

# Monitoring the Compliance of Sentinel General Practitioners in Public Health Surveillance: Which GPs Persevere?

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*Objectives.* This study was undertaken to develop a novel approach to measure compliance of general practitioners (GPs) in sentinel public health surveillance. More specifically, its purpose was to determine the characteristics in the SGP's profile which can be objectively associated with perseverance.

*Methods.* Since 1984, the French sentinel network has collected weekly data on eight communicable diseases, involving volunteer SGPs. In this study, 'compliance' was defined as the length of time during which a SGP complies with a given theoretical surveillance protocol. This left-censored variable was computed from individual SGP's connection time series. Kaplan-Meier method was used to estimate the compliances survival distribution for all the SGPs (1824 SGPs who have been part of the network, at one point or another, since 1984). Using Cox regression model, a prospective survey on the 376 most recent recruits allowed us to select the characteristics associated with a longer compliance. Sensitivity analyses were carried out using the bootstrap method.

*Results.* According to the maximum number of silences allowed by the given theoretical protocol, median compliances varied between 11.7 (95% CI: 11.1–12.3) and 38.8 (95% CI: 35.7–40.7) months. In multivariate analyses, we observed long compliances for SGPs whose main motivation for being involved in the network was an interest in epidemiology and SGPs with <5 or ~20 years seniority. On the other hand, interest in local epidemiological surveys and previous experience with other surveillance networks were associated with short compliances. We found no statistical association between compliance and computing experience, having a medical secretary, a particular feeling of being a 'public health actor', or the desire to belong to a GPs' network.

*Conclusion.* We have shown our longitudinal method to be an efficient tool for monitoring non-compliant SGPs with respect to given surveillance protocols. Furthermore, this approach allows us to select out of the SGPs' profile the characteristics which are associated with a longer compliance. This regression model could be further refined by extending the SGPs' profile. The additional variables to be taken into account in this profile could be identified through a complementary sociological approach. Our work addresses the question of understanding what determines the motivation of GPs to participate in public health surveillance. This question is essential if we hope to turn general practice information systems into genuine public health surveillance tools.

*Keywords:* public health surveillance, general practitioners, surveillance system, motivations

Public health surveillance systems have been collecting data from general practitioners (GPs) in North America and Europe for several years.<sup>1,2</sup> As 'front line observers' for community surveillance,<sup>3,4</sup> their role in the surveillance of communicable diseases has been recognized for more than a decade.<sup>5–7</sup> Recently, the surveillance of adverse reactions,<sup>8</sup> drug prescriptions<sup>9</sup> and chronic diseases<sup>10</sup> has been researched using GPs' data.<sup>11,12</sup>

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When establishing a continuous surveillance system with sentinel general practitioners (SGPs), the preliminary objectives are the recruitment of SGPs who are likely to supply high quality data,<sup>13</sup> and the minimization of their turnover rate. Several sentinel systems involve unpaid volunteer SGPs.<sup>14–16</sup> Naturally, these are likely to experience high turnover rates. In this context, it is important to point out that the indirect costs of maintaining an SGP within the system (regular feedback, personal reminder operations ...) are far lower than those related to the recruitment of a new participant (recruitment campaigns in the medical

press, training of new recruits in surveillance protocols ...). This concern necessarily leads to an attempt towards *a priori* identification of profiles of compliant SGPs and the development of methods to carry out such identifications.

Since 1984, a computerized network of voluntary and unpaid SGPs has been performing the surveillance of frequent communicable diseases in the general population, as part of the French Communicable Diseases Network (FCDN). To date, these SGPs have connected with the host computer more than 150 000 times; since the average connection time is 12 minutes, this figure translates into a total workload of 30 000 hours. This significant additional work provided for free by private GPs is another reason to try to understand why some of them remain sentinels for a long time, and identify possible improvements to the system in order to ensure long term collaborations.

The identification of the typical profile of compliant SGPs would facilitate targeting of recruitment campaigns to improve their efficiency, and allow the system to be adjusted to take into account the surveillance concerns of SGPs. To achieve this goal, we set up a method of monitoring the compliance of SGPs. Participation data were examined using the statistical tools of survival analysis. This method was set up (i) to give accurate estimates of SGP turnover and to describe the characteristics of the participating sentinel sample over time; (ii) to identify which of the practitioners' characteristics could be predictive of good compliance.

## MATERIAL AND METHODS

The sentinel system of the FCDN has five main objectives: description of attitudes (surveillance of HIV screening test prescriptions in general practice), epidemiological description of communicable diseases without any vaccination programme in France (e.g. chickenpox), evaluation of immunization programmes (mumps, measles), outbreak detection and alert (influenza syndrome, acute diarrhoea), and description of annual trends for sexually transmitted diseases (viral hepatitis, male urethritis). The FCDN SGPs are also occasionally used as a panel to study other epidemiological problems of interest in general practice.<sup>17</sup>

The SGPs must declare and describe all cases of the eight diseases under surveillance (influenza-like disease, acute diarrhoea, measles, mumps, chickenpox, viral hepatitis, male urethritis, HIV test prescriptions) to the FCDN database. They may log onto the system either with their personal computer via a modem, or through their home videotex terminal (MINITEL™, readily available from the French telecommunications company).

The SGPs are requested to log on to the host computer at least once a week, at their own convenience. If they have not encountered any of the diseases under surveillance, they declare 'zero case'. When an SGP has not logged on for >12 days, the cases that he/she reports for this 'silent period' are not taken into account. This late connection (after a 'silent period' of >12 days) is considered as the beginning of a new surveillance period. The SGPs must declare their absences from work (e.g. vacations or continuing medical education) to the FCDN administrator. An ORACLE™ database records and updates continuously each SGP's time series of connections and number of days of effective surveillance.

Over the last 11 years, more than 1800 GPs have been recruited through 'Sentinelles' (the network's quarterly bulletin which is mailed to all French GPs) and through the three French medical daily newspapers, in order to maintain a sample of approximately 500 data providers (i.e. 1% of all GPs in France). While some of them have remained within the system since the inception of the FCDN in 1984, others dropped out of it after a few months.

For each SGP, an individual criteria of good quality participation was based on a 'theoretical' surveillance protocol defined as  $N$  silences of more than  $\delta$  days (where  $N \geq 1$  and  $\delta \geq 12$ ). We defined the 'compliance' of an SGP as the time between his/her first connection to the database and the date of his/her  $N^{\text{th}}$  connection followed by a silence of more than  $\delta$  days. This compliance is computed after the first month of activity to allow for the familiarization of the SGPs with the surveillance protocol (including case definitions) and the use of the FCDN videotex server.

This compliance is a left-censored time variable, we therefore used survival analysis with a point in time set at 1 January 1995. We estimated the compliance of each of the 1824 SGPs recruited by the FCDN between 1 November 1984 and 31 December 1994. Kaplan-Meier method<sup>18</sup> was used to estimate the survival distribution of these SGPs' compliance, according to different 'theoretical' protocols.

All SGPs recruited between 1 July 1992 and 31 December 1994 were studied prospectively ( $n = 376$ ). A self-administered questionnaire was mailed to them when they joined the sentinel network. The following variables were collected: age, sex, seniority, main motivation for participating in the sentinel network ('to be a public health actor', 'a scientific interest in epidemiology', or 'to belong to a GPs' network'); whether SGPs had or lacked any of the following: computerized patient records, medical secretary, acquaintance with other SGPs, membership of a medical association,

supplementary medical diploma, continuing medical education during the last 12 months of any kind, training and previous experience in public health activities (epidemiological surveys, clinical trials, surveillance networks), interest in regional epidemiological surveys (as opposed to the national surveillance proposed by our network), previous use of Minitel and/or a database server, interest in using future multimedia home servers, satisfaction in using the FCDN server.

The log-rank test was used in the univariate analysis to study the association between compliance and each of these variables. For the multivariate analysis, all the variables were entered into a Cox proportional hazards model<sup>19</sup> and were backward selected (stay level = 0.15). Relative risks (RR) and 95% confidence intervals (95% CI) were computed from the estimated parameters of the final regression model. Each SGP was assigned an individual compliance score based on these same parameters. Three methods were used to study the adjustment of the model: the study of the best variable selection as proposed by Furnival and Wilson,<sup>20</sup> the study of deviance and martingal residuals<sup>21</sup> and the measure of the proportion of variance explained by the model.<sup>22</sup> To evaluate the stability of the regression model, we studied the median and interquartile (25th-75th percentile) of its estimated parameters when fitted to 100 random samples obtained with the bootstrap method.<sup>23</sup> We also studied the selection frequency of all variables by fitting a backward regression model (with a same stay level) to these 100 random samples. For all these analyses, the theoretical protocol was defined as  $N = 4$  and  $\delta > 12$ .

## RESULTS

Figure 1 shows the survival estimates of the 1824 SGPs' compliance for  $N = 4$  silences with  $\delta > 12$  or 30 days (the maximum length of the 'silence period' allowed in our protocol, and an arbitrary longer period of a month). The respective median survival times were 11.7 months (95% CI: 11.1-12.3) and 38.8 months (95% CI: 35.7-40.7).

Table 1 shows the description of the 376 SGPs included in the prospective study, as well as the results of the log-rank test for each of these variables. In univariate analysis, three variables were significantly associated with better compliance: survival estimates at 6 months ( $SE_6$ ) were higher for SGPs whose seniority was  $\leq 5$  or  $\geq 20$  years ( $SE_6 = 60$  and 48 respectively,  $P = 0.05$ ), or whose main motivation was a scientific interest in epidemiology ( $SE_6 = 55.3$  and 51.4,  $P = 0.03$ ), or who had not previously participated in other sentinel networks ( $SE_6 = 55.5$  and 30,  $P = 0.05$ ). Since the

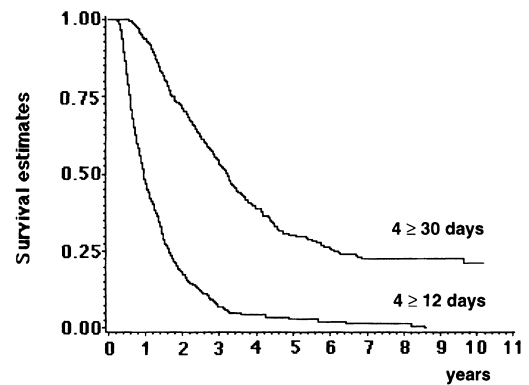


FIGURE 1 Survival estimates of the compliance of all sentinel general practitioners recruited by the French Communicable Disease Network between 1984 and 1994 ( $n = 1824$ ), according to different definitions of compliance: respectively no more than four silences  $\geq 12$  or 30 days

survival estimates for SGPs with a seniority  $< 5$  years were close to those of SGPs with a seniority  $> 20$  years, these two seniority groups were collapsed. This allowed for an increase of this subsamples size for the purposes of the multivariate analysis.

The multivariate analysis showed that seniority of  $\leq 5$  or  $\geq 20$  years (RR = 0.67, 95% CI: 0.47-0.95) and main motivation of an interest in epidemiology (RR = 0.65, 95% CI: 0.46-0.92) were associated with longer compliance while previous experience in other surveillance networks (RR = 2.1, 95% CI: 1.1-3.8) and interest in regional epidemiological surveys (RR = 2.1, 95% CI: 0.99-4.6) were associated with shorter compliance (Table 2). Giving the respective value +1 (or 0) to an SGP with (or without) the first two characteristics and -1 (or 0) to an SGP with (or without) the last two, the individual score assigned to each SGP was an integer ranging between -2 and +2. Their respective median compliance estimates ranged between 5.2 and 12.4 months. The SGPs with negative, nil or positive scores had respective median compliances of 5.7, 6.2 and 9.7 months respectively ( $P > 10^{-3}$ , Figure 2).

The multiple correlation coefficient was  $R = 0.26$ , which indicated a proportion of variance predicted by the regression model as low as 6.7%. The variables which were selected in the multivariate analysis were the best subset selection of four variables. They were also those which were the more often selected when the same regression procedure (Cox model with backward selection) was applied to 100 bootstrap samples (Table 3). The parameter estimates of the final regression model were always included in their interquartile

TABLE 1 *Distribution of the individual variables and compliance survival estimates at 6 months for all the sentinel general practitioners (SGPs) recruited since July 1992*

Variables	Survival estimates at 6 months		
	% (n = 376)	Yes / no (%)	P-value
age $\geq$ 40	49.1	51.6 / 52.1	0.97
seniority between 5 and 20 years	64.6	48.0 / 60.0	0.05
male sex	87.5	55.2 / 52.0	0.46
computer equipment	36.4	54.1 / 51.9	0.94
medical secretary	37	58.0 / 55.0	0.90
acquaintance with other SGPs	12.5	38.9 / 55.4	0.83
membership of a medical association	60.5	51.8 / 56.0	0.10
supplementary medical training	48.7	51.3 / 55.2	0.65
continuing medical education/12 last months	84.8	50.3 / 54.8	0.27
training in public health	17.1	54.6 / 49.0	0.39
previous experience in other surveillance networks	9.3	30.0 / 55.5	0.05
clinical trials	17.6	50.0 / 54.4	0.68
epidemiological surveys	19.5	41.5 / 57.1	0.22
main motivation 'to be a public health actor'	37.5	54.1 / 52.6	0.35
scientific interest in epidemiology	41.2	55.3 / 51.4	0.03
to belong to a GPs' network	21.3	44.5 / 54.7	0.06
interest in regional epidemiological surveys	96.5	50.8 / 100	0.07
previous use of Minitel <sup>®</sup>	73.6	51.6 / 59.0	0.44
satisfaction in using the FCDN <sup>a</sup> server	77.4	53.1 / 44.4	0.06
previous use of database server	52.3	50.0 / 57.6	0.94
interest in using multimedia home servers	61.2	53.5 / 53.3	0.70

<sup>a</sup>French Communicable Disease Network.

TABLE 2 *Estimates of the regression model when fitted to the study population (relative risks) and to 100 bootstrap samples (relative risks interquartiles)*

Variables	Study population	Bootstrap
	relative risks	relative risks interquartiles
seniority $\leq$ 5 or $\geq$ 20 years	0.67	(0.66–0.86)
motivation = scientific interest in epidemiology	0.65	(0.64–0.84)
previous experience in surveillance networks	2.10	(1.72–2.29)
interest in regional epidemiological surveys	2.10	(1.51–2.46)

whenever this model was fitted to these 100 bootstrap samples (Table 2).

## DISCUSSION

Many studies regarding GPs' attitudes with respect to: curative and preventative medicine,<sup>24–26</sup> emergence of professional control and regulation organizations,<sup>27–29</sup> primary care research<sup>30–32</sup> and clinical trials<sup>33</sup> are reported in the literature. Others have identified the GPs' own interest in research or surveillance topics as a key factor in their effective participation<sup>34,35</sup> and proposed different methods to improve their recruitment for research purposes.<sup>36,37</sup> Nevertheless, to the best of our knowledge, the individual factors which determine GPs' efficient participation in surveillance have never been investigated. Thus, very little is known about the characteristics of the GPs who are interested (and who actually participate) in public health surveillance, even in countries such as Great Britain where such systems have been in existence for many decades.<sup>38</sup> The method which we propose allows quantitative monitoring of the

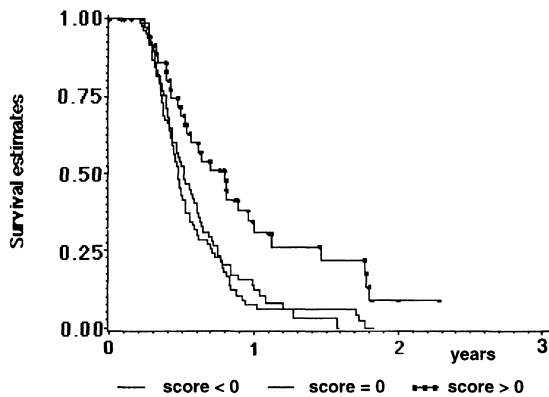


FIGURE 2 Survival estimates of the compliance of the sentinel general practitioners recruited since July 1992 ( $n = 376$ ), according to their individual score built after the regression model estimates

compliance of SGPs and further describes their profile in terms of regularity and perseverance.

When applied to our data, our method shows that the GPs who are mainly motivated by interest in epidemiology and who have a seniority of  $<5$  years or  $>20$  years have longer compliance than the others. This correlation could be the result of change of behaviour over the course of a physician's professional development.<sup>39</sup> Younger practitioners might have a longer compliance because of a stronger interest in epidemiology (and public health surveillance) due to the emphasis placed on public health in their training. Older GPs might comply because of a need to add a new activity to an otherwise uneventful health care workload. Since seniority is known to be correlated to the size of a practice, younger doctors might also have more free time to devote to an unpaid activity. Our data further shows that an interest in local epidemiological surveys is significantly correlated with shorter compliance. This result seems to indicate that an interest in field epidemiology is inconsistent with motivated participation in a continuous and centralized public health surveillance system.

It is interesting to point out that some variables are found to have no association with the SGPs' compliance. For instance, even though our surveillance system forces the SGPs to devote time to computer data entry, we observed no significant correlation between their compliance and their computing experience (previous use of database server or Minitel, computer office equipment), or the fact that they had or did not have a medical secretary. Compliance is found to have no association with a particular feeling an SGP might have

TABLE 3 Selection frequency of the variables in the backward regression model (when fitted to 100 bootstrap samples)

Variables	%
<i>interest in regional epidemiological surveys<sup>a</sup></i>	83
<i>seniority between 5 and 20 years<sup>a</sup></i>	61
<i>previous experience in surveillance network<sup>a</sup></i>	43
<i>motivation = scientific interest in epidemiology<sup>a</sup></i>	43
training in public health	36
satisfaction in using the FCDN <sup>b</sup> server	34
previous experience in clinical trials	29
interest in using multimedia home servers	26
motivation = to belong to a GPs' network	25
complementary medical diploma	19
previous experience in epidemiological surveys	16
continuing medical education / last 12 months	15
age $\geq 40$	12
previous use of database server	10
membership of a medical association	9
previous use of Minitel <sup>b</sup>	9
medical secretary	9
computerized patients records	7
acquaintance with other SGPs <sup>c</sup>	4
male sex	4
motivation = 'to be a public health actor'	0

<sup>a</sup> The variables in italics are those which are effectively selected in the model when fitted to the study population.

<sup>b</sup> French Communicable Disease Network.

<sup>c</sup> Sentinel general practitioners.

of being 'a public health actor'. This could be interpreted in two possible ways: (i) SGPs behave primarily as private professionals even when participating in a public health surveillance project, or (ii) because of the nature of their profession, GPs are obviously 'public health actors' whether they are part of a surveillance system or not. Furthermore, GPs whose main avowed motivation for enrolling in our system was 'to belong to a GPs' network' do not comply for a long period. Their compliance seems to be even shorter in univariate analysis with a  $P$ -value close to statistical significance (Table 1). This might suggest that a national surveillance activity fails to break the feeling of professional isolation which has been well described elsewhere.<sup>40-42</sup>

Our regression model explains a very small proportion of variance, but its adjustment and stability seem to be good. Such a small proportion of explained variance is not uncommon when modelling social or behavioural variables.<sup>43-45</sup> Nevertheless, our methodology remains a useful tool in that it uses time-to-event statistics to measure compliance. However, a complementary sociological approach is needed to supplement

our quantitative method.<sup>46-48</sup> In our future investigations, we plan to use qualitative methods (group and face-to-face interviews with GPs) to integrate new attitudinal variables, such as: perception of physicians' role in public health, professional satisfaction, relations with other GPs and with medical research institutions, attitudes toward new information systems and communication technology. Research on these new variables will, in itself, help enhance the commitment to the quality of collaboration between academic epidemiologists and GPs.

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