observational, nonrandomized study were identified via a retrospective chart review of patients with epilepsy seen between January 2011 and November 2018 at the Comprehensive Epilepsy Center, Seirei Hamamatsu General Hospital (Hamamatsu, Japan).

2.2. Ethics approval

Patients or the parents of pediatric patients provided written informed consent for publication of case details. The ethics committee at Seirei Hamamatsu General Hospital approved this study.

2.3. Booklet (Epi Passport)

We began distributing the booklet, which we named the “Epi Passport” (Fig. 1), to patients with epilepsy in December 2014 at the comprehensive Epilepsy Center, Seirei Hamamatsu General Hospital, a specialist treatment center. The Epi Passport is a tool designed to share information within the regional epilepsy network of the Gep. Three items are recorded in the booklet: 1) the date of visit to the GP or to our facility, 2) the presence or absence of an epileptic seizure, and 3) the presence or absence of antiseizure medication (ASM) adjustments, along with the signature of the physician who saw the patient. Both seizure occurrence and ASM use and changes are recorded using checkboxes in the booklet. The general visit cycle to the GP in Japan ranges from once a month to every 3 months, and, as shown in Fig. 1, each booklet contains 5 squares. All Epi Passports were first used during visits to specialists at our hospital. After the remaining 4 squares were completed at GP visits, patients visited our hospital again to evaluate current seizure control and undergo an electroencephalogram and/or magnetic resonance imaging. The Epi Passports were kept by the patients and were brought with them back and forth to appointments.

2.4. Outcome measurements

We compared seizure control, household income level, number of patients being referred to specialists, number of patients being referred back to GPs, and number of GPs referring patients to specialists, all within the Gep network, between the pre-Epi Passport period (January 2011 to December 2014) and the post-Epi Passport period (January 2015 to November 2018).

2.4.1. Seizure control among patients seeing GPs

We compared seizure frequency when we referred patients back to GPs and when they returned from GPs to us following the use of the Epi Passport. General physicians see patients every 1 to 3 months in Japan, and generally, specialists see patients every 6 to 18 months. Therefore,

the maximum period between visits to a specialist was 18 months. We included 1) patients seen in the Gep network with at least 18-month follow-up periods and 2) patients who had been seen at our epilepsy center for more than 1 year to control seizures. Patients with follow-up periods of 17 months or less were excluded. When a patient visited our epilepsy center several times within follow-up periods in the Gep network, we used the latest data. We evaluated seizure outcome when we referred patients back to GPs and when a patient visited our epilepsy center following the introduction of the Epi Passport. We enrolled patients with generalized tonic–clonic seizures, focal onset awareness seizures with motor manifestation, focal onset impaired awareness seizures, and focal to bilateral tonic–clonic seizures. Because we included all seizure types, we did not regard myoclonus and aura (nonmotor focal onset awareness seizures) as epileptic seizures. We divided seizure outcome into four levels using a modified version of the International League Against Epilepsy classification [19]: level 1 (seizure-free); level 2 (1–3 seizure days/year); level 3 (4 seizure days/year to 50% reduction); and level 4 (<50% reduction in seizures).

2.4.2. Patients' economic status

We compared patients' upper limit of medical expenses between the pre-Epi Passport period and post-Epi Passport period as we could not obtain individual income information. In Japan, patients with epilepsy can benefit from a system that determines the upper limit for self-payment of medical expenses according to their household income. For example, if a family earns less than ¥800,000 (about \$7300 USD) annually, the upper limit for self-payment is ¥2500 (about \$23). However, this service is not available for families whose annual income is more than ¥8,100,000 (about \$74,000). Approximate annual income was determined based on use of self-payment for medical services. We divided household income level into 6 levels: level 1 (no income), upper limit ¥0; level 2 (<¥800,000/year), upper limit ¥2500/visit; level 3 (¥800,000 to <¥1,600,000/year), upper limit ¥5000/visit; level 4 (¥1,600,000 to <¥3,700,000/year), upper limit ¥10,000/visit; level 5 (¥3,700,000 to <¥8,100,000/year), upper limit ¥20,000/visit; and level 6 (>¥8,100,000/year), no upper limit. For levels 4 and 5, the upper limit was decided based on the amount of local tax payment, so the incomes here are approximations.

2.4.3. Number of referred patients, number of patients referred back to GPs, and number of referring GPs

We counted the number of patients who were referred to a specialist, number of patients referred back to GPs, and the number of GPs who referred patients to our facility between the pre-Epi Passport period and the post-Epi Passport period as secondary outcome measurements.

2.4.4. Statistical analysis

We used Mann–Whitney's *U* test and multivariate logistic regression analysis to compare clinical and economic data of patients before and after the introduction of the Epi Passport. Statistical significance was set at $P < 0.05$. All analyses were done using JMP® 10 (SAS Institute Inc., Cary, NC, USA).

3. Results

3.1. Clinical information

We issued Epi Passports to 564 patients with epilepsy from December 2014 to November 2018. Among the 564 patients who were issued the Epi Passport, 336 patients met the inclusion criteria (mean age 35.5 years, standard deviation 14.2, range 11–79, 191 females and 145 males). The follow-up period ranged from 18 months to 48 months (mean period 30.0 months, standard deviation 11.2). Among the enrolled patients, 201 (102 females and 99 males) were with diagnosed

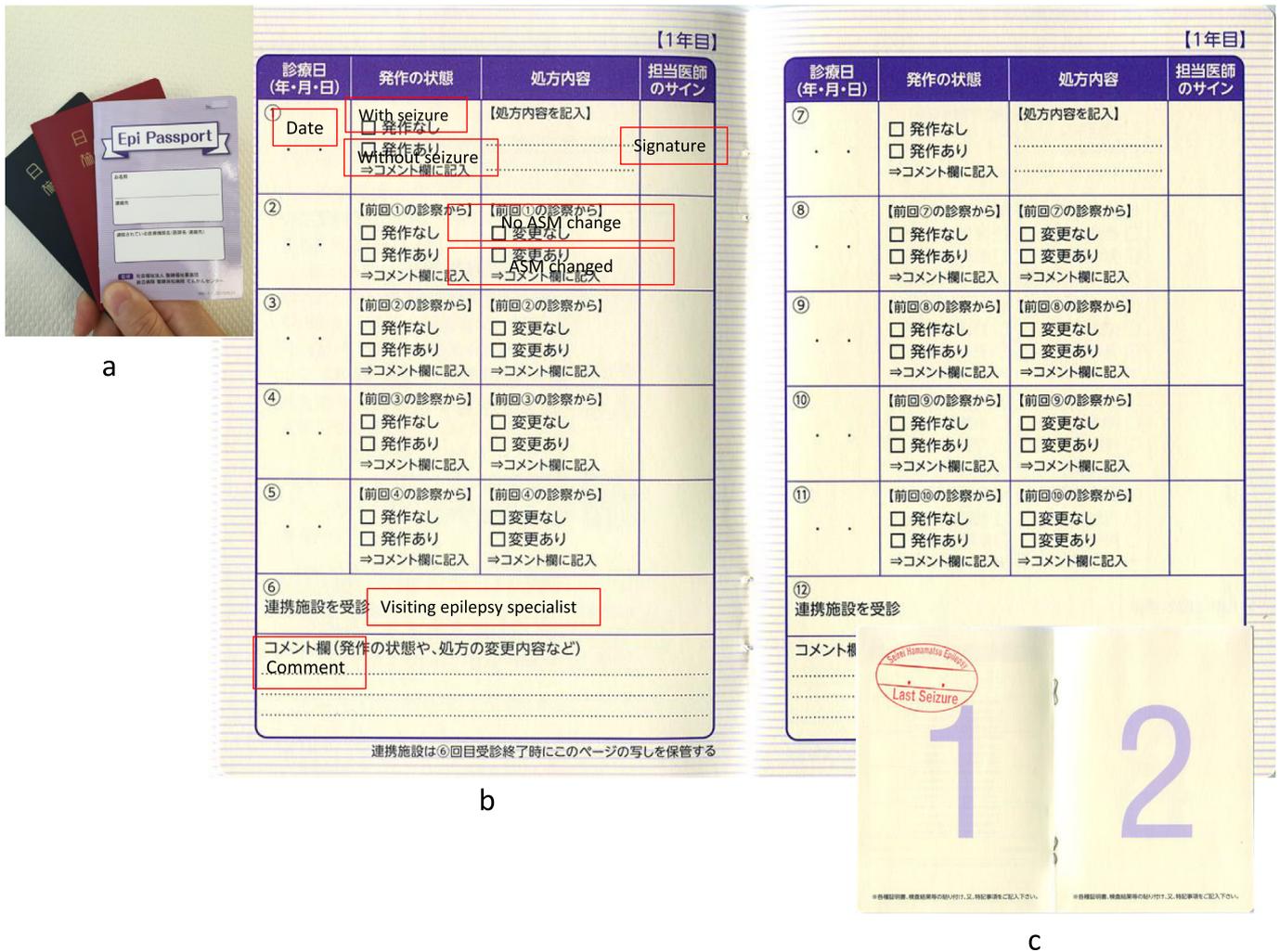


Fig. 1. The Epi Passport. We used the same size document as a travel passport (a). Each step has check boxes for the date of the patient's visit, occurrence or nonoccurrence of seizures, medication use and changes, and the signature of the physician who saw the patient (b). Other blank pages are used for physicians to communicate with each other (c). Antiseizure medication; ASM.

focal onset epilepsy; 107 (78 females and 29 males) were with diagnosed idiopathic generalized epilepsy; 23 (9 females and 14 males) were with diagnosed symptomatic generalized epilepsy, and 5 (1 female and 4 males) were unclassified. Table 1 shows the clinical information for patients.

3.2. Outcome measurements

3.2.1. Seizure control

Seizure frequency was not significantly different between pre-Epi Passport and post-Epi Passport introduction (P = 0.215). It can be

Table 1
Clinical information of participants.

Patients' number (females, males)	366 (191 females, 145 males)
Age	Mean 35.5, Std Dev.14.2
Follow-up period	Mean 30.0 months, 18–48 months, Std dev 11.2
Epilepsy	
Focal onset	201 (102 females, 99 males)
IGE	107(78 females, 29 males)
SGE	23 (9 females, 14 males)
Unclassified	5 (1 femae, 4 males)

Std Dev, standard deviation; IGE, idiopathic generalized epilepsy; SGE, symptomatic generalized epilepsy.

said that the level of seizure control by GPs and by specialists was about the same, as GPs mainly saw the patients after introduction of the Epi Passport. Nine patients (2.46%) deteriorated during the follow-up period (6 patients deteriorated from level 1 to 2, 2 patients from level 1 to 3, and one from level 1 to 4). Among them, the GPs prescribed ASMs for 5 (55.5%), and the other 4 were immediately referred to us when followed up in the Gep network.

3.2.2. Patients' economic status

Mean household income level was 2.14 before the Epi Passport introduction and 2.83 after the Epi Passport introduction. Significant increases in household income were seen among 134 patients (36.6%) in the post-Epi Passport period who were primarily seen by GPs (P < 0.001). However, 35 patients (9.6%) showed a decrease in income from the pre-Epi Passport period to the post-Epi passport period, and 197 patients (53.8%) showed no change. Age was significantly associated with increases in household income only for those aged 20–39 years (P = 0.0287) in the Gep network. There were no statistically significance differences in sex, epilepsy type, and seizure control with respect to household income between the pre- and post-Epi Passport periods (Table 2).

3.2.3. Number of patients referred to specialists, number of patients referred back to GPs, and number of GPs referring to specialists

From the pre- to post-Epi Passport period, the number of patients referred from the GP to specialists increased from 668 to 903 patients,

Table 2
Economic status level and factors related to household income.

	P-value
Economic status when referring (Pre-Epi Passport) Level 2.14	
Economic status when referred (Post-Epi Passport) Level 2.83	
134 (36.6%) increase, 35 (9.6%) decrease	<0.001*
Age	
<19	
20–39	0.0287*
>40	0.1572
Sex	
Male	
Female	0.741
Epilepsy	
Focal	
IGE	0.3027
SGE	0.168
Seizure control when referring (Pre-Epi Passport)	
Level 1	
>Level 2	0.6467
Seizure control when referred (Post-Epi Passport)	
Level 1	
>Level 2	0.5125

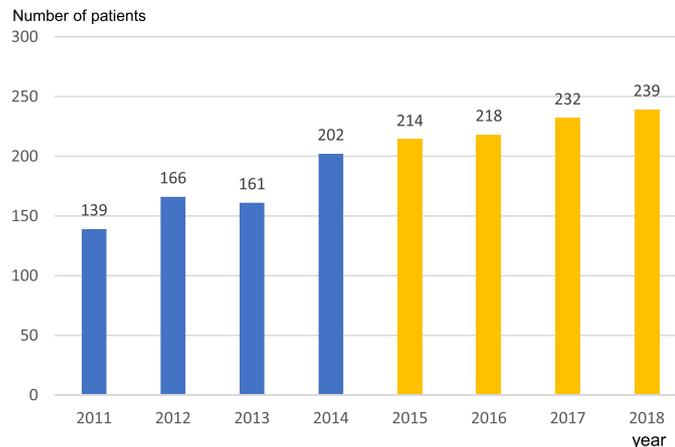
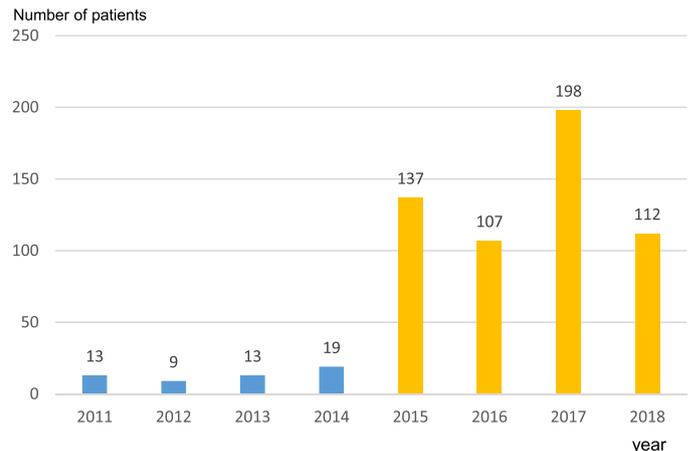
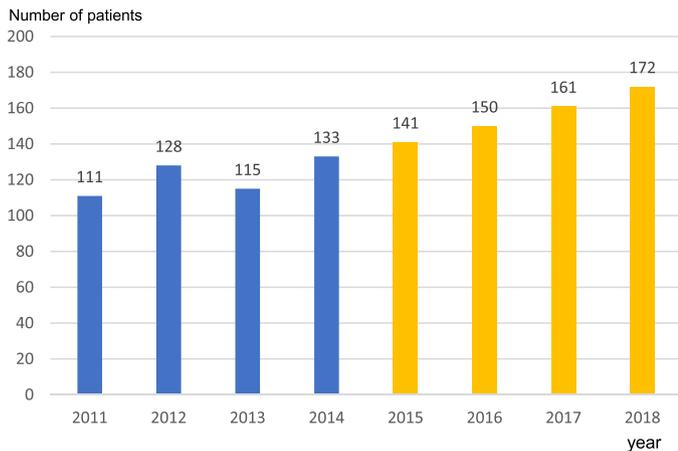
IGE, idiopathic generalized epilepsy; SGE, symptomatic generalized epilepsy.

* Statistical significance p value <0.05.

specialists' referrals to GP increased from 54 to 564, and number of GPs referring to our facility increased from 487 to 624 patients. **Table 3** shows the number of referred patients, number of patients referred back to GPs, and number of GPs making referrals per year.

Table 3

Annual number of patients referred to specialists (3a), number of patients referred back to GPs (3b), and GPs referring patients to specialists (3c) from the pre-Epi Passport period to the post-Epi Passport period.



4. Discussion

There was no difference between specialists and GPs in terms of seizure control in patients with epilepsy. As both specialists and nonspecialists have experience treating chronic diseases, the use of a specialist or nonspecialist may not have an impact on disease as long as the disease is stable [20].

It is possible that epilepsy managed primarily by local GPs and secondarily by epilepsy specialists may impact patients' income. Results showed that patients' household income significantly increased in the post-Epi Passport period for 36.6% of patients when they were primarily seen by GPs. We considered that the increase of the patients' household income is not a direct effect of the Epi Passport but rather based on the inclusion of GPs in the epilepsy treatment. Maximizing a patient's participation in their medical care to remain in their own social setting minimizes stress and distress for patients' family and caregivers [13]. When patients are seen in the Gep network, they are able to stay in their community longer without physician visits interfering with work activities, daily living, and private time and money, and they do not need frequent visits to specialists who cost more money and take more time to get an appointment to see. Among patients in our study in the post-Epi Passport period, patients aged 20–39 years were most likely to benefit economically. Once epilepsy has been controlled by a specialist, the specialist should refer the patient back to the GP, so as to minimize the impact of their disease.

The number of patients referred to specialists, the number of patients referred back to GPs, and the number of GPs referring those patients increased from the pre-Epi Passport period to the post-Epi

Passport period. The reason for this finding is likely due to the high number of patients in the Gep network.

We hypothesized that, after introduction of the Epi Passport, the inclusion of GPs in the multidisciplinary treatment team for epilepsy may have an economic benefit for patients with good seizure control, as they can stay within their own community for treatment and pay less for visits to GPs than specialists. In some patients, income was significantly impacted by the higher use of GPs.

One limitation of this study was that we could not determine accurate individual income levels. Therefore, we used the upper limit of medical expenses indirectly in this study. Future studies should examine actual income with the cooperation of governmental agencies. We would like to emphasize that many patients with epilepsy in this study were in the level 2 household income group. We should consider not only their medical concerns but also economic factors when we work with these patients. Another limitation is that we cannot deny the relationship of temporal elements in this study. Future prospective and randomized studies are needed in groups in the Gep network and groups that continue to follow up with specialists. Finally, this study did not examine the efficacy of the Epi Passport, but rather changes that occurred before and after its introduction.

5. Conclusion

After the introduction of the Epi Passport, about one-third of patients with epilepsy who were mainly seen by GPs in their community showed an increase in household income. There was no difference in seizure control among those who saw a GP or a specialist. Inclusion of GPs in the multidisciplinary treatment team for epilepsy may lead to increased patient income.

Compliance with ethical standards

Conflicts of interest

The authors report no conflicts of interest concerning the patients or methods used in this study or the findings specified in this paper. We received Epi Passport materials from UCB Japan. All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or nonfinancial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Contributions

Acquisition of data: AF, NI, KS, MN, HE, and TO. Analysis and interpretation of data: AF, NI, TO, and HE.

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