

Measuring the cost of a pediatric vaccine administration in the UK

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ABSTRACT

The administration of a vaccine dose involves a series of activities prior to and on the day of vaccine delivery. Total vaccination cost should include the cost of each activity, which is often not done or poorly reported.

To calculate those costs a field study was performed in 6 United Kingdom (UK) sites (General Practitioner (GP) practices) during a 4-month period (April–June 2015). First, a workflow map of all the relevant vaccine-related activities per site was obtained through interviews. Second, time estimates for activities happening prior to the vaccination day were obtained through interviews and associated costs were calculated. A prospective, non-interventional study using Time & Motion (T&M) methodology was used to measure time for activities happening on the day of vaccination. Consumables, wastage, and guardian time were also collected. Third, the time for each task and for all tasks combined during the T&M study was analyzed using a random intercept model to account for site effect.

Hundred and twenty-three T&M observations with approximately 20 per site were collected and were equally stratified by vaccination visit during the first year of a baby's life. Total cost per visit was £11.9 (site range: £8.6–£17.0) when supply cost and time for activities prior to the vaccination day were included. Time per dose administered was 7.1 min (site range: 5.7–9.2) and the associated cost was £4.3 (site range: £3.1–£6.2).

The study demonstrates an accurate reflection of the time and cost involved in a vaccine dose administration in a pediatric setting in the UK. The amount measured is consistent with the current National Health Services fee schedule.

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1. Introduction

Cost of vaccine dose administration has been poorly reported. It is often considered marginal in the developed world as compared with the cost of the vaccine. As pediatric vaccination schemes are getting dense, assessing the time and cost impact of introducing new vaccines with extended dose schemes could become critical. Decision-makers may want to know the marginal cost incurred

per vaccination visit and per single vaccination dose. This information is necessary to assess the cost implications of introducing a new vaccine in the most cost-efficient way [1].

Time for a vaccine dose administration has previously been reported in the range of 17.3 min in the United States (US) (activities prior to and on vaccination day) [2] and 23.8 min in New Zealand [3] based on diaries and questionnaires. Both studies highlighted that the sample size and the self-reported time estimates led to large variations in the results. Objective observations of time measured by third party individuals should help circumvent those issues.

In the absence of precise cost data on pediatric vaccine dose administration in the United Kingdom (UK), a field study was set up that includes Time & Motion methodology to define the workflow process and to quantify the time spent on completing the different activities identified. T&M is well-established in measuring time especially in production settings [4,5]. In healthcare the aim has often been to measure the dynamics of staff movement and

Abbreviations: AN, auxiliary nurse; CDP, central data platform; CI, confidence interval; CRF, case report form; GP, general practitioner; HCP, healthcare professional; IEC, independent ethics committee; NHS, National Health Service; RN, registered nurse; SAS, statistical analysis software; T&M, time and motion; UK, United Kingdom; US, United States.

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the utilization of healthcare resources [6,7]. The method consists in decomposing a process into essential activities and involves the repeated measurement of each pre-specified activity by trained observers using a stopwatch. The study here aimed at calculating the time and cost dedicated by healthcare professionals (HCPs) to the activities of a vaccine dose administration in young children (first year of life). The study also quantifies the consumable usage, the vaccine wastage, and the caregiver time associated with the vaccine administration visit.

2. Methods

2.1. Study design

The workflow of pediatric vaccine administration in the UK was first identified during a feasibility evaluation by interviewing 3 nurses with field experience. A workflow map was then generated listing pre-specified activities prior to and during vaccination day (Fig. 1). Subsequently, a Case Report Form (CRF) was developed with start- and stop-points for those pre-specified activities.

A field study, consisting of two phases, was then conducted in 6 United Kingdom (UK) sites. First, information on time usage for activities performed prior to the vaccination day was collected through an interview at each site. Second, accurate time measurements for activities performed on vaccination day were performed through a T&M study. To remain representative for the UK, site stratification was introduced according to geographical area (north, south, and middle) and population density (rural, urban). Other selection criteria were the General Practitioner (GP) practice’s experience in clinical research, the availability of local observers, and interest to participate. Selection of English sites only was

adopted to simplify the Independent Ethics Committee (IEC) approval obtained from each participating site and from the National Research Ethics Service. All participants signed an informed consent.

2.2. Data collection

In each site the head nurse was interviewed to collect information about site characteristics (number of subjects, vaccinations, and visits), vaccination-related activities taking place prior to and on vaccination day with start- and stop- points, the main performer of each activity, and their estimated time. Adjustments to the generic CRF were proposed to accurately reflect each site’s practice.

Activities occurring prior to the vaccination day were not using the T&M technique because they occur infrequently, pertain to more than one subject, and may not follow a standardized process.

Time for activities occurring on vaccination day for child visits at 2, 3, 4 and 12–13 months [8] was measured using T&M. All vaccines were delivered via intramuscular (IM) injection with the exception of rotavirus vaccine being delivered orally. Eleven vaccine doses are given during the first year of life during those 4 visits resulting in 2.75 doses on average per visit. Observers at each site received training to measure the time of each activity by identifying the start- and stop-points and to record time onto site-specific CRFs.

Completed CRFs were sent to the Study Coordinating Centre (SCC) on an ongoing basis and status updates were sent in weekly. The SCC issued data clarification forms for missing data, out-of-range values, and illegible or inconsistent responses.

The study outcomes were the HCP time per pre-specified activity measured with a stopwatch (minutes and seconds), total HCP

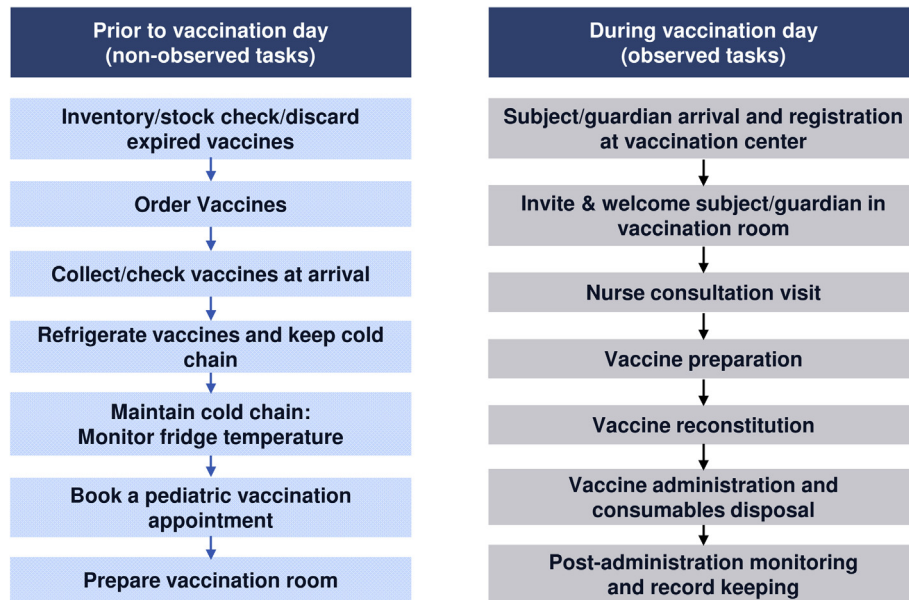


Fig. 1. Chronological listing of pediatric vaccination activities.

Table 1
HCP staff unit cost.

Staff Type	Gross Annual Salary	Other Employer Expenses (Training, Social Security, Contributions, etc.)	Full Loaded Salary Cost	Hours per Annum	Unit Cost (£/min)
Registered nurse	£25,847 [10]	149% [10]	£64,254	1575	0.68
Auxiliary nurse (support staff)	£16,282 [10]	118% [10]	£35,566	1575	0.38

[10] Personal Social Services Research Unit (PSSRU) 2014; HCP, Healthcare Professional.

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