Karolinska Institutet

Department of Medical Epidemiology and Biostatistics

Development of methods for population-based surveillance of influenza

AKADEMISK AVHANDLING
som för avläggande av medicine doktorsexamen vid Karolinska Institutet offentligen försvaras i Atrium, Nobels väg 12 b, Karolinska Institutet, Solna

Torsdagen den 10 oktober, 2013, kl 09.00

av
Hanna Merk
Leg. läkare, MSc

Huvudhandledare:
Professor Olof Nyrén
Karolinska Institutet
Institutionen för medicinsk epidemiologi och biostatistik

Bihandledare:
Docent Annika Linde
Smittskyddsinstitutet
Generaldirektörstab

Fil. dr. Sharon Kühlmann-Berenzon
Smittskyddsinstitutet
Enheten för epidemiologi och biostatistik

Fakultetsopponent:
Priv. Doz. Dr. med. Walter Haas
Robert Koch Institut
Department of Infectious Disease Epidemiology

Betygsnämnd:
Professor Anna Ekéus Thorson
Karolinska Institutet
Institutionen för folkhälsovetenskap

Professor Toomas Timpka
Linköpings Universitet
Institutionen för datavetenskap

Professor emeritus Åke Svensson
Stockholms Universitet
Matematiska institutionen

Stockholm 2013

ABSTRACT

When this work was initiated the infectious disease surveillance systems available to public health authorities in Sweden and elsewhere were not providing continuously updated information on individuals stricken by disease unless the individuals sought health care or considerable field work was undertaken. However, continuous information on the incidence, regardless of health care seeking behaviour, is vital when estimating the case fatality rate and societal impact of a disease, and when comparing surveillance results between countries and over time. Furthermore, surveillance that relies on health care may be severely compromised in major emergencies.

In 2007 we therefore created a population-based surveillance system that relies on passive surveillance by participants from a random sample of the general population who self-report via an automated telephone service or via the Internet. We chose to initially focus the surveillance on influenza and influenza-like illness and during the experimental phase the effort was confined to Stockholm County, Sweden.

We then proceeded to evaluate the surveillance system and its methods, in order to further develop the methods for population-based surveillance of influenza.

In Paper I we focused on the participation rates and choices of reporting technologies. We found that both the telephone and web were utilized, and that choice of technology did not affect the reporting. We also found that the surveillance cohort was affected by selection, which should be possible to adjust for to some extent since the surveillance recruits participants with random sampling.

In Paper II we focused on the self-reporting. Two validation studies during two influenza seasons and a retrospective questionnaire showed that although the reporting was lacking in sensitivity it exhibited high specificity, and the validity measures were constant over time. Therefore the results could be adjusted for the low sensitivity. The surveillance results also compared well to sentinel surveillance in terms of shape of the epidemic curve. The adjusted influenza-like illness (ILI) incidence yielded by the population-based surveillance data was almost one order of magnitude higher than the weekly incidence proportion of ILI consultations calculated from the Swedish sentinel data, suggesting that the population-based surveillance captured a larger portion of the total incidence.

In Paper III and IV we explored whether the population-based surveillance system could collect data that could be applied in analytical cohort studies of risk factors for disease. We focused on the effect of layman-defined hand-washing on acute respiratory tract infection (ARI) incidence, and on the effect of child contacts outside the household on ARI incidence in adults. We found that increased frequency of hand-washing, as the layman perceives it, beyond 4 times daily may have little protective effect on ARI and that reducing outside household child contacts may reduce the risk of ARI but only if the individual has few contacts overall.

Overall the methods we applied in our population-based surveillance system can produce next-to-real-time estimates of the incidence in the population - without requiring health care seeking or considerable field work, and the surveillance system also renders itself quite well to analytic studies of relevant public health measures, even in connection with a pandemic. Our work also implies that although accuracy and completeness are not absolute requirements for surveillance, in the development of surveillance methods much can be gained by studying these characteristics.

ISBN 978-91-7549-270-4