England's Electronic Prescription Service

8

Infrastructure in an Institutional Setting

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8.1 Introduction

Primary care computing in the UK has been presented as a national success story for health informatics development and use (Benson 2002a, b). Despite each UK nation having its own devolved National Health Service and developing its own systems, primary care health professionals in England, Northern Ireland, Wales and Scotland all use electronic patient records, on-screen prescribing decision support, and electronic prescription printing. Recently this has been augmented by the adoption of electronic transmission of prescriptions (ETP), with each devolved nation's NHS developing their own version to meet local needs. The subject of this chapter is the solution adopted by England's National Health Service (NHS), which takes the institutional form of the Electronic Prescription Service (EPS).

England's EPS was designed to support the processing and management of increasing primary care prescription volumes, which have shown a consistent growth of around 5% a year for the last two decades. Currently, England's 56 million citizens receive over 1,000 million prescription items from NHS primary care services. Whilst the potential for electronic prescription transmission has been long recognised, the development and deployment of EPS as a national system has taken over 13 years (2003–2015). As of early 2016, deployment is

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ongoing, although the service looks to be gaining widespread acceptance as it has now been installed in 98% of the 11,844 community pharmacies, and 78% of the 7,803 GP practices in England (Health and Social Care Information Centre 2016).

In this chapter, we examine the making of EPS and the forces that shaped its present form and status. EPS has been assembled as an operational service from decades of technical development and pilot implementation efforts brought together within a specific project under the NHS National Programme for Information Technology (NPfIT) – the decade long centrally mandated initiative running from 2002 to 2013. It also drew heavily from (and at times changed) the established work practice in primary care. Our analysis adopts three interlinked temporal perspectives to trace the influence of existing systems, old and new infrastructures and wider interests in the way EPS has been assembled. These are expressed as; (1) a causal past represented by history and the installed base, (2) a concurrent present of established practices and change programmes seeking to influence them, (3) desired futures as reflected in policy goals and visions. Thus EPS is assembled from its past, its present and its future(s). This process is traced out using three interwoven perspectives; the realization and negotiation of *constraints* found in the wider NHS context that limit change, as *inertia* arising from limited resources and weak incentive structures, and in a purposive *fidelity* to existing institutional culture, seen here most directly in the history, practices and ethos of the NHS (Fig. 8.1).

This chapter draws data from a commissioned evaluation of EPS (see Box on Methods and Data), reported in Cornford et al. (2014), although the analysis here is new. In particular we focus on how the EPS entering wide scale use today (2016) draws on extant technologies and installed bases of infrastructures, and how this relates to and reflects the practices and interests of multiple stakeholders. EPS draws from, and contributes to, the long history of UK health informatics (Fig. 8.2). This is a history characterised by incremental development and pilot deployments, recurring local and national initiatives, and successive policies looking for service transformation through technology. The history begins with the computerisation of hospital admissions and hospital pathology laboratories in the 1960s (Brennan 2005), and continues into the present with a promise of an Integrated Digital Care Record (NHS England 2013). This history is punctuated by occasional failures, for example with the Care Records Service (CRS) component of the National Programme for Information Technology (Matheison 2011). Still, the NHS continues to pursue, with undimmed enthusiasm, the new frontiers of health informatics. Thus current informatics policy is focused on supporting a transformed service that embodies integrated patient-centred care, accountability in care provision, and the capture and curation of aggregated data for NHS management, research and the promotion of better health and healthcare (NHS England 2013).

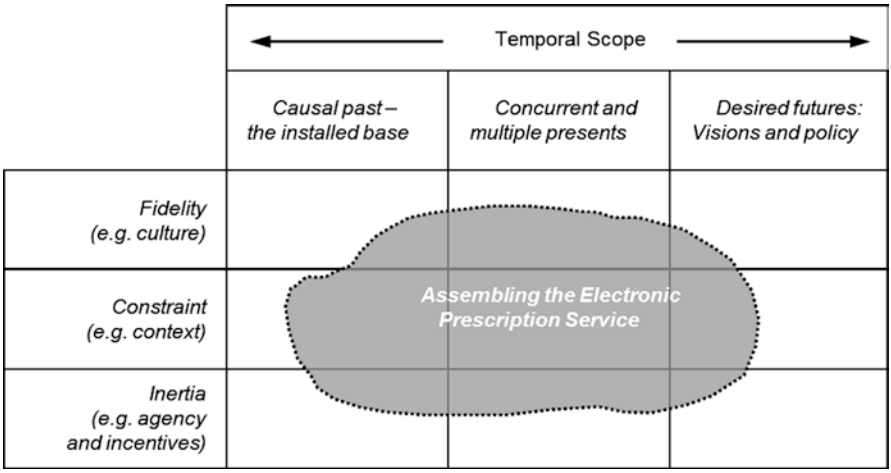

Fig. 8.1 The analytical model used

Methods and Data

This chapter draws from work conducted as part of the Evaluation of the Electronic Prescription Service in Primary Care, a project which ran from 2008 to 2013 and was funded by the Connecting for Health Evaluation Programme (Cornford et al. 2014; Hibberd et al. 2012; Petrakaki et al. 2012; Lichtner et al. 2012). In writing this chapter we identified from the project data key exemplars of where the installed base, which can be thought of as a multi-layered set of socio-technical systems, based on Cornford et al. (1994), constrained or influenced the development of the service.

The evaluation encompassed both a historical analysis and an examination of the contemporary development of the service through interviews with key stakeholders from the agencies and software companies developing the systems, end-users in the form of patients, GPs and community pharmacists, as well as observations of practice. This data provided an understanding of the intent of the system, its operation in various settings, and examples of operational surprises which often revealed unforeseen influences of the installed base.

The EPS has undergone further development since the evaluation research ended. To reflect this we also examined contemporary public literature from the EPS delivery agency, the Health and Social Care Information Centre, and from practitioner organisations, such as the Pharmaceutical Services Negotiating Committee, an organisation that has been an influential stakeholder in the development of the EPS.

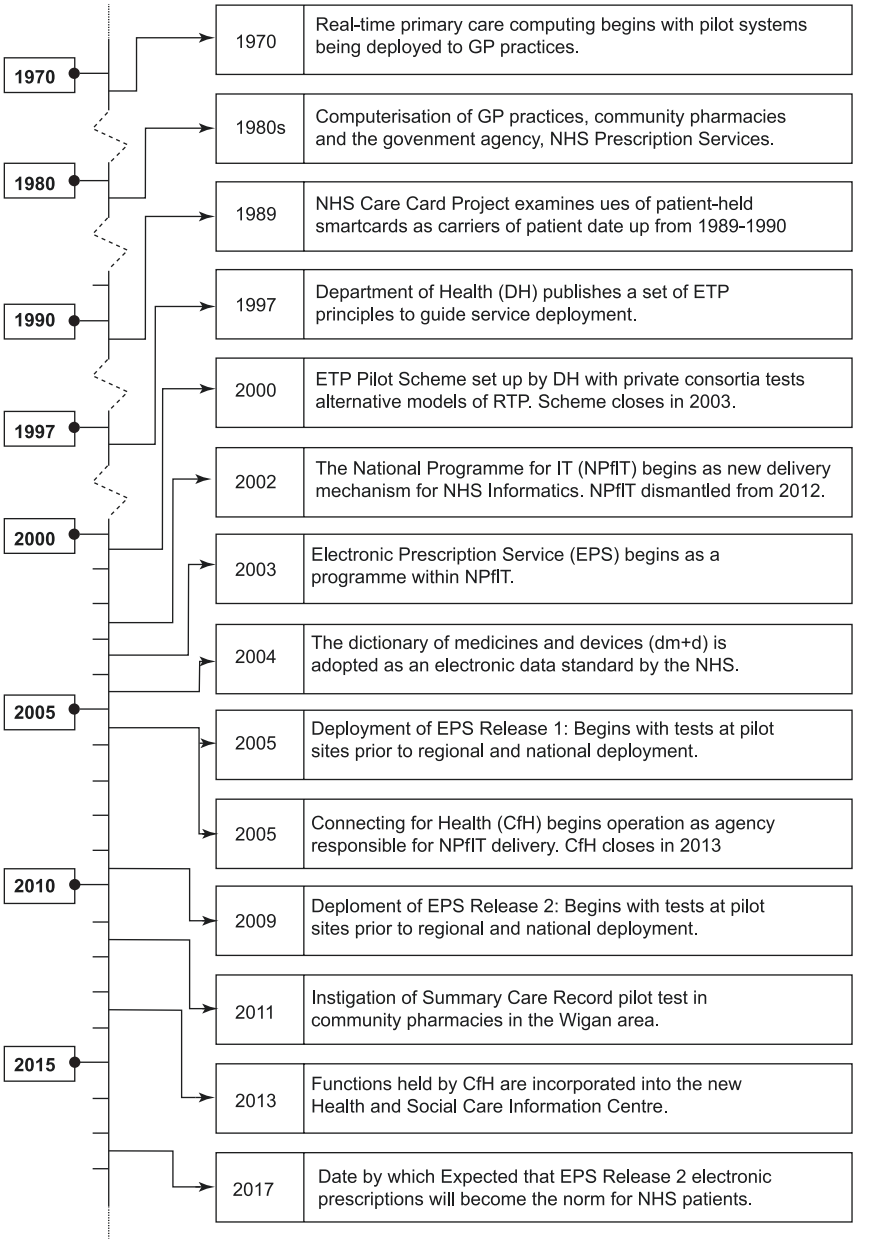

Fig. 8.2 Timeline of electronic prescription development in England

8.2 Primary Care and Health Informatics in England

The NHS commissions and delivers healthcare at a population level, supporting the development of health informatics to help achieve its broader remit for care. Funding for the service is through both general taxation and the charging of capped co-payments for some services, including primary care prescriptions. It commissions care from both public and private healthcare facilities. The NHS has also developed an unenviable reputation for reorganization of its core management structures (Talbot-Smith and Pollock 2006). Current policy, following the Health and Social Care Act of 2012, places emphasis on devolution of decision-making, service commissioning and budgeting. This landscape might appear incompatible with national informatics programmes such as EPS, and indeed EPS did emerge from a different economic and political era, being conceived in 2003 as part of the National Programme for Information Technology (NPfIT) that sought to direct informatics initiatives from the centre (Takian and Cornford 2012).

From its foundation in 1948 primary care in the NHS has been delivered mostly by private sector providers (Talbot-Smith and Pollock 2006). A rough division can be drawn between those who diagnose, prescribe and refer on to secondary care, typically general practitioners (GPs) and those licensed to provide therapeutic aids and drugs to patients, typically community pharmacies in high street shops. Both constituencies represent private businesses providing services to NHS patients though local and national commissioning contracts.

The devolved structure of primary care presents a challenge to new informatics based initiatives, insofar as any new service requires that primary care providers adopt compatible systems that are themselves supplied through competitive private sector markets, and to assent to sharing of data with both other primary care service providers and NHS secondary use services (Cornford et al. 2014). Thus NHS primary care providers and their informatics contractors, can and do at times hesitate and resist when asked to deploy new services and systems. Provision and use of health informatics services also reflects, in most cases, espoused health policy visions and strategies and come with some associated incentives. Thus, in the case of EPS there is a policy vision of community pharmacy as a resource that can support prescribers and patients by undertaking a greater role in the management of drug therapies for patients with chronic illness.

8.2.1 Prescribing, Dispensing and Reimbursing Primary Care Drugs

The typical pattern of prescription management in primary care is for the general practitioner to issue a prescription and for a community pharmacist to dispense against this, as appropriate. This division was first enshrined in the 1911 National Insurance Act which removed from prescribers the right to provide therapeutic drugs as part of a single care package (Anderson 2006). This had the effect of

supporting an emerging pharmacy profession that gained greater and greater importance over the next 80 years as an ever-expanding catalogue of pre-packaged ready to use, experimentally proven drugs displaced the remedies traditionally compounded by pharmacists (Wade 1993).

More recently, during the period from 1979 to 2013, the average number of prescription items dispensed in primary care per capita each year has increased from 6 to 19 (Government Statistical Service 1991; Comptroller and Auditor General 1992; Health and Social Care Information Centre 2015), with those over 60 years of age receiving on average over forty prescription items per year. Increasing life expectancies and the associated increases in co-morbidities suggest that the prescribing and dispensing activities of primary care will become more central to care, more complex and could also have greater potential for harm (Banarjee et al. 2011). In response, community pharmacy has been promoted as needing to have a greater role in management of therapeutic drugs (Zermansky 1996), which is reflected in policy around service digitalization and repeat dispensing (Cornford et al. 2014).

8.2.2 Computers in English Primary Care

Development of EPS has been able to exploit a substantial installed base of NHS primary care informatics which has emerged from over three decades of initiatives in community pharmacies, GP practices and by the agency responsible for reimbursing primary care contractors for therapeutic drugs dispensed, NHS Prescription Services (Hayes 2008). But despite computerisation efforts in all three of these constituencies since the 1980s, it was not until the EPS programme in 2002 that a concerted effort was made to digitize the exchange of prescription data. Prior to this data flowed between the three main constituencies using hand-written, and more recently, computer-printed, paper prescription forms, officially known as the FP10.

Of these constituencies, GP practices have the longest history of computerisation, stemming back to batch processing experiments in the 1960s and real-time computing with a shared primary and acute care electronic patient record in the 1970s (Hayes 2008). The advent of the personal computer in the 1980s, schemes to support the adoption of primary care computing such as the Micros for GPs scheme (Project Evaluation Group 1985), and a reorganization that placed emphasis on documenting care provision as well as experiments in GP fundholding, led to the development of GP practice computing in earnest with many vendors entering the market (Brennan 2005; Hayes 2008). The numbers of vendors of GP practice systems subsequently declined through the 1990s, following the imposition of mandatory accreditation, but adoption of computerisation increased, reaching 96% of GP practices by 1996 (Hayes 2008).

Adoption of these systems by GP practices was initially driven by the value that the systems held for these businesses in the face of contractual change. In community pharmacy, computerisation was also driven by business concerns. In the 1980s pharmacy wholesalers recognized the opportunity for computers to support

pharmacists in managing stock, and themselves in supporting ordering. These early systems, initially promoted and supplied by wholesalers, were subsequently developed as a platform that could integrate new clinical functionality. Thus as new professional requirements, such as maintaining patient medication records (PMRs) and creation of printed labels for dispensed items, came into force, these software systems were adapted (Shepherd 2008).

Given that it was the business opportunities provided by computers that drove the adoption of informatics by primary care providers, it would have been surprising if NHS Prescription Services (NHS PS) had failed also to adopt new informatics in support of its role of remuneration for prescription drugs dispensed. Although some prescriptions do attract a fixed patient co-payment (currently £8.20 ≈ €10.00 per prescribed item), the majority of funding for primary care dispensing is from the NHS, and is managed by NHS PS. Pharmacies make claims for the costs of dispensing therapeutic drugs to NHS PS using the prescriptions they have dispensed. Thus a prescription represents an invoice to be checked and paid as well as an authorisation to supply therapeutic drugs. It also provides a means to capture data on prescribing practices, and to collate data that can show how prescribers and GP practices are prescribing in comparison to their local and national peers (NHS Prescription Services 2011b, 2012).

NHS PS started computerisation in the 1970s as it became apparent there were no longer sufficient numbers of recruits to support the paper intensive process (Shepherd 2008). A later automation initiative, the Capacity Improvement Programme (CIP) launched in 2007 during EPS development, was similarly a response to concerns over the year-on-year prescription volume increases (NHS Prescription Services 2008, 2011a). The CIP was however still focused on the paper based system, using sophisticated optical character recognition to render prescription forms into digital data for processing.

8.2.3 Early ETP Experiments and Pilots

Computerisation of the NHS in the 1980 and 1990s inspired two in-vivo ETP experiments prior to the development of EPS. The first of these was the NHS Care Card programme of the late 1980s, which used the then novel technology of microprocessor based smartcards held by patients to transfer health record and prescription data between suitably equipped health care providers (NHS Management Executive 1991). Although this experiment, run in parts of England and Wales, did successfully demonstrate the service's concept, concerns over the cost and durability of the smartcards, and also of the lack of a back-up network to transfer data in case of smartcard failure, led to the abandonment of this solution (Hayes 2008; NHS Management Executive 1991).

At the turn of this century, ETP was revisited with a second NHS experiment using the new technology of electronic data interchange (EDI) and web services. The ETP Pilot Programme of 2000 invited private sector consortia to set up regional pilot projects in order to support the development of a set of standards that could underpin an England-wide ETP service (NHS Prescription Pricing Authority 2000).

From the start it was proposed that the outcomes of the ETP Pilot Programme would be reflected in a new ETP service that would be deployed in English primary care by 2004, although this timetable was later revised to 2008 as it became apparent that the institutional texture of the primary care environment was more complex than imagined. Some suppliers in the pilot believed that this could also provide an opportunity for at scale deployment of their pilot service, but the ETP Pilot Programme closed in 2003, as originally envisaged (Mathieson 2003).

The conclusions drawn were that the solutions developed were unable to meet stated institutional requirements around ensuring continuity of existing business flows between GP practices and community pharmacies (Department of Health 2004; Sugden 2003). More importantly, the pilot systems were incompatible with the new NPfIT vision of service integration, national systems, and shared resources (Brennan 2005). However, the vision of ETP as an EDI and network-based service remained and influenced the subsequent EPS.

8.3 Assembling the Electronic Prescription Service

EPS at its simplest just offers more reliable data transfer between the three main stakeholders using a digital version of the existing FP10 prescription form. Still, the influence of EPS inevitably leads to practice change across these institutional settings. Claims made for consequential change were often expressed as benefits to be realized and illustrate the service's expected influence on practice. Anticipated benefits included support for faster, more efficient prescription processing, reduced risk through elimination of transcription errors and the availability of electronic cancellation, reduced clinician prescription management workload, and increased patient convenience. Another suggested benefit, which was not pursued, was the expectation that the service could provide a proxy record of patient adherence to treatment through a record of dispensing events (Harvey et al. 2014). Concurrent changes in prescription management (discussed below) would later bring repeat dispensing prescriptions into the dialectic around EPS, and became more dominant as managers and policy makers became familiar with the possibilities this could offer (Cornford et al. 2014).

8.3.1 Transforming the Prescription

The benefits of EPS follow from one principal goal, replacing the paper form – known in the NHS as an FP10 – as the legal prescription by an electronic and digitally-signed equivalent. This form has traditionally been handed from prescriber to patient to dispenser and then passed onto NHS PS for reimbursement. Over the years, the FP10 has evolved to encompass a number of different functions for prescription management. The example shown below (Fig. 8.3) is for a repeat prescription. The left hand side represents the prescription which is dispensed against and will be used by the

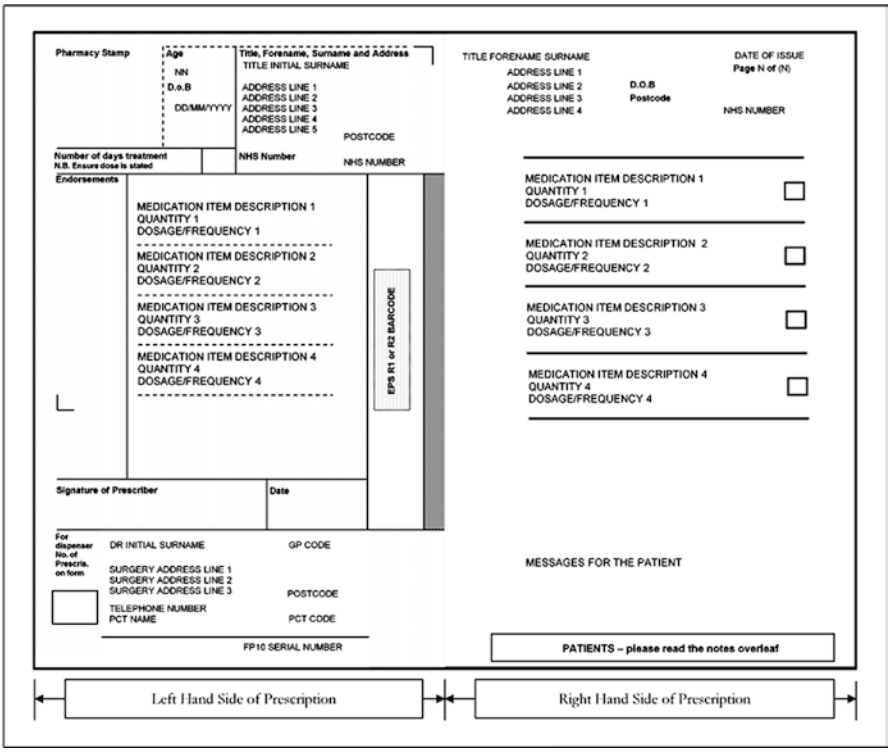

Fig. 8.3 English primary care FP10 prescription form (Gooch 2007a, b). Copyright © 2016, Re-used with the permission of the Health and Social Care Information Centre, also known as NHS Digital. All rights reserved.

dispenser to claim for what has been dispensed. The right hand side of the FP10 is a tear-off reorder form for use by the patient. Re-ordering is allowed for a set number of times until a review date has been reached, without the need for a GP consultation on each occasion. The right hand side also can be used by the GP practice for health promotion messages, or to advertise services, such as flu vaccination, which GP practices and community pharmacies might compete to provide. The back of the form (not shown) includes a signed declaration for those claiming free prescriptions.

Development of the EPS coincided with changes in how prescriptions can be managed. Prior to 2015 prescribers issued either acute or repeat prescriptions (Table 8.1). However, concerns over the capacity of GP practices to effectively monitor repeat prescriptions (Zermansky 1996) led to a new model of prescription management, the repeat dispensing prescription, where the activities of monitoring and control of prescriptions for chronic illness were handed to community pharmacy. This in turn triggered calls for change in the institutional relationship between prescribers and dispensers, principally around giving dispensers access to the concurrently developed national electronic Summary Care Record (SCR).

Table 8.1 Types of Prescription Used in English Primary Care (Cornford et al. 2014)

Type	Application	Management
Acute prescription	A one-off prescription for short term illness issued following a consultation between patient and general practitioner (GP)	The prescription is presented to the community pharmacist. Clinical checks are conducted by the pharmacist to ensure the prescription is appropriate for the patient. If the prescription is appropriate the relevant drugs are dispensed to the patient
Repeat prescription	Prescription is issued for the management of a long-term condition following a consultation between patient and GP. It is agreed by both parties that the prescription can be re-issued a set number of times until a review date without further consultations	Prescription is presented to the community pharmacist and checked and dispensed against as for acute prescriptions. The prescription is re-ordered from the GP practice using an order form printed with the prescription, and will be re-issued unless a review date has been reached or there are concerns over patient adherence
Repeat dispensing (introduced 2005)	Prescription is also used for long-term condition management. All issues of a prescription that the patient is expected to need until the review date are issued as a single batch. On paper these prescriptions are sent to a single pharmacy. With the use of electronic prescriptions each issue is a separate entity that can be dispensed against at any pharmacy	A batch of prescriptions is handed to the community pharmacist. Each issue is dispensed against when requested by the patient. Prescriptions are dispensed against in the same manner as an acute prescription with the addition of a check by the community pharmacist of patient's use of the medicine

8.3.2 Architecture

As a part of the NPfIT portfolio of projects EPS was explicitly designed alongside efforts to build services that met agreed national informatics standards. NPfIT was based on commitment to a common infrastructure through which constituent components such as EPS, SCR, the Care Records Service and others could connect and exchange data. At the core of this was a data-center and communications backbone, known as the Spine, providing common services and enabling the transfer of data between NHS computer systems. NPfIT also established a national secure network for the NHS – known as N3. The services used by EPS included the N3 network, extended to include links to high street pharmacies, and two principle Spine Services to manage the delivery of prescriptions: an Identity Agent service to establish the validity of prescribing and dispensing endpoints, and the NHS Smartcard to implement role based access control for prescribers and dispensers (Fig. 8.4). In addition a new underlying drug dictionary (dm+d) was developed – described below.

EPS functionality for prescribing and dispensing would however be delivered to health professionals by the vendors of community pharmacy and GP practice software, and to do so would make use of these core infrastructures and central data

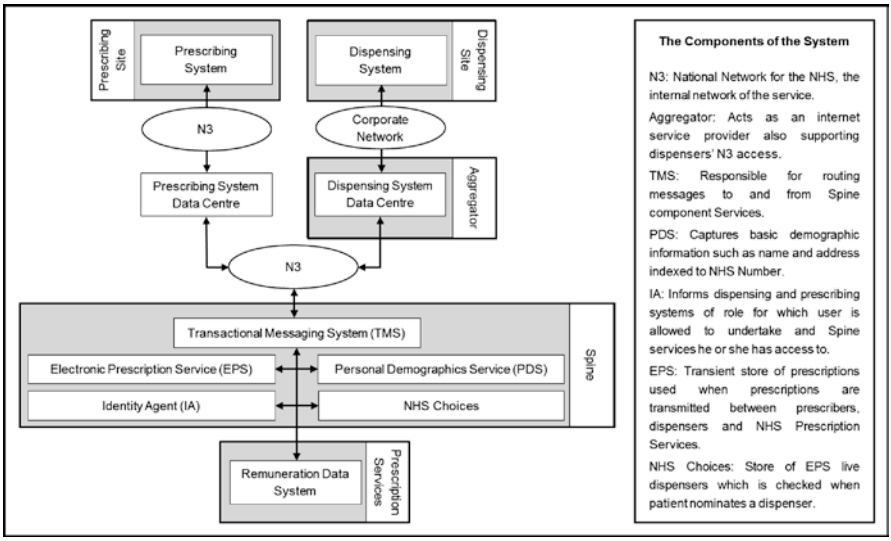

Fig. 8.4 Components of the electronic prescription service (Health and Social Care Information Centre n.d.). Copyright © 2016, Re-used with the permission of the Health and Social Care Information Centre, also known as NHS Digital. All rights reserved.

services. A set of output-based specifications were made available to software vendors that described how the EPS software for doctors and pharmacists should manage and process electronic prescriptions (Gooch 2007a, b). Compliance of software with these specifications was assessed through a multi-stage common assurance process (CAP) managed centrally (NHS Connecting for Health 2012). These specifications provided a partial definition of the operation of the service, but details as to the management of user interfaces and circumstances for the creation of paper versions of the electronic prescriptions was placed in system suppliers' hands.

Electronic Drug Dictionaries

Prior to EPS there was no single database of therapeutic drugs available for use within GP practice systems, system vendors choosing from a number of commercial suppliers, such as First Databank Europe, or opting to develop their own, as EMIS, a major software supplier, did. In parallel NHS Prescription Services compiled a monthly Drug Tariff based on manufacturer data, marketing authorisations, and latterly, dispensing volumes. One consequence of EPS was that a new and common underlying database to describe medicines as they were prescribed, dispensed and paid for was developed, the dictionary of medicines and devices (dm+d). This ontology can represent therapeutic drugs at multiple levels depending on how the data was to be used. To support access to existing decision support systems manufacturers might chose to map dm+d coding to their own dictionaries, which also allows the development of decision support across multiple international markets

8.3.3 Release Strategy and Deployment

EPS was structured and delivered to users as two sequential releases. The releases differed in their functionality and the demands made on dispensing and prescribing health professionals. This approach allowed for tests of the technical infrastructure to be conducted in the first release, including networking and the Spine services developed for NPfIT (Brennan 2005).

EPS Release 1 (EPS R1) focussed on augmenting the paper prescription with digital data (Fig. 8.5). A unique identifier for each prescription was created at the time of prescribing and printed on the prescription as a barcode. A digital copy of the prescription was then sent to the Spine. A pharmacy could scan this barcode and download a digital copy to be used to populate the patient medication record (PMR) in the pharmacy system and help in stock control and label creation. Although a dispenser could forward the digital version of the prescriptions to NHS Prescription Services, this functionality simply served as a test of prescription transmission with no immediate benefit for community pharmacy. In many ways EPS R1 was a partial parallel run of digital and paper systems side by side from which much was learned about the network and the software.

EPS release 2 (EPS R2) expanded the administrative and clinical functionality and enabled electronic and paper artefacts to trade legal status (Fig. 8.6). In EPS R2 the digital message has the legal status as a prescription, and is dispensed against and used to claim for remuneration. In addition, new clinical functionality in the form of repeat dispensing prescriptions and safety functions, such as electronic cancellation of prescriptions were added, with the expectation of more timely and effective delivery of prescription drugs to patients as well as efficiency benefits for GPs, pharmacists and NHS PS.

At the time that EPS R2 was ready to be deployed NHS primary care was composed of a number, of local health authorities, known as Primary Care Trusts (PCTs). In order to issue digitally signed electronic prescriptions, the PCT had to have Secretary of State Directions (e.g. permission). This was issued based on the readiness of the PCT to manage the local deployment process. Control over which prescribers could issue electronic prescriptions was at the discretion of the PCT. A GP practice would only be allowed to use EPS R2 when at least 80% of their existing prescription volumes could be sent to dispensing sites that had EPS available. This ensured both that there were local places to send prescriptions to, and helped avoid market distortion.

However, whilst a prescriber might be authorised to issue electronic prescriptions, not everything prescribed could be sent electronically, specifically certain schedules of controlled drugs –drugs that can be abused or employed for nefarious purposes (Department of Health 2014). Following a high profile case of murders committed using diverted controlled drugs, the department responsible for drugs policy, the Home Office, revised the Misuse of Drugs Act to restrict the

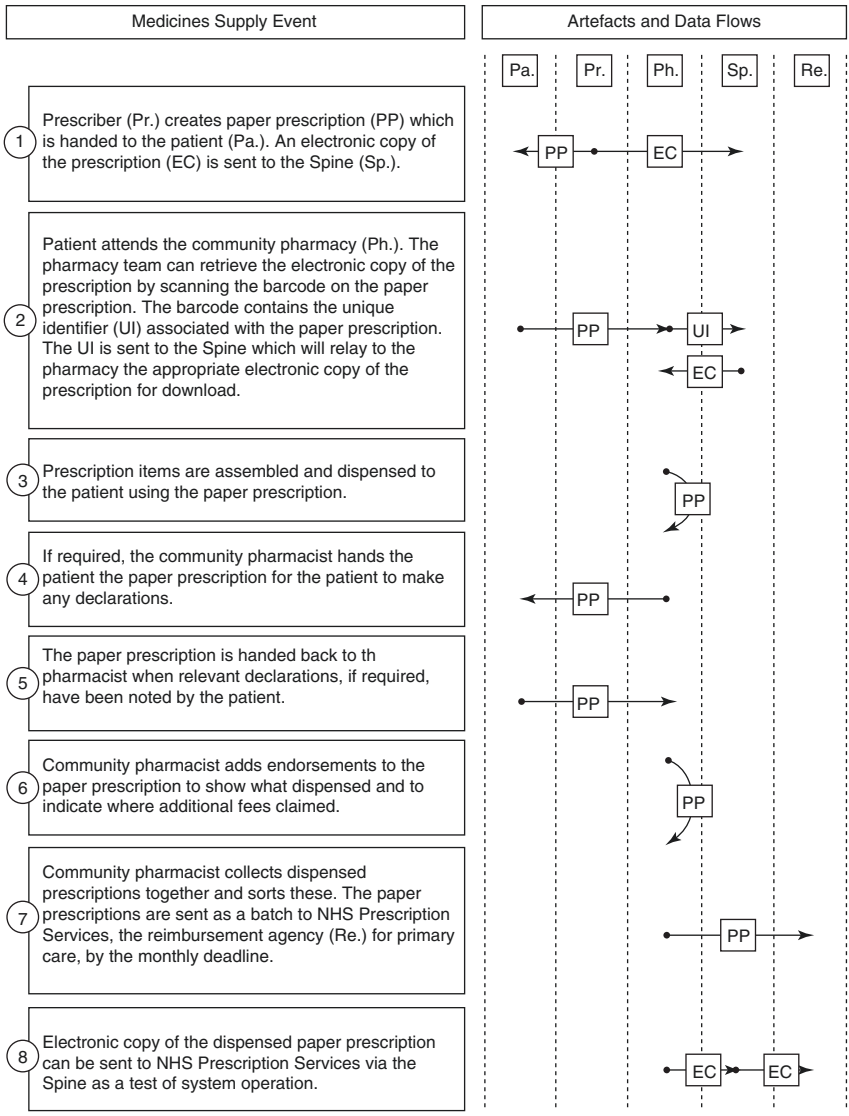

Fig. 8.5 Operation of the electronic prescription service release 1

opportunities for diversion. So, despite the potential that EPS had in restricting and auditing supply, it was not until July 2015, that the Misuse of Drugs Act and other regulations were amended to allow for full electronic prescribing of controlled drugs (Department of Health 2015).

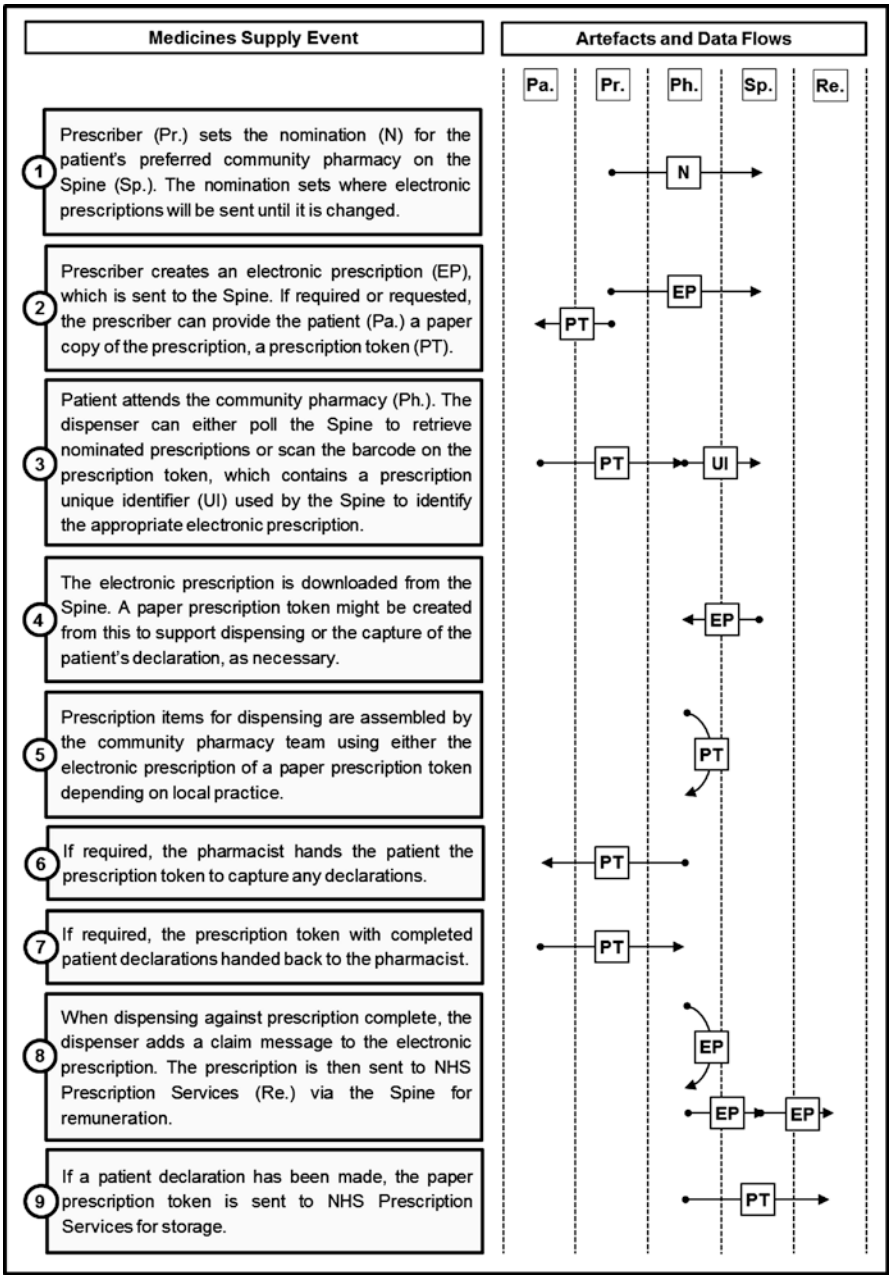

Fig. 8.6 Operation of the electronic prescription service release 2

8.4 Assembling EPS as Past, Present and Future

In this section we consider the nature of the work needed to assemble the EPS we see today. We do this using a model that identifies the work of assembly in terms of *constraints* imposed within the context of EPS development and deployment, *inertia* resulting from unaligned incentives and lack of resources, and finally concern to maintain *fidelity* to the mission of the broader NHS, its culture and practices (Fig. 8.1).

8.4.1 The Physical and Material in a Digital World

We start by considering EPS in its technical/architectural form employing a range of digital services to support communication of relationships about the physical world in terms of medicines, people and locations. General communication standards introduced across the NHS by NPfIT such as ebXML, HL7 and the clinical coding terminology SNOMED CT, provide underlying substrates for this communication. Other specific new services were developed, for example, electronic verification of users and sites by Spine Identity Agent which check both validity of role-profiles on individuals' Smartcard and the identity of endpoints through Organisational Data Services (ODS) codes. As noted above, the therapeutic drugs that can be prescribed using EPS are described in a new electronic dictionary of medicines and devices (dm+d) developed for EPS.

These protocols, databases and services each fulfill necessary roles and functions in the new EPS, but EPS must also show some fidelity to established structures, practices and professional roles within the NHS. A primary example is the FP10 prescription form. The FP10 endures within EPS in many ways and links it to the past and facilitates its viability in the present. The continuing presence of the FP10 within EPS is in part a means of overcoming inertia and institutional constraints in implementation and also a demonstration of fidelity with the past. Retaining elements of the FP10 in the assembly ensures a better 'fit' of the new EPS in the wider health care context, both conceptually and practically. The FP10 also endures in a printed form, although without legal status. For example, a printout may support the FP10's traditional role in collecting patients' signed declarations for prescription charge exemptions as well as meeting dispensers' needs for a portable representation of the prescription, a picking list, against which to assemble drugs when dispensing. Similarly, a prescriber may wish to give a patient a paper copy of their drugs to keep, even if the prescription itself is electronically transmitted. And we know that 'handing over the prescription' is a common way that doctors politely terminate a consultation.

In the new electronic world, just as with paper prescribing, an EPS prescription can be composed of multiple prescription messages, each message constrained to a maximum of four prescription items. This constraint, originally imposed by the physical size of the FP10 form, endures in EPS reflecting the need to replicate existing FP10 processes, for example in its role as a dispenser's picking list. This fidelity is

reinforced by the inertia implied in the delivery model used for EPS, in which providers of existing prescribing and dispensing software were invited to integrate relevant functionality into their *existing* software systems. As a result many aspects of EPS software design, in particular interfaces, drew directly on existing processes for FP10 handling in GP practices, Community Pharmacies and NHS Prescription Services.

8.4.2 The Reinvention of Services

EPS is constrained and shaped by the complex and multiple institutional and technical relations in which it is embedded. The confluence of multiple institutional presents place constraints on how and what EPS can do or change, and can conspire to reduce the service functionality and availability. These constraints invite resolution over time through such things as regulatory change (e.g. controlled rugs), workarounds and repurposing of infrastructures. Indeed, work-arounds are a common and an essential part of EPS's ability to respond to challenges and reshape itself over time.

This is also seen in the ways that the NHS Smartcard is repeatedly renegotiated as a part of EPS. The NHS Smartcard implements a Role Based Access Control (RBAC) model in which access to services are associated with specific privileges for individual's roles stored in the Spine's Identity Agent (NHS Connecting for Health 2011). A health professional's NHS Smartcard has to be in an attached reader for the session and a password entered at the start of a session. This is broadly suitable to work practices of prescribers in primary care and such use, for example by doctors preparing prescriptions, predates EPS.

This model was not, however, found appropriate for dispensers in community pharmacy and indeed was never designed to encompass 'non NHS' persons in private organisations – the status of a community pharmacist, either as a permanent or locum staff. The result is that new models of Smartcard use emerged in the form of work-arounds. First, for EPS R1, given access is only to an electronic copy of the patient's prescription, information that the community pharmacy already has, the solution found was simple. Each community pharmacy was issued with an NHS Smartcard that acted as a proxy for the site, and which represented shared rather than a personal roles and privileges. But this 'fix' could not work in EPS R2 where dispensers gained access to Spine services that support inspection and amendment of patient data, which requires an audit trail (NHS Connecting for Health 2010).

For EPS R2, community pharmacies moved to the model used by NHS clinicians. In this model the Spine Identity Agent records the identity of the clinician, the clinician's roles and the sites at which this role is enacted, each site being identified by an ODS code. Locum community pharmacists, moving often from site to site, posed a problem if their ODS mapping requires frequent updates. The solution found was to create a virtual organisation for dispensing staff, initially community pharmacists but later dispensing technicians too, which was given the ODS code FFFFF, the 5-F code (NHS Connecting for Health 2010). This workaround allowed an EPS R2 user access to limited patient data. However, it is now policy that pharmacists have access to the Summary Care Record (SCR) – a national summary of

the individual health record including medicines prescribed, seen as an essential tool to support pharmacists in safe therapeutic drug supply. This created a need to reinvent the process once again to provide a more detailed audit trail. Now locum staff access the SCR by the 'emergency' access button *plus* manually inputting the ODS code for the site where they are working (Royal Pharmaceutical Society 2014).

8.4.3 Ruthless Standardization

> We will improve the leadership and direction given to IT, and combine it with national and local implementation that are based on ruthless standardisation. (Department of Health 2002)

NPfIT, the large national programme within which EPS was initiated, started out with a mantra of 'ruthless standardization'. It took time to dilute and finally wash this idea away. EPS as it has been delivered is very much a child of this policy and the retreat from it. Initially NPfIT proposed that all GP systems would be replaced with just one of two national 'solutions' incorporating EPS. In time there was revolt as GPs realised they would be coerced into giving up systems they knew and trusted. To placate them, in 2006 a new model of GP software procurement was established, GP Systems of Choice (GPSoC). This allowed GP practices theoretically to adopt any software that offered GPSoC functionality including EPS and the Summary Care Record (NHS Connecting for Health 2008).

The GPSoC model of approval based around output-based specifications (OBS) only defined how *electronic* messages would be handled. So controlled drugs initially fell outside of EPS and thus also fell outside of the OBS. Consequently, with no guidance available as to how to manage prescriptions which contained both EPS and non-EPS items, no common model was proposed for managing these situations. Some software suppliers choose to prevent any part of a prescription containing controlled drugs being transmitted electronically, others choose to create an electronic prescription for non-controlled drugs, and in parallel a paper prescription for the out-of-scope controlled drugs. Receiving drugs from GP practices with systems adopting the latter model caused confusion and inconvenience in their own work practices and for patients. This was only resolved when the law on controlled dugs changed.

A more active approach to addressing inertia and limited resources is seen in the structuring of development of pharmacy systems and the lengthy period of software testing required by the Common Assurance Process (NHS Connecting for Health 2008). This stepped assurance process for both dispensing and prescribing systems, moved from safety case analysis through to in-vitro testing with test messages in a sandpit environment through to in-vivo testing in a limited number of sites with a test set of messages, and later, real prescriptions. This detailed programme provided a mechanism through which to focus resources and supplier attention. Deliberate selection of early implementation sites on the basis of their readiness also allowed for the gradual expansion of the service and provided some quarantine for problems arising and unexpected events.

8.5 What Can the Electronic Prescription Service Teach Us?

Looking back over the history of EPS, what stands out is how much of EPS is formed by hybridisation of the digital and the physical/material. EPS was conceived to be new and powerful, embodying policy visions of transformation, but it had also to fit within existing processes and work practices, mimicking existing data flows, and co-opting core artefacts such as the FP10. Thus a flexible and evolving assembly of the digital and the physical was necessary for EPS to come into existence. Further, it is from the institutional environment as much as the installed base of infrastructures that the necessary conditions and resources for EPS are mobilised, assembled and sustained. Of course in this they also create (assemble) the conditions for complications, as we saw with regard to management of prescriptions for controlled drugs in the early implementation of EPS and the multiple reconfigurations of the NHS smartcard RBAC system.

EPS also illustrates how inertia, as represented in the limited capacities of dispensing and prescribing system suppliers to resource change, can be managed through institutional arrangements such as testing and controlled deployment. NPfIT and those managing the deployment used the power to establish specific arrangements to overcome inertia and channel limited resources within the supply network and in the context of use. Even a programme with unprecedented political commitment behind it, as NPfIT had at the outset, had to remain flexible. So our final message drawn form EPS is that the search for new opportunities within and beyond the installed base is driven by a creative search across institutional spaces as much if not more than across technological spaces. The installed base is in this way more diverse, and more pliable than we might at first think, and introduction of innovation rests on the opportunities and routes carved through.

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