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The Belgian network of Sentinel General Practices between 2007 and 2012: a short report

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Introduction

In this short report we describe the aims and characteristics of the Belgian network of Sentinel General Practices (SGP) and we present values for network parameters that are considered to be indicators of the validity of the surveillance system.

Sentinel surveillance by GPs is an accepted system of public health surveillance, i.e. the on-going collection, analysis, and interpretation of health data essential to public health practice, closely integrated with timely dissemination of information for intervention[1]. In sentinel surveillance a sample of professionals or organisations such as general practices, hospitals, laboratories, clinicians are designated to collect and report data that are considered as representative for a specified population.

Networks of SGP were developed by GPs to use the wealth of the information they gathered in their daily practice for research, education or management. General practice is the first source of professional health information next to the general population and most health problems are exclusively managed by GPs[2;3]. In 1979 the Belgian network of SGP was developed drawing on experiences by the Weekly Returns Service in the UK and the Sentinel Stations in the Netherlands[4]. In the early 1990s several networks of SGP were operating and co-operating in Europe[5].

All networks of SGP have in common that anonymous data from clinical practice on well-defined problems are recorded by voluntary, self-selected GPs covering a region/population and subsequently transferred to a central office for analysis and diffusion of study results. Networks of SGP may differ in their aim (surveillance of infectious/non-infectious health problems or oriented towards health services research), size (regional or national) and available methods for the estimation of populations at risk (patient lists or number of patient contacts per week) and data transmission (by paper forms or electronic data transmission)[5]. Applying this typology, the current Belgian SGP is a nationwide, paper-based network, and the size of the covered patient population is estimated by the number of weekly patient contacts. The aims of the Belgian network of SGP have broadened over time. The network has a long history of routine surveillance by monitoring continuously the occurrence of influenza-like illness. The periodical surveillance of e.g. suicidal behaviour may be considered as an enhanced surveillance by its collection of additional data on top of age, gender and other core data[6]. The surveillance of end-of-life care is definitely oriented towards health services research as the study aims to describe usual care by GPs. Appendix 1 displays a list of SGP studies published in peer-reviewed journals indexed in PubMed since 2007 and October 2013.

Sentinel networks and morbidity networks in general practice apply quality assurance practices and methods to ascertain the sustainability and acceptance of the network, the quality of data and the validity of study results. An overview of the main practices and methods applied by the Belgian network to achieve its rationales is presented in Appendix 2.

Participation in the Belgian network of SGP is subject-independent, i.e. sentinel GPs cannot choose to report only on their preferred subjects. This is an important prerequisite for a representative network in terms of morbidity and patient management. Three studies found no important differences in morbidity and quality of care

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between research-active and other general practices[7-9].

In Belgium, primary health care is not the exclusive domain of GPs. Medical specialists are equally directly accessible and both type of physicians provide first contact care for a broad range of health problems. The 'open access' system in Belgium contrasts with gatekeeping systems where the provision of primary health care is delivered only by GPs and organised separately from higher care levels. Yet, GPs play a key role in Belgian health care. A comparative study of 21 OECD countries for the year 2000 showed that Belgium ranked second highest both for the proportion of adults consulting a GP within the previous 12 months and for annual mean numbers of GP consultations by adults[10]. In 2008 almost all Belgians (95%) reported to have a regular GP, 78% of the Belgian population had a contact with a GP in the past 12 months and the average number of contacts was 4.5 per person[11]. According to national health insurance reimbursement data 91% of the Belgian population had at least one contact with a GP over a 3 year period (2006-8)[12].

As Belgian inhabitants are not listed with a single GP (practice), the size and age-gender distribution of the population covered by the SGP network is not readily available. The denominator population, i.e. the population at risk, is estimated by dividing the sum of all patient encounters in the participating SGP by the mean number of patient encounters in Belgian general practice per inhabitant, provided by the NIHDI[13]. The result is a global estimation of the population size without data about the age-gender distribution. The Belgian SGP surveillance system relies on the assumption that a sufficient number of GPs in all the districts and a similar age-gender distribution of the sentinel GPs compared to non-sentinel GPs, results in an unbiased population, i.e. similar to the actual source population in size, needs and general characteristics. Therefore, the achievement of the following three targets related to the internal and external validity of the SGP surveillance system is monitored since the mid-eighties.

- The age-gender distribution among sentinel GPs and non-sentinel GPs should be similar;
- The network of SGP should cover all Belgian districts and preferably 1% of its population;
- The network should be stable in order to achieve a continuous data quality. Therefore the annual drop-out rate of SGP should be less than 10% with reference to the previous year. This target is of minor importance because the network should also renew itself in order to represent the general practice workforce.

The objectives of the remaining part of this report is to describe to what extent these targets were met in the period between 2007 and 2012, and to provide related data about the network since 2001.

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Methods

Data on age and gender of all participating SGP were collected by annual surveys. We compared the age-gender distribution among SGP participants and non-sentinel GPs in Belgium and its two main regions, the Flemish and the Walloon region, in the period between 2007 and 2012. The age-gender distribution between sentinel and non-sentinel GPs is not compared for the Brussels region due to the limited number of sentinel GPs in this region. Data on age and gender distribution of the GP workforce by district were provided by the National Institute for Health and Disability Insurance (NIHDI). Additional analysis was done to explore the distribution of the SGP over Belgium and the Flemish region. For pragmatic reasons, this analysis was limited to the year 2009. To examine the association between the distribution of the SGP network and the territorial typology of Belgium and the Flemish region in 2009, we used the typology of respectively the Organisation for Economic Cooperation and Development (OECD) and VRIND[14;15]. Assuming that districts with less GPs may be less covered by the SGP network, we examined the association between the achievement of the 1% coverage target and the proportion of active GPs per 100,000 inhabitants in the district.

Results

Size and stability of the Belgian network of SGP

Between 2001 and 2010, each year between 142 (in 2010) and 182 (in 2005) general practices were participating in the SGP network. In that period the median annual drop-out rate, with reference to the previous year, was 9% (interquartile range (IQR) 8-14) and the median annual renewal rate was 10% (IQR 4-15). Overall 282 Belgian SGP have been participating in the Belgian network of SGP between 2001 and 2010, with a median of 6 participation years (IQR 2-10).

Table 1 shows the network parameters between 2007 and 2012. On average 151 SGP per year were participating.

Table 1. Main size and coverage of the Belgian network of SGP between 2007 and 2012

	2007	2008	2009	2010	2011	2012
Size of the SGP network						
Sentinel GPs (N)	187	214	199	189	170	±172[a]
Sentinel practices (N)	156	172	161	142	130	146
Sentinel practices Flemish region (N)	85	95	87	75	72	84
Sentinel practices Walloon region (N)	56	62	59	53	44	44
Sentinel practices Brussels region (N)	15	15	15	14	14	18
Coverage of the SGP network						
% of Belgian population covered	1.6	1.8	1.8	1.5	1.4	1.6
% of Flemish region covered	1.7	1.9	1.9	1.5	1.6	1.8
% of Walloon region covered	1.5	1.7	1.7	1.5	1.1	1.1
% of Brussels region covered	1.3	1.2	1.3	1.2	1.2	1.5
Belgian population covered (N)	170,546	189,505	186,801	165,008	151,222	175,119
Districts with <1% coverage (n/N)	7/43	5/43	5/43	11/43	14/43	13/43

[a] The number of participating sentinel GPs will be available in 2014

Size and stability of the Belgian network of SGP

Table 2 presents the statistical significance of the association between sentinel GPs and non-sentinel GPs in gender and age-gender distributions per year. Almost no gender differences were found between sentinel and non-sentinel GPs but significant differences were found in age groups. Women GPs ≤39 years were under-represented in the network since 2008. Over the years women aged 50 years and more became over-represented (see Figure 1).

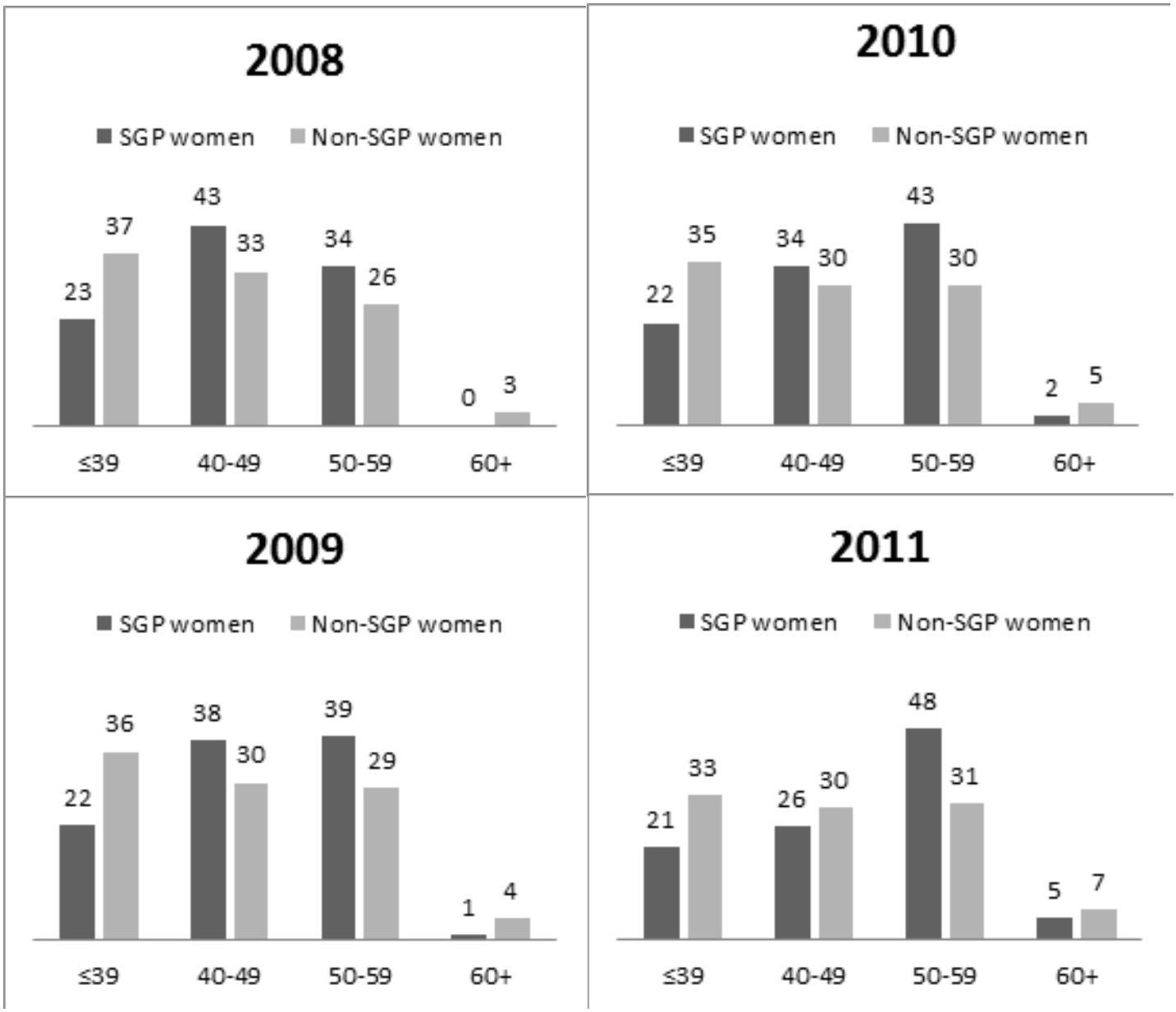
Table 2. Statistical significance of the association between gender distribution and age-gender distribution among sentinel GPs and non-sentinel GPs between 2007 and 2011[a]

	2007	2008	2009	2010	2011
Statistical significance of differences between GENDER distribution of sentinel and non-sentinel GPs by region and overall[b]					
Flemish region	p=0.05	p>0.05	p>0.05	p>0.05	p>0.05
Walloon region	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05
Belgium (including Brussels region)	**p=0.03**	p>0.05	p>0.05	p>0.05	p>0.05
Statistical significance of differences between AGE distribution of sentinel and non-sentinel GPs by gender per region and overall[a]					
Flemish region					
Men	p>0.05	p>0.05	p>0.05	**p=0.031**	p>0.05
Women	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05
All	p>0.05	p>0.05	p>0.05	**p=0.018**	p>0.05
Walloon region					
Men	p>0.05	p>0.05	p=0.05	p>0.05	p>0.05
Women	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05
All	p>0.05	p>0.05	**p=0.017**	p>0.05	**p=0.020**
Belgium (including Brussels region)					
Men	**p=0.05**	p>0.05	p>0.05	p>0.05	p>0.05
Women	p>0.05	**p=0.020**	**p=0.038**	**p=0.029**	**p=0.029**
All	**p=0.03**	p=0.05	p>0.05	**p=0.013**	**p=0.021**

[a] The information for 2012 will be available in 2014

[b]Tested by Pearson Chi2, significant differences between sentinel and non-sentinel GPs (p<0.05) are marked in bold

Figure 1. Comparison between distribution of age groups among SGP women and non-SGP women between 2008 and 2011



Coverage of the population by the SGP network

Between 2007 and 2012 the Belgian network of SGP monitored 1.4 to 1.8% of the national population (Table 1). The highest population coverage was reached in the Flemish region over all years. The number of under-covered districts increased over the years to 14 out of 43 Belgian districts in 2011. Six out of 9 under-covered Walloon districts were under-covered during 11 years or more between 1990 and 2011.

In 2009 one or more SGP were found in 20% of all 589 Belgian municipalities (Table 3). Nationwide, the SGP participation was significantly lower in rural municipalities (13%) compared to urban (22%). At the district level there was no significant relation between territorial typology and achievement of the 1% coverage target in 2009. In the Flemish region the SGP participation was equally lower on the country side (13%).

Table 3. SGP participation and population coverage at the level of 1% by territorial typology of residence of the Belgian population and the Flemish population, in 2009

SGP participation				
	No SGP	**≥ 1 SGP**	**Total**	**p**
Belgian municipality level (N=589)	**N(%)**	**N(%)**	**N(%)**	
Rural municipalities (population density < 150km²)	122(87%)	19(13%)	141(100%)	
Urban municipalities (population density ≥150km²)	350(78%)	98(22%)	448(100%)	
Total	472(80%)	117(20%)	589(100%)	0.029
SGP participation				
Flemish municipality level (N=308)	**No SGP**	**≥ 1 SGP**	**Total**	**p**
	N(%)	**N(%)**	**N(%)**	
Metropoles (2053/km²)	0(0%)	2(100%)	2(100%)	
Centre cities (983/km²)	4(36%)	7(64%)	11(100%)	
Metropolitan Brussels area (980/km²)	8(62%)	5(38%)	13(100%)	
Metropolitan fringe (898/km²)	16(84%)	3(16%)	19(100%)	
Structure supporting cities (482/km²)	13(62%)	8(38%)	21(100%)	
Regional-urban fringe (465/km²)	18(90%)	2(10%)	20(100%)	
Transitional area (432/km²)	83(86%)	13(14%)	96(100%)	
Suburban provincial area (377/km²)	16(64%)	9(36%)	25(100%)	
Country side (228/km²)	88(87%)	13(13%)	101(100%)	
Total	246(80%)	62(20%)	308(100%)	0.000
Population coverage				
Belgian district level (N=43)	**≥1% coverage**	**<1% coverage**	**Total**	**p**
	N(%)	**N(%)**	**N(%)**	
Mainly rural (≥50% of population lives in rural municipalities)	6(100%)	0	6(100%)	
Largely rural (15-50% of population lives in rural municipalities)	7(70%)	3	10(100%)	
Urban (<15% of population lives in rural municipalities)	25(93%)	2	27(100%)	
Total	38(88%)	5	43(100%)	0.103

Districts with less than 1% of the population covered by the network of SGP showed a similar density of GPs compared to well-covered districts (Table 4).

Table 4. SGP population coverage at the level of 1% by density of GPs per 100,000 inhabitants at the district level, in 2009

	≥1% coverage	**<1% coverage**	**All districts**
Density of GPs/100,000 inhabitants per district (N=43)	**N**	**N**	**N**
<92	9	1	10
92-95	5	4	9
96-105	10	3	13
≥106	5	6	11
Total	29	14	43

Discussion

Young women GPs are under-represented in the SGP network, possibly due their higher preferences to balance work and personal life. The population in rural areas is less covered by SGP, possibly due to a larger workload in rural areas. Yet, we found that districts with less than 1% of the population covered by the SGP network had a similar density of GPs compared to other districts.

With an average of 151 participating SGP per year, the Belgian network is large compared to any of 11 Dutch general practice registration networks[16]. The representativeness of the SGP network for the total GP workforce was confirmed by a previous study among SGP participants[17]. In the latter study, the ranking of the most common Electronic Health Records-systems (EHR) was highly comparable to the ranking found in a random sample of Belgian GPs, but more sentinel GPs than non-sentinel GPs were using a certified EHR system. The proportion of sentinel GPs working in a group practice in 2009 (28%) was equally comparable to the proportion found among active Belgian GPs (27%), although the latter was calculated in full-time equivalents[12].

Conclusion

The participants of the Belgian network of SGP are fairly similar to non-sentinel GPs according to age-gender distribution although significant differences were found by age groups, especially in women. The network has a low turnover rate and is fairly distributed across urban and rural districts all over Belgium.

References

(1) Last JM. A Dictionary of Epidemiology. Oxford University Press; 2004.

(2) Green LA, Fryer GE, Jr., Yawn BP, Lanier D, Dovey SM. The ecology of medical care revisited. N Engl J Med 2001; 344(26):2021-2025.

(3) White KL. The ecology of medical care: origins and implications for population-based healthcare research. Health Serv Res 1997; 32(1):11-21.

(4) Van Casteren V. Thirty years Registration Network of Sentinel General Practitioners. Arch Public Health 2009; 67(Suppl. 2):3-15.

(5) Van Casteren V, Leurquin P. Eurosentinel: development of an international sentinel network of general practitioners. Methods Inf Med 1992; 31(2):147-152.

(6) Garcia-Abreu A, Halperin W, Danel I. Public Health Surveillance Toolkit. A guide for busy task managers. World Bank; 2002.

(7) Hammersley V, Hippisley-Cox J, Wilson A, Pringle M. A comparison of research general practices and their patients with other practices--a cross-sectional survey in Trent. Br J Gen Pract 2002; 52(479):463-468.

(8) McManus RJ, Ryan R, Jones M, Wilson S, Hobbs FR. How representative of primary care are research active practices? Cross-sectional survey. Fam Pract 2008; 25(1):56-62.

(9) Tilyard MW, Dovey SM, Spears GF. Biases in estimates from the RNZCGP computer research group. N Z Med J 1995; 108(997):118-121.

(10) van Doorslaer E, Masseria C, Koolman X. Inequalities in access to medical care by income in developed countries. CMAJ 2006; 174(2):177-183.

(11) Drieskens S, Van der Heyden J, Hesse E, Gisle L, Demarest S, Tafforeau J. Health Interview Survey Belgium; 2008. Report III. Medical consumption. 2010. Brussels: Scientifc Institute of Public Health.

(12) Meeus P. [General practice performance. A check up]. 2012. Brussel, RIZIV.

(13) Lobet MP, Stroobant A, Mertens R, Van Casteren V, Walckiers D, Masuy-Stroobant G et al. Tool for validation of the network of sentinel general practitioners in the Belgian health care system. Int J Epidemiol 1987; 16(4):612-618.

(14) Flemish regional indicators (VRIND). Brussels: Flemish Government; 2012.

(15) Landelijkheid graad van verstedelijking. 2013. Online Source. statbel.fgov.be@EbookBrowse.

(16) van den Dungen C., Hoeymans N, Gijsen R, Van den AM, Boesten J, Brouwer H et al. What factors explain the differences in morbidity estimations among general practice registration networks in the Netherlands? A first analysis. Eur J Gen Pract 2008; 14 Suppl 1:53-62.

(17) Boffin N, Bossuyt N, Vanthomme K, Van Casteren V. Readiness of the Belgian network of sentinel general practitioners to deliver electronic health record data for surveillance purposes: Results of a survey study. BMC Fam Pract 2010; 11(1):50.

Appendix 1. List of articles published between 2007 and October 2013 in peer-reviewed journals indexed in Medline (n=36)

2013

Evans N, Costantini M, Pasman HR, Van den Block L, Donker GA, Miccinesi G, Bertolissi S, Gil M, Boffin N, Zurriaga O, Deliens L, Onwuteaka-Philipsen B. End-of-Life Communication: A Retrospective Survey of Representative General Practitioner Networks in Four Countries. J Pain Symptom Manage. 2013 Aug 7. doi:pii: S0885-3924(13)00331-X. 10.1016/j.jpainsymman.2013.04.008. [Epub ahead of print] PubMed PMID: 23932176.

Van den Block L, Onwuteaka-Philipsen B, Meeussen K, Donker G, Giusti F, Miccinesi G, Van Casteren V, Alonso TV, Zurriaga O, Deliens L. Nationwide continuous monitoring of end-of-life care via representative networks of general practitioners in Europe. BMC Fam Pract. 2013 Jun 3;14(1):73. [Epub ahead of print] PubMed PMID: 23731938; PubMed Central PMCID: PMC3751186.

Evans N, Pasman HR, Vega Alonso T, Van den Block L, Miccinesi G, Van Casteren V, Donker G, Bertolissi S, Zurriaga O, Deliens L, Onwuteaka-Philipsen B; EUROIMPACT. End-of-life decisions: a cross-national study of treatment preference discussions and surrogate decision-maker appointments. PLoS One. 2013;8(3):e57965. doi: 10.1371/journal.pone.0057965. Epub 2013 Mar 5. PubMed PMID: 23472122; PubMed Central PMCID: PMC3589464.

Ko W, Beccaro M, Miccinesi G, Van Casteren V, Donker GA, Onwuteaka-Philipsen B, Miralles Espí MT, Deliens L, Costantini M, Van den Block L; EURO IMPACT. Awareness of general practitioners concerning cancer patients' preferences for place of death: evidence from four European countries. Eur J Cancer. 2013 May;49(8):1967-74. doi: 10.1016/j.ejca.2013.01.006. Epub 2013 Feb 15. PubMed PMID: 23415886.

Bollaerts K, Antoine J, Van Casteren V, Ducoffre G, Hens N, Quoilin S. Contribution of respiratory pathogens to influenza-like illness consultations. Epidemiol Infect. 2013 Oct;141(10):2196-204. doi: 10.1017/S0950268812002506. Epub 2012 Dec 6. PubMed PMID: 23217849; PubMed Central PMCID: PMC3757921.

2012

Leemans K, Van den Block L, Bilsen J, Cohen J, Boffin N, Deliens L. Dying at home in Belgium: a descriptive GP interview study. BMC Fam Pract. 2012 Jan 19;13:4. doi: 10.1186/1471-2296-13-4. PubMed PMID: 22260260; PubMed Central PMCID: PMC3317833.

Vanthomme K, Bossuyt N, Boffin N, Van Casteren V. Incidence and management of presumption of Lyme borreliosis in Belgium: recent data from the sentinel network of general practitioners. Eur J Clin Microbiol Infect Dis. 2012 Sep;31(9):2385-90. doi: 10.1007/s10096-012-1580-3. Epub 2012 Mar 6. PubMed PMID: 22391757.

Boffin N, Bossuyt N, Declercq T, Vanthomme K, Van Casteren V. Incidence, patient characteristics and treatment initiated for GP-diagnosed depression in general practice: results of a 1-year nationwide surveillance study. Fam Pract. 2012 Dec;29(6):678-87. doi: 10.1093/fampra/cms024. Epub 2012 Apr 20. PubMed PMID: 22523390.

Meeussen K, Van den Block L, Echteld M, Boffin N, Bilsen J, Van Casteren V, Deliens L. Older people dying with dementia: a nationwide study. Int Psychogeriatr. 2012 Oct;24(10):1581-91. doi: 10.1017/S1041610212000865. Epub 2012 May 30. PubMed PMID: 22647226.

Boffin N, Bossuyt N, Vanthomme K, Van Audenhove C, Van Casteren V. Short-term follow-up of patients diagnosed by their GP with mild depression or first-time moderate depression. Results of a 1-year nationwide surveillance study. Fam Pract. 2012 Dec;29(6):688-95. doi: 10.1093/fampra/cms032. Epub 2012 Apr 20. PubMed PMID: 22523392.

Hombrouck A, Sabbe M, Van Casteren V, Wuillaume F, Hue D, Reynders M, Gérard C, Brochier B, Van Eldere J, Van Ranst M, Thomas I. Viral aetiology of influenza-like illness in Belgium during the influenza A(H1N1)2009 pandemic. Eur J Clin Microbiol Infect Dis. 2012 Jun;31(6):999-1007. doi: 10.1007/s10096-011-1398-4. Epub 2011 Sep 8. PubMed PMID: 21901635.

2011

Devroey D, Van Casteren V. Signs for early diagnosis of heart failure in primary health care. Vasc Health Risk Manag. 2011;7:591-6. doi: 10.2147/VHRM.S24476. Epub 2011 Sep 14. PubMed PMID: 21966224; PubMed Central PMCID: PMC3180513.

Boffin N, Bossuyt N, Vanthomme K, Van Casteren V. Declining rates of suicidal behavior among general practice patients in Belgium: results from sentinel surveillance between 1993 and 2008. Arch Suicide Res. 2011;15(1):68-74. doi: 10.1080/13811118.2011.540476. PubMed PMID: 21294001.

Meeussen K, Van den Block L, Echteld MA, Boffin N, Bilsen J, Van Casteren V, Abarshi E, Donker G, Onwuteaka-Philipsen B, Deliens L. End-of-life care and circumstances of death in patients dying as a result of cancer in Belgium and the Netherlands: a retrospective comparative study. J Clin Oncol. 2011 Nov 10;29(32):4327-34. doi: 10.1200/JCO.2011.34.9498. Epub 2011 Oct 11. PubMed PMID: 21990415.

Bossuyt N, Van den Block L, Cohen J, Meeussen K, Bilsen J, Echteld M, Deliens L, Van Casteren V. Is individual educational level related to end-of-life care use? Results from a nationwide retrospective cohort study in Belgium. J Palliat Med. 2011 Oct;14(10):1135-41. doi: 10.1089/jpm.2011.0045. Epub 2011 Aug 4. PubMed PMID: 21815816.

Amato-Gauci A, Zucs P, Snacken R, Ciancio B, Lopez V, Broberg E, Penttinen P, Nicoll A; European Influenza Surveillance Network EISN. Surveillance trends of the 2009 influenza A(H1N1) pandemic in Europe. Euro Surveill. 2011 Jun 30;16(26). doi:pii: 19903. Review. PubMed PMID: 21745444.

Meeussen K, Van den Block L, Echteld M, Bossuyt N, Bilsen J, Van Casteren V, Abarshi E, Donker G, Onwuteaka-Philipsen B, Deliens L. Advance care planning in Belgium and The Netherlands: a nationwide retrospective study via sentinel networks of general practitioners. J Pain Symptom Manage. 2011 Oct;42(4):565-77. doi: 10.1016/j.jpainsymman.2011.01.011. Epub 2011 May 6. PubMed PMID: 21530152.

2010

Boffin N, Bossuyt N, Vanthomme K, Van Casteren V. Readiness of the Belgian network of sentinel general practitioners to deliver electronic health record data for surveillance purposes: results of survey study. BMC Fam Pract. 2010 Jun 25;11:50. doi: 10.1186/1471-2296-11-50. PubMed PMID: 20579350; PubMed Central PMCID: PMC2910665.

Devroey D, Van Casteren V. Symptoms and clinical signs associated with hospital admission and mortality for heart failure. Cent Eur J Public Health. 2010 Dec;18(4):209-14. PubMed PMID: 21361105.

Bruyninckx R, Van den Bruel A, Buntinx F, Van Casteren V, Aertgeerts B. Excess of mortality in patients with chest pain peaks in the first 3 days period after the incident and normalizes after 1 month. Fam Pract. 2010 Dec;27(6):604-8. doi: 10.1093/fampra/cmq052. Epub 2010 Jul 16. PubMed PMID: 20639281; PubMed Central PMCID: PMC2980602.

Devroey D, Van Casteren V. The incidence and first-year mortality of heart failure in Belgium: a 2-year nationwide prospective registration. Int J Clin Pract. 2010 Feb;64(3):330-5. doi: 10.1111/j.1742-1241.2009.02212.x. PubMed PMID: 20456173.

Smets T, Bilsen J, Van den Block L, Cohen J, Van Casteren V, Deliens L. Euthanasia in patients dying at home in Belgium: interview study on adherence to legal safeguards. Br J Gen Pract. 2010 Apr;60(573):e163-70. doi: 10.3399/bjgp10X483940. PubMed PMID: 20353662; PubMed Central PMCID: PMC2845507.

2009

Meeussen K, Van den Block L, Bossuyt N, Bilsen J, Echteld M, Van Casteren V, Deliens L. GPs' awareness of patients' preference for place of death. Br J Gen Pract. 2009 Sep;59(566):665-70. doi: 10.3399/bjgp09X454124. PubMed PMID: 19682405; PubMed Central PMCID: PMC2734354.

Van den Block L, Deschepper R, Bilsen J, Bossuyt N, Van Casteren V, Deliens L. Euthanasia and other end of life decisions and care provided in final three months of life: nationwide retrospective study in Belgium. BMJ. 2009 Jul 30;339:b2772. doi: 10.1136/bmj.b2772. PubMed PMID: 19643825; PubMed Central PMCID: PMC2719064.

Bruyninckx R, Van den Bruel A, Aertgeerts B, Van Casteren V, Buntinx F. Why does the general practitioner refer patients with chest pain not-urgently to the specialist or urgently to the emergency department? Influence of the certainty of the initial diagnosis. Acta Cardiol. 2009 Apr;64(2):259-65. PubMed PMID: 19476121.

Bossuyt N, van Casteren V. Domestic violence: variation in case-management by the general practitioner in Belgium. Int J Public Health. 2009;54(2):106-11. doi: 10.1007/s00038-009-7074-0. PubMed PMID: 19288287.

Van den Block L, Deschepper R, Bilsen J, Bossuyt N, Van Casteren V, Deliens L. Euthanasia and other end-of-life decisions: a mortality follow-back study in Belgium. BMC Public Health. 2009 Mar 9;9:79. doi: 10.1186/1471-2458-9-79. PubMed PMID: 19272153; PubMed Central PMCID: PMC2660906.

Thomas I, Gérard C, Wuillaume F, Van Casteren V, Brochier B. [Virologic surveillance of influenza, and of influenza A/H1N1 in particular, in Belgium]. Bull Mem Acad R Med Belg. 2009;164(10):268-74. French. PubMed PMID: 20669616.

Schoenmakers B, Buntinx F, Devroey D, Van Casteren V, DeLepeleire J. The process of definitive institutionalization of community dwelling demented vs non demented elderly: data obtained from a network of sentinel general practitioners. Int J Geriatr Psychiatry. 2009 May;24(5):523-31. doi: 10.1002/gps.2147. PubMed PMID: 18942067.

2008

Bruyninckx R, Van den Bruel A, Aertgeerts B, Van Casteren V, Buntinx F. Half of the patients with chest pain that are urgently referred are transported in unsafe conditions. Eur J Emerg Med. 2008 Dec;15(6):330-3. doi: 10.1097/MEJ.0b013e328302c840. PubMed PMID: 19078835.

Devlies J, De Clercq E, Van Casteren V, Thienpont G, Lafontaine MF, De Moor G. The use of a compliant EHR when providing clinical pathway driven care to a subset of diabetic patients: recommendation from a Working Group. Stud Health Technol Inform. 2008;141:149-61. PubMed PMID: 18953135.

Van den Block L, Deschepper R, Bossuyt N, Drieskens K, Bauwens S, Van Casteren V, Deliens L. Care for patients in the last months of life: the Belgian Sentinel Network Monitoring End-of-Life Care study. Arch Intern Med. 2008 Sep 8;168(16):1747-54. doi: 10.1001/archinte.168.16.1747. PubMed PMID: 18779461.

Arkema JM, Meijer A, Paget WJ, van Casteren V, Hungnes O, Mazick A, Van der Velden J. The influenza season has started in a number of European countries. Euro Surveill. 2008 Jan 24;13(4). doi:pii: 8021. PubMed PMID: 18445399.

2007

Bossuyt N, Van Casteren V. Epidemiology of suicide and suicide attempts in Belgium: results from the sentinel network of general practitioners. Int J Public Health. 2007;52(3):153-7. PubMed PMID: 17958281.

Van den Block L, Deschepper R, Bilsen J, Van Casteren V, Deliens L. Transitions between care settings at the end of life in belgium. JAMA. 2007 Oct 10;298(14):1638-9. PubMed PMID: 17925515.

Van den Block L, Van Casteren V, Deschepper R, Bossuyt N, Drieskens K, Bauwens S, Bilsen J, Deliens L. Nationwide monitoring of end-of-life care via the Sentinel Network of General Practitioners in Belgium: the research protocol of the SENTI-MELC study. BMC Palliat Care. 2007 Oct 8;6:6. PubMed PMID: 17922893; PubMed Central PMCID: PMC2222051.

Appendix 2.

Figure 2. The Belgian network of SGP: attributes, rationale, practices and indicators[A]

System attributes		Rationale	Means	Indicators
Valid	Simple, flexible, affordable	The data collection relies on routine tasks, low burden on GPs, requested data fit usual GP practices and new health problems are studied or old problems are re-studied;	Use of standard protocols, weekly standard forms designed for surveillance;	Low item non-response, few missing weekly reports;
		Voluntary participation and project ownership by GPs, consent (for their patients) to deliver high quality data that are accepted by all national health system players;	Invitations to GP representatives and health policy decision makers to participate in steering committee meeting twice a year;	Low (<10%) annual turnover among SGP; High attendance of meetings steering committee by invitees;
	Accepted		Distribution of yearly feedback, reports, articles and newsletters; Occasional SGP meetings/ congresses;	Reports accepted in Belgian (GP) journals; Participation in international projects; SGP data serve as reference in national projects;
		Acceptance by (external) review;		Research protocol approved by peers; Ethical approval (to be renewed); Privacy procedures not yet completed;
		Internal and external validity of results;	Yearly survey of participating SGP; Monitoring of coverage at district level;	Age-gender distributions of the self-selected SGP participants is representative for national GP workforce; Coverage of 1% of the population in all districts;
			Use of standard case definitions, instruction sheets and protocols;	Incidence rates match a gold standard;
			Periodical surveillance of shingles;	Incidence of shingles is constant over years;
			Consistency checks during data entry; Missing data follow-up; Confirmation report & zero cases control.	

[a]Based on : Gijsen R, Poos MJ. Using registries in general practice to estimate countrywide morbidity in The Netherlands. Public Health 2006; 120(10):923-936.
Deckers JG, Paget WJ, Schellevis FG, Fleming DM. European primary care surveillance networks: their structure and operation. Fam Pract 2006; 23(2):151-158.
Van Casteren V, Leurquin P. Eurosentinel: development of an international sentinel network of general practitioners. Methods Inf Med 1992; 31(2):147-152.
Garcia-Abreu A, Halperin W, Danel I. Public Health Surveillance Toolkit. A guide for busy task managers. World Bank; 2002.