

## International exchange

# The Kuwait–Scotland eHealth Innovation Network (KSeHIN): a sustainable approach to quality improvement in healthcare

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## ABSTRACT

**Background** The rising prevalence of obesity and diabetes in Kuwait represents a significant challenge for the country's healthcare system. Diabetes care in Scotland has improved by adopting a system of managed clinical networks supported by a national informatics platform. In 2010, a Kuwait–Dundee collaboration was established with a view to transforming diabetes care in Kuwait. This paper describes the significant progress that has been made to date.

**Methods** The Kuwait–Scotland eHealth Innovation Network (KSeHIN) is a partnership among health, education, industry and government. KSeHIN aims to deliver a package of clinical service development, education (including a formal postgraduate programme and continuing professional development) and research underpinned by a comprehensive informatics system.

**Results** The informatics system includes a disease registry for children and adults with diabetes. At the patient level, the system provides an overview of clinical and operational data. At the population level, users view key performance indicators based on national standards of diabetes care established by KSeHIN. The national childhood registry (CODeR)

accumulates approximately 300 children a year. The adult registry (KHN), implemented in four primary healthcare centres in 2013, has approximately 4000 registered patients, most of whom are not yet meeting national clinical targets.

A credit-bearing postgraduate educational programme provides module-based teaching and workplace-based projects. In addition, a new clinical skills centre provides simulator-based training. Over 150 masters students from throughout Kuwait are enrolled and over 400 work-based projects have been completed to date.

**Conclusion** KSeHIN represents a successful collaboration between multiple stakeholders working across traditional boundaries. It is targeting patient outcomes, system performance and professional development to provide a sustainable transformation in the quality of diabetes healthcare for the growing population of Kuwaitis with diabetes in Kuwait.

**Keywords:** diabetes mellitus, education and training, general practice, health system reform, primary care, quality improvement

### How this fits in with quality in primary care

#### What do we know?

The prevalence of diabetes in Kuwait is amongst the highest in the world, yet the current healthcare system is poorly configured to manage patients with long-term conditions. By contrast, diabetes care in Scotland has benefitted from a system of managed clinical networks supported by a national informatics platform.

#### What does this paper add?

This paper describes how health, education, industry and government can successfully collaborate with a view to improving primary healthcare in a population with unmet need. By improving informatics, education and clinical governance it is hoped that any change will be both sustainable and transferable to other settings.

## Introduction

The Kuwait adult population has the sixth highest prevalence of diabetes in the world, affecting approximately 24% of the population.<sup>1</sup> A number of potential causes for the rising trends in diabetes have been identified, including genetic predisposition, westernised diet, lack of physical activity and limited recreational facilities. Kuwait also has one of the highest levels of obesity in the world. It is estimated that three-quarters of the adult population are overweight or obese with the latter accounting for between 30 and 50% of the population.<sup>2,3</sup> These problems are not

restricted to the adult population. The prevalence of diabetes in children and young adults is rising, estimated to be around 33 per 100 000.<sup>4</sup> Kuwait also has a high prevalence of overweight and obesity in children and adolescents.<sup>5–7</sup> As the number of cases of diabetes and obesity continues to rise these patients place an ever increasing burden on the healthcare system.

Kuwait is situated in the Arabian Gulf and has a population of approximately 3.9 million people.<sup>8</sup> Whilst Kuwait territory covers approximately 17 000 km<sup>2</sup>, the metropolitan area is concentrated within 200 km<sup>2</sup>, and contains approximately 97% of the total population.<sup>9</sup> The population is served by the Kuwaiti healthcare system, which is free at the point of delivery

and comprises nearly 100 primary health centres in addition to six secondary care hospitals and a further 10 hospitals offering tertiary level care. Health policy makers face a number of challenges in meeting the public's expectations for high-quality services that are easily accessible. Infrastructure and resources are largely concentrated on treating established disease in an episodic fashion with limited connectivity between primary and secondary care systems. Investment in curative rather than preventive services has resulted in a range of secondary services provided in primary care settings. The result is that patients act as consumers, often bypassing primary care in an effort to seek a diagnosis or treatment that meets their expectations.<sup>9</sup> In 2006, the Dasman Diabetes Institute (DDI) was established. This tertiary level centre aims to prevent and treat diabetes and other related conditions via a combination of research, training, treatment, education and health promotion.<sup>10</sup> However, it is also acknowledged that a transformational change in the health service is required, particularly in relation to the management and prevention of diabetes and the provision of long-term continuity of care.

Diabetes care in Scotland relies on a series of managed clinical networks supported by a national informatics platform.<sup>11</sup> The prevalence of diabetes in Scotland has increased over the past decade.<sup>12</sup> Despite this, there has been a sequential improvement in quality performance indicators and the incidences of diabetes-related complications have decreased.<sup>12–14</sup> The prevention of non-communicable disease is now deeply embedded within NHS primary care systems.<sup>15,16</sup> By offering a package of informatics, research, education and clinical governance, the Kuwait–Dundee collaboration aims to learn from the Scottish experience to provide a sustainable approach to tackling the diabetes epidemic in Kuwait.

## The Kuwait–Scotland eHealth Innovation Network

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The Kuwait–Scotland eHealth Innovation Network (KSeHIN) is a partnership between the Kuwait Ministry of Health (MoH), the DDI, NHS Tayside (NHST), the University of Dundee (UoD) and Aridhia Informatics Ltd. This international collaboration was established in October 2010 with the signing of a memorandum of understanding (MOU) outlining the scope of the project. The aims of KSeHIN are to address the enormous challenge of diabetes and its complications in Kuwait by delivering an integrated package of clinical service development, education and research, all underpinned by state-of-the-art technology. Specifically, KSeHIN aims to enable the

effective and safe treatment of patients at reduced cost through real-time integration of clinical and administrative services for disease management, audit and governance; to create knowledge through capacity building and staff development, and to achieve scientific advance through engagement with the international research community. In the three years following the MOU, significant advances have been made in achieving the stated aims of KSeHIN – the collaboration was shortlisted for a 2012 Times Higher Education Award in recognition of this progress.<sup>17</sup> This paper provides an overview of KSeHIN's achievements to date, and how this international collaboration between government, health, education and industry has the potential to further improve healthcare delivery and outcomes.

## Informatics: the Kuwait Health Network and the Childhood Onset Diabetes Electronic Registry

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An integral part of the overall KSeHIN programme has been to establish an informatics platform for healthcare improvement and quality assurance. It was envisaged that by doing so, the availability of real-time patient case management data from across the healthcare domain would not only lead to improved health outcomes, but would also act as a catalyst for educational and research activities. The Kuwait Health Network (KHN) was developed by Aridhia Informatics Ltd in collaboration with senior clinicians across primary, secondary and tertiary healthcare in Kuwait to provide an informatics solution that supports integrated care of diabetes and its complications. The system includes a disease registry for adults with diabetes containing clinical data based on a defined dataset of coded clinical terms. The chronic disease management solution is designed to be fully integrated with existing primary and secondary care information technology (IT) systems and provides a unified patient view across healthcare domains.

KHN is an outcome-focused analytical application that provides healthcare professionals (HCPs) with instantly accessible information regarding current provisions of care. In addition, KHN provides a secure network for the delivery of high-quality clinical information, data and documents. Within the secure network, patient data can flow with operational data, ensuring that healthcare professionals have access to the most accurate confidential picture of patient health status and the operational context in which they are being treated. KHN facilitates data collection, tailored for the multidisciplinary team (see Appendix 1),

and provides team members with a unified overview of clinical, laboratory-based and operational data. A user-accessible analytics module allows healthcare professionals to instantly view their organisation's achievement of key performance indicators, diabetes quality outcome measures and to stratify patients according to risk of complications (see Appendix 2).

Prior to implementation, connectivity was established on a national scale between primary, secondary and tertiary care settings using a healthcare domain model.<sup>18</sup> National primary care clinical data was also linked with data from four laboratory information systems at an individual patient level, providing provisional data on disease prevalence in addition to enabling data seeding of KHN.<sup>19</sup> KHN v. 1.0 was implemented as a pilot in the capital region of Kuwait in February 2013. There are approximately 4000 people with diabetes registered on the system, which is currently live and being used in four primary healthcare centres. The scalability of the system's architecture means that national deployment is eventually possible, assuming that the pilot meets with approval from all stakeholders. In addition to providing clinical and organisational support, KHN also serves as a platform for the educational and research work streams.

A mixed methods programme of evaluation is currently underway to identify facilitators and barriers to the wider adoption of the system, whilst seeking feedback on the usability and usefulness of the system. Early usage data would suggest a mixed response from the 28 HCPs involved in the pilot, with local champions accessing the system on a daily basis, in contrast with minimal use by some others. Usability was assessed via a 46-item questionnaire which incorporated Brooke's 10-item System Usability Scale (SUS).<sup>20</sup> Responses were obtained from 20 of 35 users (57%) with representation from all members of the multi-disciplinary team in each of the four clinics. The mean SUS score was 64.1 (95% confidence interval [CI] 55.6–72.5) out of a possible 100. It has been suggested that developers should aim for an SUS score > 70. Scores under 50 are deemed unacceptable, whilst a score of 50–70 would suggest scope for improvement.<sup>21</sup> In addition to the questionnaire, feedback was obtained during field testing and implementation support. Users found the system to be useful but the main barrier to widespread adoption was a lack of integration with existing primary care IT systems, resulting in duplicate data entry. This was due to a disruption in the data feed which hopefully will be reinstated, as KHN is designed to be fully integrated with such systems. Further feedback from clinicians included the wish to formally view an assessment of their quality performance indicators (QPIs) in the format of an offline report (as well as being able to view QPIs interactively on KHN). This is now provided via

a fully automated report generator that utilises a combination of analytical and document preparation freeware which instantly collates domain-specific results. This allows clinic leads to easily publish and disseminate a near real-time summary of QPIs in a print/tablet-friendly format.

The Childhood Onset Diabetes Electronic Registry (CODEr) was also developed as a collaborative project within KSeHIN. CODEr evolved from a pre-existing childhood diabetes registry which has been gathering data since 1992, as part of the WHO Multinational Collaborative Diabetes Mondiale (DiaMond) Project.<sup>22</sup> Case ascertainment procedures have been described previously.<sup>23,24</sup> Briefly, cases are identified by authorised individuals who undertake regular review of case records obtained from both primary and secondary care. Data captured includes demographics, clinical presentation and family history. This dataset has been used to demonstrate a rising incidence of type 1 diabetes within the childhood population of Kuwait, resulting in one of the highest prevalences within the Gulf region.<sup>23–25</sup> CODEr converted the existing registry into a web-based application providing authorised users with instant access to population-level data for the purposes of clinical follow-up of individuals, disease surveillance, healthcare planning and the identification of population sub-groups of interest. CODEr has collected data from each of the five health regions within Kuwait since January 2011. In that year, 313 new cases of diabetes in children aged up to 19 years were identified, with type 1 diabetes accounting for 88% of the cases. The overall incidence rate of type 1 diabetes was 37.1 per 100 000 per year (95% CI 32.2–42.0) for children aged 0–14 years. This represents a 1.7-fold increase in incidence in the same age group since 1992–97 (20.9 per 100 000 [95% CI 18.8–23.0]).<sup>24</sup> A further 234 patients were added to the registry in 2012. Validation of the data for these patients is currently being undertaken.

## Education: postgraduate courses and the Kuwait Clinical Skills Centre

From the outset, KSeHIN has sought to establish a programme of education that equips healthcare practitioners working across the entire health sector in diabetes care to make changes in the way they practice and deliver care. This involves members of the primary care and specialist care teams. The programme is structured to enable learning to be relevant and is tailored to the cultural context in which it is being delivered. The postgraduate course teaching is coordinated via a virtual learning environment hosted

by DDI servers – the KHN Learning Zone – access to which is via users' KHN login details.

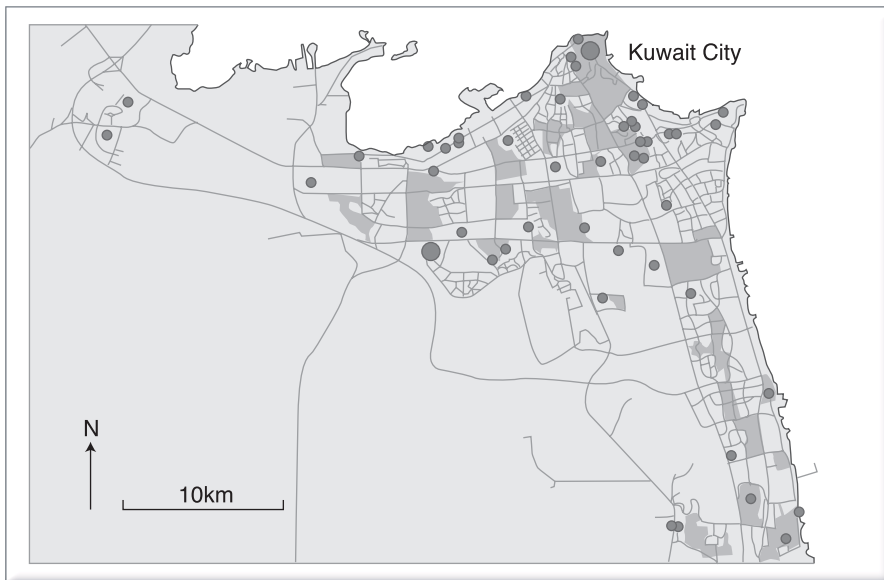
Students can enrol in a postgraduate certificate, diploma or masters in diabetes care and education. The modular structure offers a balance between students' professional development needs and the need to ensure they develop the knowledge of clinical, educational, leadership and organisational theories relevant to a multidisciplinary team approach to the management of chronic diseases within a healthcare system. By designing the assessments around workplace-based projects, students have been able to make significant improvements in healthcare delivery in Kuwait from the outset. Qualifications from credit-bearing courses (postgraduate certificate, postgraduate diploma and MSc) are awarded by UoD, in accordance with the Scottish Credit and Qualifications Framework. The wider healthcare community also has the opportunity to participate in additional continuing professional development by registering for standalone individual modules, symposia and workshops.

Teaching is provided within the DDI education suite and the newly established Kuwait clinical skills centre. The latter, based on a similar facility in Dundee, allows students to learn new skills and explore new working practices to improve patient care in a safe environment with the aid of simulators. This is the first clinical skills suite of this type in the Gulf area. An inaugural clinical skills conference was hosted by the centre in 2012,<sup>26</sup> and it is acting as a catalyst for the development of faculty, training and skills in this educational discipline within the Middle East. This sustainability is key to ensuring the ongoing development of the use of simulation and enhancing reliable

standards of practice in technical and non-technical skills.

Over 150 MSc students are currently enrolled and are completing modules in a range of topics including: diabetes, cardiovascular management, eHealth, chronic disease management, facilitation and leadership, and reflective professional practice. The majority of students work in primary care, whilst others are based in secondary care, industry and academia. To date, students have completed over 400 work-based projects, involving: clinical audit, clinical guideline development, teaching skills, and leadership and change management projects. These projects provide immediate impact in terms of improving clinical care – examples include: the establishment of diabetes patient education programmes, technology support for diabetes care, development of retinal screening services, and developing materials for the multicultural/multi-language population. There is a widespread geographical distribution of students' workplaces within Kuwait which serves to demonstrate the reach of the programme in terms of the dissemination of good clinical practice (see Figure 1). Students are encouraged to publish results, and are given the opportunity to present their work at a national level via the annual 'Dasman–Dundee Discovery Course' – a CPD accredited national conference aimed at HCPs currently working in Kuwait.<sup>27</sup>

Students have been asked to reflect on course content, their learning and practice via questionnaires and other novel methods designed to overcome cultural barriers.<sup>28–30</sup> On the whole, this feedback has been positive and has directly contributed to development of course content (see Box 1).



**Figure 1** Geographical distribution of students' workplaces in Kuwait metropolitan area. Markers represent workplaces. Marker size is proportional to the number of students working there

### Box 1 Free-text comments from students

*Recommendation – the programme is great if you are looking to make changes in your workplace.*

Student 1

*Reflection was a new thing for me. It was really very interesting. I told my friend – you will not just learn about diabetes but your personality will grow too.*

Student 2

*At first it was very difficult, I felt like a stranger in a new town but after a while I felt very comfortable. It is very easy to talk to all of the teachers.*

Student 3

### Box 2 Kuwait Government of National Clinical Standards

*Many thanks to everyone involved in the process from the Ministry of Health, whether from Primary or Secondary Healthcare services; the Faculty of Medicine at Kuwait University; the University of Dundee and the Dasman Diabetes Institute for their tremendous efforts and dedication ... These Standards are evidence-based and developed in consultation with many people across Kuwait, and emphasize the need for multidisciplinary team working across disciplines as well as effective referral procedures between secondary and primary care service providers.*

Dr Hilal M Al-Sayer, Minister of Health, Kuwait 2011

## Clinical governance: national standards

KSeHIN established a clinical standards committee, comprising members from primary and secondary care (MoH), higher education (Kuwait University) and tertiary services (DDI), with additional input from the international clinical diabetes community. The committee developed 15 evidence-based Clinical Standards for Diabetes Care in Kuwait which provides clinicians, patients and researchers with clearly defined standards for optimal diabetes care.<sup>31</sup> The need for multidisciplinary teamworking and effective referral procedures between primary and secondary care service providers is emphasised throughout. The standards are regularly reviewed and revised to make sure they remain relevant and up to date. The standards also form the basis of the key performance indicators and diabetes quality outcome measures accessible to KHN users via the analytics module. They were adopted nationally in 2011 and have received government endorsement (see Box 2).

Long-term continuity of care is improved by establishing a culture of record keeping within a comprehensive electronic system that provides connectivity between healthcare domains. Students enrolled in the postgraduate courses are all currently working within the Kuwaiti health system across a number of domains. This ensures that newly acquired skills can be immediately applied to the working environment. Thus the sustainability of the programme

is ensured in terms of equipping those within the healthcare system with the skills necessary to implement change.

In terms of improving patient outcomes, the national clinical standards described previously include the recommendation that glycated haemoglobin (HbA1c) is measured at least every six months, serum cholesterol and body mass index (BMI) are measured annually and blood pressure (BP) is measured at each clinic visit. By April 2013, there were 4390 registered patients, 4305 (98.1%) of whom had type 2 diabetes. At this early stage of implementation, adherence to the national standards is generally low – a minority of patients have had their cholesterol or BMI checked within the last 15 months, whilst approximately two-thirds had HbA1c and BP measured in the same period. Of those who have been screened, most patients are failing to meet clinical targets, placing them at increased risk of long-term morbidity and mortality (see Table 1). Planned KHN software releases for the coming months include: additional QPIs, disease stratification, clinical decision support tools and tailored reports for individual patients.

In addition to providing immediate access to QPIs, the coded dataset at the heart of the KHN disease registry has established a phenotypic database for those living with diabetes in Kuwait. The scalability of the infrastructure means that KHN has the potential to collect this data on a national scale. In addition, future stratified medicine research is possible by linking this repository with any emergent genomic data.

**Table 1** Number of patients screened for complications of diabetes and the proportion meeting current guideline targets. Data from four primary healthcare centres within the capital region of Kuwait within a 15-month period (February 2012 to April 2013)

Measure	Screening completed		Target range	Within target range	
	<i>n</i> = 4390	%		%	95% CI
HbA1c	3006	68.4	< 53 mmol/mol	25.8	24.3–27.4
Cholesterol	1645	37.5	< 5.2 mmol/l	81.2	79.2–83.1
BMI	2026	46.1	18–25 kg/m <sup>2</sup>	25.7	23.8–27.7
BP	2721	62.0	< 130/80 mmHg	37.0	35.2–38.8

## Conclusion

The over-arching aim of KSeHIN is to co-ordinate a national programme which will embed value within daily clinical practice and to provide evidence for improved patient care. The achievements of the KSeHIN collaboration are the result of a substantial investment of time and effort by all stakeholders. These include partners in health, education, industry and government working across geographical and institutional boundaries. Local clinicians' opinions have been a critical component in the development of both the KHN system and the educational programme. Identifying these specific users' needs from the outset and responding to their feedback in an iterative fashion has ensured that KSeHIN continues to meet these needs whilst remaining relevant to the cultural context into which it is being implemented. This collaborative approach lies at the heart of KSeHIN's achievements.

Successful quality improvement interventions lead to better patient outcomes, enhanced system performance and improved professional development.<sup>32</sup> This paper demonstrates how KSeHIN has targeted all three aspects of quality improvement to enable change to a healthcare system that is both sustainable and scalable. KSeHIN represents a truly transformational change in diabetes clinical care and positions Kuwait as an exemplar site for technology innovation, integrated chronic disease management and academic health science collaboration both within Gulf and the wider international healthcare community.

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## CONTRIBUTORS

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