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BRIEF COMMUNICATION

A Web-Based Registry for Familial Hypercholesterolaemia

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Familial hypercholesterolaemia (FH) is the most common and serious monogenic disorder of lipoprotein metabolism that leads to premature coronary heart disease. Patients with FH are often under-treated, and many remain undiagnosed. The deployment of the FH Australasia Network Registry is a crucial component of the comprehensive model of care for FH, which aims to provide a standardised, high-quality and cost-effective system of care that is likely to have the highest impact on patient outcomes. The FH Australasia Network Registry was customised using a registry framework that is an open source, interoperable system that enables the efficient customisation and deployment of national and international web-based disease registries that can be modified dynamically as registry requirements evolve. The FH Australasia Network Registry can be employed to improve health services for FH patients across the Australasia-Pacific region, through the collation of data to facilitate clinical service planning, clinical trials, clinical audits, and to inform clinical best practice.

Keywords Disease registry • Familial hypercholesterolaemia • Interoperable • Model of care • Open source • Registry framework

Introduction

Familial Hypercholesterolaemia

Familial hypercholesterolaemia (FH) is a relatively common genetic disorder that is associated with premature coronary heart disease (CHD) [1,2]. In Australia, at least 65,000 people are estimated to have FH with the vast majority of cases remaining undiagnosed, and in many diagnosed cases, patients are receiving inadequate treatment [1,3]. A patient registry to store clinical and family data is essential to the effective provision of services [4–7], and is therefore a vital component of the FH model of care for Australasia [3] and integrated guidance of care for FH [8]. A recent global 'call to arms' by the European Atherosclerosis Society FH Studies Collaboration also emphasises the importance of FH registries worldwide [9].

The Registry Framework

Recently, we presented an open source disease Rare Disease Registry Framework (RDRF), that allows the efficient

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deployment of web-based registries that can be modified dynamically as requirements evolve [10,11]. The RDRF empowers registry administrators to construct registries with minimal software developer effort, by allowing users to dynamically create all data elements (DEs) that define a patient registry and to share DEs across registries. Registries are described in a computer-readable text file, which allows a registry definition to be imported/exported, versioned, and stored in a shared accessible environment.

The RDRF takes a conceptual approach to the design and development of patient registries to ensure access, security, privacy, and to meet the need for harmonisation across multiple clinical sites in a given country, or internationally. The RDRF also fulfills the key criteria required for sustainable registry development [12–15], and continues to evolve since first described by Bellgard et al. [10,11,13,16].

We describe the deployment of the FH Australasia Network Registry utilising the RDRF. The primary purpose of the FH Australasia Network Registry is to collate data to facilitate clinical service planning, and to inform clinical best practice [4]. The registry will also enable research on aggregated data, and the identification of eligible volunteers for clinical trials.

Materials and Methods

Governance and Access to Patient Data

The FH Australasia Network Registry is governed by a National Advisory Board appointed from expert members from Australia and New Zealand of the FH Australasia Network, which is a subcommittee of the Australian Atherosclerosis Society. The National Advisory Board, which has a Chairman and a Custodian elected by members of the Board, oversees the governance of the registry and is responsible for all registry activities and reviewing all requests for access to data. All projects sanctioned by the Board are conditional on approval by a recognised authoritative body in the relevant jurisdiction in which the investigation will be undertaken. Access to the registry is co-ordinated by the registry co-ordinator (assigned by the National Advisory Board) who is responsible for overarching data curation, cross-site co-ordination, and arranging processes for data extraction. The registry co-ordinator provides access to the registry through the provision of password protected user accounts to authorised data curators.

The FH Australasia Network Registry includes individuals diagnosed with FH, individuals with suspected FH, children of individuals with diagnosed FH, and family members of individuals diagnosed with or suspected to have FH. The registry links index patients to family relatives through the Family Linkage and Patient Relatives modules.

Recruitment to the FH Australasia Network Registry began in January 2015, co-ordinated through the registry co-ordinator lending support to each jurisdictional clinical service. Patients with a diagnosis of FH from participating clinics in Australia and New Zealand were provided with a FH Registry Information and Consent Form (available from https://fhregistry-international.com). After providing consent, patients were registered and assigned to a ''working group'', which is their jurisdictional clinical service. The RDRF has multiple levels of access (Appendix A), with the ability to assign different users to selected working groups. Only the registry co-ordinator has administration privileges, and therefore access to patient data from all jurisdictions.

Requests for access to data by third parties are regulated through the National Advisory Board. Provision of de-identified data is subject to approval by a jurisdiction human research ethics committee, recommendation by the National Advisory Board, approval of the data custodian (assigned by the National Advisory Board) and the study objectives being aligned with Registry objectives.

Ethics Committee and governance approvals were obtained for each clinical service site prior to registering patients for the registry. There are no costs to registrants or their family members.

System Architecture, Registry Deployment and Security

The FH Australasia Network Registry is web-based and accessed from https://fhregistry-international.com. The RDRF is built on top of Django 1.8 (www.djangoproject.com), utilising PostgreSQL (www.postgresql.org), MongoDB (www.mongodb.org), HTML, CSS, YAML (www.yaml.org), Javascript, jQeury (https://jquery.com) and Bootstrap (http://getbootstrap.com). The RDRF is typically deployed via Docker containers (www.docker.com) using uWSGI (https://uwsgi-docs.readthedocs.org) and nginx (https://nginx.org). Django provides distinct levels of inbuilt security, including secure socket layer (SSL) security (encrypts all web traffic to and from the application), cross-site request forgery (CSRF) checking, login restrictions of all views, with the RDRF utilising the Django secure package middleware with all settings enabled by default. The RDRF also stores identifying patient demographic data in a distinct database to any clinical data (Figure 1) [11,13,16]. The source code for the RDRF is available at https://github.com/muccg/rdrf.

Capture of Patient Data

The demographics and clinical information for each patient are captured by the 'Demographics' and 'Consents' modules and six additional Forms titled Clinical Data, Medications, Genetic Data, Imaging, Apheresis and Follow Up (Figure 2). Currently, all DEs requested by the International FH Consortium are included in the FH Australasia Network registry (see Appendix B for a detailed list of all current Data Elements).

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