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PRIMARY HEALTH CARE MODELS AND SUITABILITY FOR PROVISION OF E-SERVICES: AN OVERVIEW

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Abstract

We present an overview of the most frequently distributed types of primary health care (PHC) models of delivery across different countries and cultural environments. We summarise and describe most important definitions, principles of classification, attributes, necessary conditions (e.g., patient-management systems, electronic health records, ICT platforms) and organisation and key performance indicators (KPI) for functioning of the primary health care systems. We review and explore the suitability of different PHC models for provision of electronic (e-) services.

Keywords: Primary Health Care, Systems, Models, E-services, Overview.

1 INTRODUCTION

The health care systems of the future needs to focus on *prevention, screening and early diagnosis* rather than the later stages of the care cycle. According to Silfen [2009], the 20th century paradigm of hospital-based care must be reformed to reflect economic and demographic realities. Health systems based on a strong primary health care system are more effective and efficient than those centred on specialty and tertiary care. For instance, various national and provincial commissions on health care in Canada concluded that strengthening and expanding primary health care will meet the needs for prompt access to comprehensive evidence-based services. Major initiatives have also been undertaken in New Zealand and the United Kingdom to strengthen primary health care. As health systems worldwide engage in evaluation efforts to assess the impacts of primary health care renewal initiatives, there is a critical need to provide evaluation frameworks and tools to facilitate these efforts.

In USA, for instance, the integrated community model is the most generally desirable form when all performance characteristics are taken into account. However, the dominant model in the US, the so called "professional contact" (see Table 2 below) is highly accessible (*for those with insurance!*) and responsive, but relatively ineffective, inefficient, and of mediocre quality [Kuzel, 2006]. Furthermore, the purported superiority of the professional contact model on these two dimensions (*accessibility and responsiveness* in the as fielded in the US) is challenged by a recent survey of adults about their experiences with primary health care in the US, Canada, New Zealand, Australia, and the UK. The survey found that *"Across multiple dimensions of care, the United States stands out for its relatively poor performance. With the exception of preventive measures, the US primary care system ranked either last or significantly lower than the leaders on almost all dimensions of patient-centred care: access, coordination, and physician-patient experiences"* [Schoen et al as cited in Kuzel, 2006]. Shortly, the main problems of most current PHC models may be summarised by 3 main issues: *access to care; interactions/relationships within the primary care practice* (e.g., "doctor-staff") and *continuity of care* (e.g., at transition from primary to/from other levels of healthcare).

In 2003, the US Institute of Medicine (IOM) recommended that *"all health professionals should be educated to deliver patient-centred care as members of an interdisciplinary team, emphasizing*

evidence-based practice, quality improvement approaches, and informatics". In the same time, the policy "Better Healthcare for Europe" [EU Portal, 2009] in Europe is an EU policy, research and development agenda involving eHealth policy development [EU E-Health, 2004], development of EU public health portal (Health-EU) and eHealth interoperability (i.e., cross-border interoperability of electronic health records, telemedicine, healthcare and society, eHealth Resolution) [EU Commission, 2008b]. Notably, the eHealth is an integral component of the EU's i2010 policy framework [EU i2010] which seeks to promote an open and competitive digital economy. One of the three EU i2010's pillars is to foster inclusion, better public services and quality of life through development and implantation of novel, better ICTs. To note, the modern digital world, by the means of novel ICTs have dramatically changed the potential for obtaining and using new information. For instance, one of the challenges of the ICT research under the EU FP7 has focused on two very important specific aspects: (i) personalised monitoring and point-of-care diagnosis and (ii) patient safety and risk assessment [EU Commission, 2006, 2008b].

The **objectives** of our present work are to: (i) summarise and review main types of primary health care (PHC) models; (ii) describe, assess and classify their most important principles, attributes and key performance indicators; and (iii) explore minimum necessary conditions (e.g., EHR, ICT tools, etc.) and suitability of the PHC models for introduction and provision of e-services.

2 PRIMARY HEALTH CARE (PHC) SYSTEMS AND MODELS

The present paper is due to address a very important, currently debated problem of *introduction and development of various e-services in the routine practice of different primary health care (PHC) delivery systems*. The current policies, research and development agendas in e-Health and ICT in healthcare in different countries promote widely the introduction and development of e-services across all levels of the healthcare provision. While we consider the primary health care level as one of the most important and badly needed targets for such innovative approaches, we would suggest that without a proper overview and a systematic analysis of existing models of PHC delivery and their relative suitability, any such tasks and policy measures are hardly achievable.

What is primary health care? According to the definition of the US IOM in 1996 [Trotter, 2008] the primary health care is "*the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing a sustained partnership with patients, and practicing in the context of family and community*". In an extended form, according to the World Health Organisation (WHO), the primary health care is defined as "*...an essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination. It forms an integral part both of the country's health system, of which it is the central function and main focus, and of the overall social and economic development of the community. It is the first level of contact of individuals, the family and community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first element of a continuing health care process*" [WHO, 1978]. Not all PHC delivery systems contain all aspects of a comprehensive primary health care; this definition may be used not to exclude but to include those of the models that display at least one or more of these aspects as listed above.

What are the core functions of primary health care? The main five functions of a PHC delivery system are (from Trotter [2008] with modifications):

- (i) Provision of care at first contact with the healthcare system;
- (ii) Continuity of care;
- (iii) Coordination of care;
- (iv) Comprehensiveness of care (*including prevention and health promotion*);
- (v) Gate-keeping role to the upper levels of the healthcare system.

What models of primary health care delivery do exist? We use here the term ‘model’ represent in a summary form and describe complex relations within the real world. A model is always a simplified framework of the real world, because it is designed to highlight only selected properties of a system and their inter-relationships. The term model here is used to capture the fundamental structure of primary health care delivery and its organisational structure and relationships. It describes the principal interactions between the service components, and includes information about the organisation, distribution and utilisation of resources within the system. In 2006, Kuzel summarised findings by Canadian researchers who examined the organizational structure of 28 distinct models of primary health care delivery in a large number of industrialized nations. From their analysis, 4 main (archetypal) organizational models were derived: (i) *Professional contact model* (care by GPs solo or in groups; little/no association with other health care professionals; fee-for-service; IT is for internal use only; no formal attention to continuity; no formal integration of services with other providers; dominant model in the United States, Canada and Belgium); (ii) *Professional coordination model* (care by GPs and nurses; capitation or capitation plus fee-for-service; formal attention to continuity; IT integrates with other sources of health care service; nurse liaison helps integrate health care services; dominant model in UK, Denmark, The Netherlands and United States (HMO staff model)); (iii) *Integrated community care model* (population care provided by health care centres linked with IT to other providers serving same population; continuity assured by team; availability of care at all times; full scope of care assured; can be found in some provinces in Canada); and (iv) *Non-integrated community care model* (health care centre focus and full range of services, but no IT or other mechanisms to integrate services with other providers; services not available at all times; no formal mechanism to ensure continuity; found in some provinces in Canada).

For instance, more recently, Trotter [2008] classified primary care models in two categories: (1) *the traditional models*; and (2) *the newer models* (e.g., GP vs. PCT - primary care teams in Sweden/UK; community-based primary care – polyclinics; group-visit models; alternative - telephone care, remote telemedicine, etc.). Another good summary of primary care models [PC-models-web, 2010] concludes with a new vision of primary care focused on the health of populations. Integration of services and practitioners, continuity of care and a focus on health promotion and disease prevention would all be supported by new facilities and funding mechanisms. Patient navigators and advocates, along with case management and discharge planning, would be keeping people healthy and helping them manage their own care. *It is suggested that investments in primary care working towards this vision will yield savings in the long-term.*

The comparison of the four primary care models from Canada [Milliken et al, 2008] has shown clearly that *the type of the primary care practice is of importance*. For example, *how practices are organized* and *how physicians are remunerated* affect the costs associated with the provision of care. According to Milliken et al [2008], we cannot say that one specific type of a primary care model dominates. Clearly, further research is warranted to better track the relationship between the primary care model and the use of other health system resources in order to better understand which approach makes the best use of resources and options for wider ICT implementation.

3 PRINCIPLES, ATTRIBUTES AND KEY PERFORMANCE INDICATORS (KPI) OF PHC MODELS

Population (public) health is an approach that aims to improve the health of the entire populations or sub-groups within the population and to reduce health inequalities among population groups. Based on this approach, most health strategies in various countries define the core *principles* of primary health care models as *equity, people-centeredness, quality and collective management/accountability* well as introduce also other important principles that relate to the main functions of primary health care, in particular, such as first-point contact, continuity of care and the utilisation of a holistic, complex approach not only to ensure universal coverage but also to maintain and improve population health.

To be properly described and studied, most important *attributes* of the PHC delivery models should be taken into account. Once such list of main PHC attributes has been presented with their definitions by Kuzel [2006] in **Table 1**. Certainly, this list may not be exhaustive and other attributes, more or less specific, can be also added (e.g., *cultural environments, quality-of-life constructs, etc.*).

A) Clinical practice attributes
A.1) First-contact accessibility: The ease with which a person can obtain needed care (including advice and support) from the practitioner of choice within a time frame appropriate to the urgency of the problem
A.2) Accessibility-accommodation: The way primary health care resources are organized to accommodate a wide range of patients' abilities to contact health care clinicians and reach health care services. (The organization of characteristics such as telephone services, flexible appointment systems, hours of operation, and walk-in periods)
A.3) Comprehensiveness of services: The provision, either directly or indirectly, of a full range of services to meet patients' health care needs. This includes health promotion, prevention, diagnosis and treatment of common conditions, referral to other clinicians, management of chronic conditions, rehabilitation, palliative care and, in some models, social services
A.4) Informational continuity: The extent to which information about past care is used to make current care appropriate to the patient
A.5) Management continuity: The delivery of services by different clinicians in a timely and complementary manner such that care is connected and coherent
A.6) Technical quality of clinical care: The degree to which clinical procedures reflect current research evidence and/or meet commonly accepted standards for technical content or skill
B) Structural dimensions
B.1) Clinical information management: The adequacy of methods and systems to capture, update, retrieve, and monitor patient data in a timely, pertinent, and confidential manner
B.2) Multidisciplinary team: Practitioners from various health disciplines collaborate in providing ongoing health care High Quality improvement process: The institutionalization of policies and procedures that provide feedback about structures and practices and that lead to improvements in clinical quality of care and provide assurance of safety
B.3) System integration: The extent to which the health care unit organization has established and maintains linkages with other parts of the health care and social service system to facilitate transfer of care and coordinate concurrent care between different health care organizations
C) Person-oriented dimensions
C.1) Advocacy: The extent to which clinicians represent the best interests of individual patients and patient groups in matters of health (including broad determinants) and health care
C.2) Continuity-relational: Therapeutic relationship between patient and clinician(s) that spans various health care events and results in accumulated knowledge of the patient and care consistent with patient's needs
C.3) Cultural sensitivity: The extent to which a clinician integrates cultural considerations into communication, assessment, diagnosis, and treatment planning
C.4) Family-centred care: The extent to which the clinician considers the family (in all its expressions) and understands its influence on a person's health and engages it as a partner in ongoing health care
C.5) Interpersonal communication: The ability of the clinician to elicit and understand patient concerns, explain health care issues, and engage in shared decision making, if desired
C.6) Respectfulness: The extent to which health professionals and support staff meet users' expectations about interpersonal treatment, demonstrate respect for patients' dignity and provide adequate privacy
C.7) Whole-person care: The extent to which a clinician elicits and considers the physical, emotional, and social aspects of a patient's health and considers the community context in their care
D) Community-oriented dimensions
D.1) Client/community participation: The involvement of clients and community members in decisions regarding the structure of practice and services provided (advisory committees, community governance)
D.2) Equity: The extent to which access to health care and quality services are provided on the basis of health needs, without systematic differences on the basis of individual or social characteristics
D.3) Intersectoral team: The extent to which the primary care clinician collaborates with practitioners from nonhealth sectors in providing services that influence health
D.4) Population orientation: The extent to which the primary care clinicians assess and respond to the health needs of the population they serve. (In professional models, the population is the patient population served; in community models, it is defined by geography or social characteristics)
E) System performance
E.1) Accountability: The extent to which the responsibilities of professionals and governance structures are defined, their performance is monitored, and appropriate information on results is made available to stakeholders
E.2) Availability: The fit between the number and type of human and physical resources and the volume and types of care required by the catchment population served in a defined period of time
E.3) Efficiency/productivity: Achieving the desired results with the most cost-effective use of resources

Table 1. Main primary health care attributes and their definitions. From Haggerty et al [2007] with permission.

For instance, several other dimensions were identified that could not be termed “attributes”, but they emerged as important aspects of PHC delivery models. One such aspect is the *patient enablement*, a patient’s sense of self-efficacy in being better able to understand and manage a health condition as a result of the clinician’s behaviour during the visit. As is satisfaction, patient enablement is considered to be an outcome rather than an attribute of care and is elicited only in visit-based questionnaires. Another is *trust*, which is most likely an outcome rather than an attribute of the care process. To note, cost may be a barrier to accessibility but if a universal access to medical services is to be aimed, such cost barriers are theoretically minimal. Although derived on a Canadian basis, these definitions seem robust internationally. For example, the attributes (Table 1) map well to the 6 characteristics identified by the Institute of Medicine (IOM) of a health system that meets patients’ needs: *safe, effective, patient-centred, timely, efficient, and equitable*.

In the same time, PHC delivery models are assessed by their *outputs (outcomes)* and/or *key performance indicators (KPI)*. The “output” is the direct product or service as a result from the interaction between patients and PHC providers, that is, *the volume, type and quality of services provided and received*. For instance, the use of PHC services by the entire population, and by subgroups stratified by age, sex, geographic area and morbidity level. For example, the proportion of the population using PHC services within their local health area (LHA) provides a measure of *self-sufficiency* as mentioned above. Types of PHC services include physician visits for specific conditions or specific types of visits, including preventive, episodic, chronic and palliative care. Information is available from both administrative and survey data for measures such as annual check-ups, screening tests, physician visits for mental health conditions, and use of other health services (specialist physician services, emergency department, hospital, and home care services). Administrative data sources quantify the number and type of visits covered through publicly funded services, while survey data describe physician and other health provider use both from the patient perspective and the provider perspective [Broemeling et al., 2006]. As an example of *KPI*, we can illustrate 6 performance characteristics of the abovementioned 4 main (archetypal) organisational PHC models (**Table 2**):

PHC Model	Effectiveness	Productivity	Accessibility	Continuity	Quality	Responsiveness
Professional contact	4	4	1	3	3	1
Professional coordinated	3	2	1	4	3	1
Integrated community	1	1	3	1	1	3
Non-integrated community	2	2	4	2	2	3

Table 2. Performance characteristics of primary care models. From Kuzel [2006] with permission.

Most likely, the highest performance metrics has been observed in integrated primary care provided by healthcare teams. For instance, the Irish Healthcare Strategy defines the terms “*healthcare team*” as “*an inter-disciplinary team including GPs, nurses, midwives, health care assistants, home helps, physiotherapists, occupational therapists, social workers and administrative personnel, serving small population groups*” and the term “*healthcare network*” as a “*a wider network of health and social care professionals (speech and language therapists, community pharmacists, dieticians, community welfare officers, dentists, chiropodists and psychologists) working with a primary care teams to improve integration of care*”. [Government of Ireland, 2001; Harvey, 2007]. Innovative *home health solutions* (mainly in USA) may be a better answer for patients with specific, mostly chronic diseases, clinicians and the bottom line. In this sense, especially when scientific research is involved, for the purpose of healthcare integrity and consistency one can easily refer to both the hospital and the community setting investigation as “*applied clinical research*” (*personal communication*). This notion is novel and it has not been used widely across the different settings, however, the current tendency is for it to be adopted in the clinical practice worldwide. In conclusion, most of the current healthcare models in Australia, Canada, France, Germany, Netherlands, Sweden, UK and USA [Banta, 2004] have suggested an added value from adopting an integrated health care model incorporating international healthcare practices; it was also proposed a wider availability of primary care services through teams (PCT or primary care teams) and/or GP co-operatives and establishment of “*multi-disciplinary PCTs*”.

4 NECESSARY CONDITIONS AND SUITABILITY OF PHC MODELS FOR E-SERVICES PROVISION

"E-services", a business concept developed by Hewlett Packard (HP), was the idea that the World Wide Web was moving beyond e-business and e-commerce into a new phase where many services could be provided for a business or consumer using the Web. Some e-services, such as remote bulk printing, may be done at a Web site; other e-services, such as news updates to subscribers, may be sent to your computer. Other e-services will be done in the background without the customer's immediate knowledge. HP defines e-services as "*modular, nimble, electronic services that perform work, achieve tasks, or complete transactions*". Therefore, any application program or information resource is a potential e-service and Internet service providers (ISPs) and other companies are logical distributors or access points for such services. The e-services concept also sees services being built into "*cars, networked devices, and virtually anything that has a microchip in it*". HP's vision is that IT departments will increasingly address their needs in a modular way so that individual modules can potentially be addressed by some e-service. [Anonymous, 2002] In healthcare, however, and in the primary health care in particular, any business model for e-services should promote cooperation and effective/efficient interoperability based on the core relationships between organizational strategy, primary and support processes, and technological infrastructure. Beyond Internet, the potential of cell phone communications, portable devices and electronic instrumentation in the development of e-Health services for patient monitoring and follow-up, together with advances in sensor technology, wireless communications and pervasive computing technologies will be able to facilitate the development of new tools and models of services to support independent living and enhanced quality of life (the so called "*e-enabling*"). Such a useful example from Spain on *telemedicine* (more as an organisational formula rather than as a technology *per se*), together with enabling assistive technologies, embedded computing and wearable devices has shown how physiological parameters and other data can be retrieved in real-time and delivered to the medical personnel [Garcia-Santesmases et al, 2004]. Similarly, the adoption for a "glycemia test" sent by Internet for monitoring of diabetic patients in their homes (i.e., community level) requires new approach and marketing strategies by the provider. Although innovation in emerging e-services for health is a high-risk business endeavour, the increasing trend of adoption of ICTs in the primary health care settings is a clear sign of the expanding needs and newly developing markets that will certainly require not only new ways of thinking but also specific approaches for provision of the primary care to the populations.

The PHC physicians (GPs, family doctors) provide the foundation of health care systems in most countries and are the main figures that ensure access, connect care and endorse continuity of care for the patients and their families. In the same time, the aging populations, increasing prevalence of chronic disease and widening abilities to deliver complex care outside the hospitals have prompted international efforts to redesign primary health care to improve outcomes and efficiency. A recent international survey, funded by the Commonwealth Fund [Schoen et al, 2009], investigated PHC physicians across 11 countries. One of the most important aspects of this survey was the current status of ICT in healthcare provision at PHC level. The survey addressed *14 computerized functions* of the PHC practice, including basic electronic medical (health) records (EHRs), namely electronic ordering of medications and tests, computer access to test results and medication lists, computer alerts/prompts, and decision support; computerized reminder systems for prevention and follow-up care (**Figure 1**); computerized ability to list patients by diagnosis, laboratory results, and medications; and electronic entry of notes and medical histories. To evaluate multifunctional capacity, a summary variable counting the number of functions was created and it categorised systems as low (0–3), middle (4–8), or high (9–14) [Schoen et al, 2009].

The survey found a striking spread across countries in the adoption of EHRs and the range of electronic functions. For instance, in Australia, Italy, the Netherlands, New Zealand, Sweden, and the United Kingdom, EHRs are nearly universal, and >50% of the practices reported at least nine of the surveyed functions. The physicians in Canada, the United States and France lag behind in basic EHRs as well as multifunctional support. Even though EHR use is nearly universal in Norway, its functional capacity is low as is that of Germany.

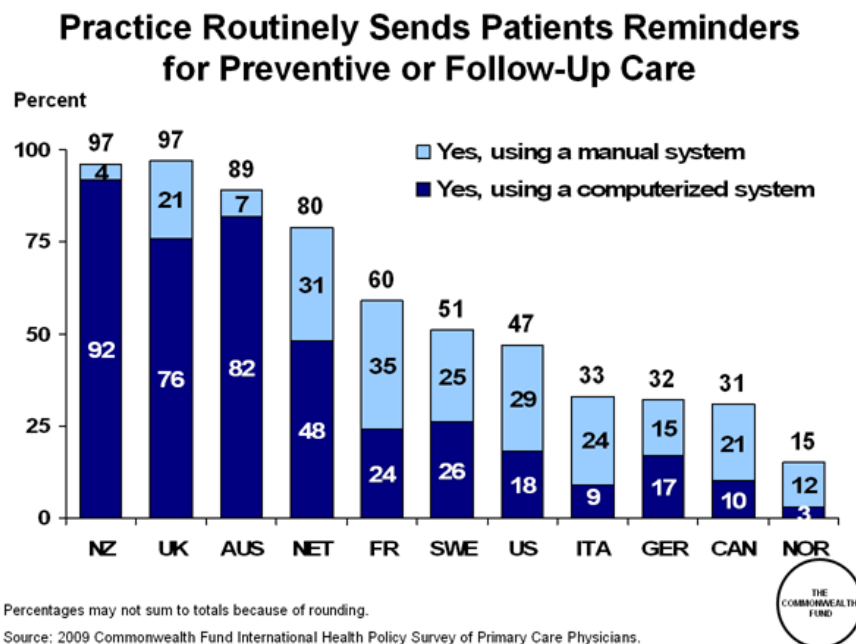


Figure 1. ICT communications in primary health care in different countries. Reproduced from Schoen et al [2009] with permission.

In the same time, there was a large variation in the responses indicating different emphases in building capacity. For example, among the seven countries with near-universal EHRs, the majority of physicians reported electronic access to laboratory results, yet fewer than half of Dutch, Norwegian and U.K. doctors can order tests electronically. Across countries, most doctors with EHRs reported electronic clinical notes, routine electronic prescribing, and computerized alerts about potential problems with drug doses or interactions (except in Norway). In particular, decision support (e.g., computerised decision support systems, CDSSs) appears generally less well developed. Computerized reminders for treatment guidelines, tracking laboratory tests and prompts to provide patients with test results were the least frequently reported, including countries with multifunctional capacity. Notably, the seven countries with near-universal EHRs have succeeded in spreading multifunctional capacity to smaller as well as larger practices. Their national policies and standards have supported the spread of this IT multifunctional capacity. In contrast, U.S. multifunctional capacity remains concentrated in larger practices, e.g., one-half of the U.S. practices with high-function capacity were associated with *integrated care systems* such as Kaiser in USA [Schoen et al, 2009] or NHS in UK [Trotter, 2008]. In summary, only 46% of U.S. doctors use electronic medical (health) records compared with over 90% of doctors in Australia, Italy, the Netherlands, New Zealand, Norway, Sweden and UK.

A specific example of successful application of ICT support in PHC delivery is the introduction and development of targeted programmes and initiatives for better health education, promotion and health monitoring. Mainly at a regional level, such programmes can surely profit from a further expansion and wider implementation, on a world-wide scale. One such programme is the ICT support for self-monitoring and glucose control in primary care in diabetic patients. For instance, the National Service Framework (NSF) standards 3-6 in UK relate to working with individuals and their support networks to support self-care, however, the diabetics are not maximising the benefit of self-monitoring or the lifestyle changes required to slow the disease development and minimise its further complications with, for example, over-usage of glucose monitoring without adequate knowledge of how to use the information to improve glucose control [Davis et al, 2006; PHRISK Portal]. In particular, as measured in the Quality & Outcomes Framework (QOF) in general practice, the rates of blood glucose control in primary care should increase from 65% in 2007-2008 to 68% in 2010-2011 (i.e., as a Primary Care Trust Corporate Objective). Other similar examples of successful case studies of ICT support in primary health care and health promotion at general practice level have been

described recently by Maad et al [2009] in a study to explore options and present a conceptual bioengineering framework for a global ICT platform implementation in and a development of a long-term scalable primary care model.

5 CONCLUSIONS

We summarised recent evidence on the main types of PHC delivery models across different countries and cultural environments and explored their suitability for provision of e-services to, and of other types of computerised communications with, the patients. Notably, the main prerequisites for successful provision of *e-services to the patient within the system of PHC delivery* are the (i) highest possible level of integration of primary care, possibly with an enhanced primary care team (PCT); (ii) multidisciplinary approach; (iii) adoption of an electronic medical (health) record; and (iv) introduction, maintenance and update of computer decision support systems (CDSSs) and tools.

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