

Regional Primary Care Team to Deliver Best-Practice Diabetes Care

A needs-driven health workforce model reflecting a biopsychosocial construct of health

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OBJECTIVE—Best-practice diabetes care can reduce the burden of diabetes and associated health care costs. But this requires access to a multidisciplinary team with the right skill mix. We applied a needs-driven evidence-based health workforce model to describe the primary care team required to support best-practice diabetes care, paying particular attention to diverse clinic populations.

RESEARCH DESIGN AND METHODS—Care protocols, by number and duration of consultations, were derived for twenty distinct competencies based on clinical practice guidelines and structured input from a multidisciplinary clinical panel. This was combined with a previously estimated population profile of persons across 26 patient attributes (i.e., type of diabetes, complications, and threats to self-care) to estimate clinician contact hours by competency required to deliver best-practice care in the study region.

RESULTS—A primary care team of 22.1 full-time-equivalent (FTE) positions was needed to deliver best-practice primary care to a catchment of 1,000 persons with diabetes with the attributes of the Australian population. Competencies requiring greatest contact time were psychosocial issues and dietary advice at 3.5 and 3.3 FTE, respectively (1 FTE/~300 persons); home (district) nursing at 3.2 FTE; and diabetes education at 2.8 FTE. The annual cost of delivering care was estimated at just over 2,000 Australian dollars (~2,090 USD) (2012) per person with diabetes.

CONCLUSIONS—A needs-driven approach to primary care service planning identified a wider range of competencies in the diabetes primary and community care team than typically described. Access to psychosocial competences as well as medical management is required if clinical targets are to be met, especially in disadvantaged groups.

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Diabetes is a significant global health issue. In Australia, ~4% of the population (818,200 persons) were diagnosed with diabetes in 2008 (1), with a further 3.6% estimated undiagnosed cases. Globally, the prevalence of diabetes is estimated at 150 million (2), which is expected to climb to >366 million by 2030 (2).

Diabetes is associated with high rates of complications that affect all organ systems and include cardiovascular disease, kidney disease, diabetic retinopathy, neuropathy, and sexual dysfunction (3).

Diabetes is associated with substantial disease burden, accounting in Australia for 5.5% of all disability-adjusted life years lost due to disease and injury (4). Advanced disease adds to health system costs (5,6).

Diabetes is classified as ambulatory care sensitive, reflecting strong evidence that best-practice primary and community care can avert hospitalizations (7). There is also evidence that multidisciplinary team care consistent with best-practice guidelines is both effective and cost-effective relative to societal standards for funding of health services (8,9).

Delivery of best-practice, guideline-informed care can markedly improve clinical outcomes in patients with chronic disease (10). However, it is also noted that clinical practice guidelines do not cover all major influences on care outcomes, such as psychosocial issues, patient preferences, and other influences on self-care capacity (11). Effective diabetes care depends in part on self-care capacity, which is influenced by factors such as health literacy, physical limitations, comorbid illness, cognitive ability, nonnative language proficiency, mental well-being, and exposure to social insults (12). Patients characterized by these threats to self-care are linked to poorer adherence to recommended diabetes treatment (13–18), worse glycemic control (16,17,19), and increased rates of complications (15). In addition, these patient attributes have been associated with poorer quality care (15).

An approach to patient management that is cognizant of patient characteristics that can threaten self-care capacity (attributes most common in disadvantaged groups) may attenuate the poor health outcomes observed in disadvantaged groups. Ideally, the primary care team should incorporate the mix of skills needed to address the diverse attributes of the clinic population. This should reflect not only the clinical diagnoses but also attributes that threaten self-care capacity. Study findings that the provision of an appropriately skilled, multidisciplinary team can deliver better outcomes at lower costs of care compared with usual care provided by a medical team (20,21) support this approach.

The aim of the research reported here was to define the competencies and skill mix required to deliver best-practice diabetes care in the primary and community care setting, taking into account a wide range of patient characteristics that can affect care outcomes. The results of this research could then be used by service planners to identify the desirable composition of the diabetes primary care team

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and the regional health workforce to support optimal diabetes management.

RESEARCH DESIGN AND METHODS

The research approach covers three phases described in a previously published health workforce model developed by Segal, Dalziel, and Bolton (22): 1) a competency and skill-based needs analysis, 2) estimation of a local health service and health workforce requirement, and 3) exploration of policy implications. In this article, we report on the application of the workforce model to diabetes, with a specific focus on phases 1 and 2.

Phase 1: needs analysis

The needs analysis has previously been described in detail (23). In brief, it consists of three tasks.

1. Identification of patient attributes that require unique primary care team competencies: Twenty-six patient attributes were identified across three levels (stage of diabetes, complications,

and threats to self-care). The levels and patient attributes are described in the Workforce Evidence-Based (WEB) planning model for diabetes (Fig. 1), a unique conceptual model developed for this project. The WEB model contains more than one million possible combinations of attributes or subpopulations.

2. Estimation of population prevalence by attribute in the study region: Pertinent datasets were interrogated to populate the WEB model. The numbers for thirteen attributes were drawn from the Australian Bureau of Statistics (ABS) National Health Survey (1) and the Australian National Hospital Morbidity Database (24), with the other attributes based on international surveys of persons with diabetes (23). The estimated number of persons with diabetes with each of the twenty-six attributes is reported in Fig. 1.
3. Defining best-practice care: Best-practice care objectives were defined for each of the 26 patient attributes described in levels 2–4 of the WEB model, based on the most comprehensive published

clinical practice guidelines for diabetes (25–27). These objectives were brought to three clinical expert panels, and with use of a modified nominal group technique, clinical care protocols were derived to deliver the care objectives. The clinical panels comprised twenty clinicians, covering fifteen disciplines (community nursing, dentistry, diabetes education, dietetics, endocrinology, exercise physiology, general practice, occupational therapy, pharmacy, physiotherapy, podiatry, practice nursing, psychology, public health, and social work). The clinical panel members were chosen to cover the eighteen competencies listed in Table 1 that underscored diabetes management. A number also had diabetes and contributed views of the patient.

The outputs of this process were clinical protocols described in terms of number of consultations per year by length across eighteen core competency fields, listed in Table 1, for each of the 26 patient attributes captured in the WEB

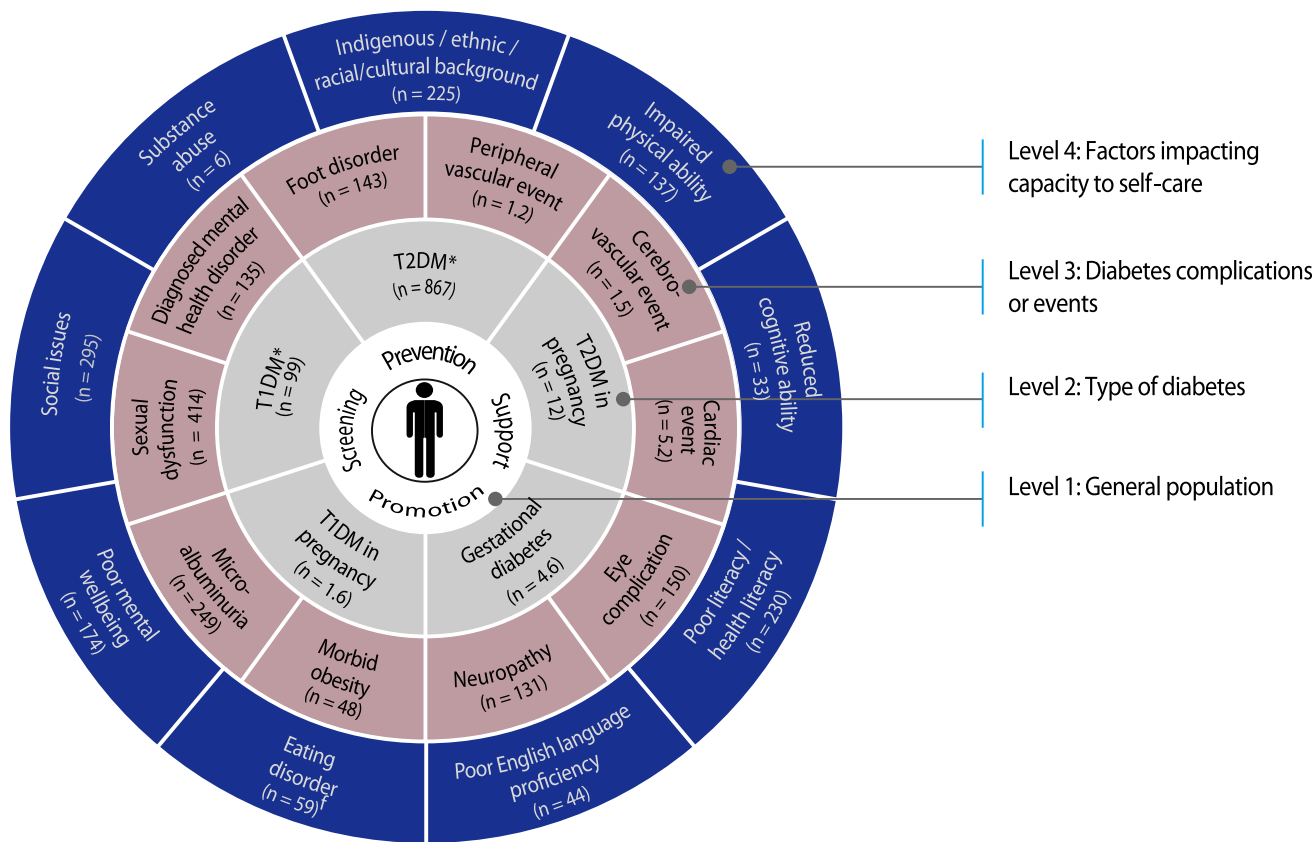


Figure 1—WEB planning model for diabetes. Number of persons by attribute per 1,000 persons with diabetes (reflects the Australian population [modified from Segal and Leach, 2011, ref. 23]). Level 1: excluded, as workforce estimation restricted to persons with diagnosed diabetes. *Newly diagnosed or established. T1DM, type 1 diabetes mellitus; T2DM, type 2 diabetes mellitus.

Table 1—Distinct competency areas for delivering best-practice diabetes care in the primary care setting

| Competency | Definition |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Case management and care coordination | Ability to plan and coordinate care for a person with diabetes and to review pertinent health outcomes, the diabetes-management plan, and existing team care arrangements. |
| Clinical medical care | Ability to assess, diagnose (through the use of advanced clinical assessment techniques and pathology tests), treat (using primarily pharmaceutical agents), and monitor diabetes and its complications. |
| Dental care | Ability to assess, diagnose, treat, and prevent dental and periodontal disease. |
| Diabetes education | Ability to deliver advanced education to a person with diabetes (of all ages and learning abilities), using appropriate learning techniques, on topics such as diabetes pathophysiology and complications, blood glucose monitoring, and pertinent self-care practices. |
| Dietary advice and management | Ability to advise on good nutritional habits and to develop and monitor individualized dietary management plans for persons with diabetes with or without complications or threats to self-care. |
| Enabling functional independence | Ability to enable persons to develop, restore, and/or maintain activities of daily living to assist them in performing activities or tasks necessary for self-care. |
| Ethnic/migrant health | Ability to deliver culturally appropriate care and support to persons with diabetes from ethnic/racial minority groups and to facilitate patient access to pertinent health and welfare services. |
| Exercise prescription and management | Ability to prescribe and monitor a suitably developed exercise program for a person with diabetes. |
| Eye care | Ability to diagnose, monitor, treat, and prevent diabetic eye disease, including diabetic retinopathy, cataract, glaucoma, and maculopathy. |
| Home nursing | Ability to assess, plan, implement, and evaluate nursing care in patients with diabetes in the home, including the provision of wound and medication management. |
| Indigenous health | Ability to deliver culturally appropriate care and support to Aboriginal and/or Torres Strait Islander people with diabetes and to facilitate patient access to pertinent health and welfare services. |
| Lower-limb care | Ability to assess, diagnose, and manage diabetes-related disorders of the foot, ankle, and lower leg, including diabetic foot ulceration, peripheral neuropathy, and peripheral vascular disease. |
| Orthotic support | Ability to measure, design, fabricate, fit, and service orthoses to assist persons in performing physical activities or tasks necessary for self-care. |
| Perinatal care | Ability to monitor signs of complications of diabetes in pregnancy and to deliver appropriate perinatal education and support to a person with gestational diabetes mellitus or diabetes in pregnancy. |
| Preventative care and surveillance | Ability to screen and monitor comorbidities, complications, pertinent risk factors, and threats to self-care; monitor concordance with the management plan and conduct annual review/cycle of care; and recall patients. |
| Psychological care | Ability to apply psychological assessment and therapy to relieve psychological distress and assist with adaptation to illness or life-threatening/highly distressing events. |
| Social support | Ability to identify pertinent (psycho)social constraints in persons with diabetes and to work to find solutions to identified issues that will meet the patient's (psycho)social needs. |
| Specialist pharmaceutical management | Ability to provide advice on the safe and proper use of diabetes medications in combination with other medicines. |

model. Competencies were used in this exercise rather than occupations to enhance the flexibility of the model and its value for workforce planning, service delivery planning, and discussion about primary care team composition. The output of this activity (one page for each of the 26 patient attributes) is available through the Health Economics and Social Policy Group Web site (28).

Phase 2: local health service/health workforce requirement: defining the composition of the primary care team

The second phase of the project was estimation, by competency, of the local or regional health service/health workforce requirements for the delivery of best-practice diabetes care. The output

of this phase was the composition of the primary care clinical team, defined by competencies, for the delivery of best-practice management of people with diabetes. For this application, we used population attributes for Australia as a whole, thus determining the primary care team requirements for a patient catchment with attributes similar to those of the Australian population with diabetes.

This research activity combined the results of the individual-level needs analysis for each attribute with the estimated number of persons with each attribute. Rather than simply adding total clinical input across all patient attributes, it was necessary to devise a logical approach to summation that recognized the ability of clinicians to deal with issues related to more than one attribute in the consult.

We developed a six-step process to sum annual competency hours across attributes and people as follows:

1. Where individual linked data were available (as was the case for thirteen attributes reported in the 2007–2008 ABS National Health Survey), we adopted the conservative position of searching by individual, within levels 2–4, for the attribute that attracted the highest value consultation time per year for each competency and using that as the estimated annual time input for the competency at that level. For example, if an individual presented with poor mental well-being and major social issues (e.g., death of a family member, marriage break up, victim of violence, eviction, loss of job) as the

only two threats to self-care in level 4 of the WEB model, and the total annual consultation time for these attributes for the competency area “social support” is 240 min to manage major social issues and 210 min for poor mental well-being; 240 min would be selected from level 4 for that individual.

2. For persons identified with poor English-language proficiency (4.4% from the ABS National Health Survey), 10% was added to the total consultation time for each competency to allow extra time associated with the use of interpreters.
3. The estimated consultation time for each competency by level for each person was then summed across levels (as each level deals with distinct types of needs) to yield the total annual clinical requirement for each person with diabetes for the thirteen attributes with linked data.
4. For the remaining (thirteen) attributes for which individual linked data were not available, annual consultation times for each competency were simply multiplied by the estimated prevalence, assuming prevalence consistent with the best Australian or international evidence.
5. Total of required contact hours for each competency for a regional/local population with diabetes was obtained by summing across individuals for the thirteen attributes for which linked data were available and adding to this the estimates for the other thirteen attributes derived from survey data. For example, in the case of neuropathy this was assumed to affect 10% of people with diabetes (29), who would then require 210 min/year of lower-limb care (based on our needs analysis), thus adding a mean 21 min/year of competency in lower-limb care across all people with diabetes.
6. The final step involved a downward adjustment in relation to the non-linked attributes for which adjustment at the individual level for expected efficiencies of dealing with more than one attribute-related set of issues in the one consult was not possible. This was not an issue for level 2 attributes: either they are mutually exclusive or clinician input is strictly additive (as for pregnancy in people with type 1 or type 2 diabetes). This leaves eight attributes for which possible efficiencies in management might be an issue,

seven of which sit at level 3. However, of these, three relate to an event (e.g., cardiac event) that requires management at the time, leaving only four with possible overlap. We considered each of these and the potential for efficiencies by competency and adjusted consultation time down by 20% for lower-limb care, dietary advice, diabetes education, exercise prescription, and clinical medical care in level 3.

This method was used to derive an estimate of the primary care team required to deliver best-practice diabetes care to a hypothetical 1,000 persons with diabetes, with the same mix of attributes as the Australian population (as reported in the ABS National Health Survey and selected international datasets).

The total consultation requirements by competency developed through this process were then reviewed by the same cross-disciplinary expert panel who informed the needs analysis, revisiting the assumptions driving the results. These assumptions were either confirmed or adjusted by consensus using a modified nominal group technique, with disagreements resolved by discussion. The requirement in hours by competency for 1,000 patients with diabetes was then recalculated. Hours were translated into full-time-equivalent (FTE) positions for each competency, based on 1,530 h consultation time per FTE position. (This presumes a 40-h week \times 45 weeks per year, allowing 4 weeks annual leave, 2 weeks public holidays, 1 week family leave, and 15% for nonclinical activities such as administration and professional development). The calculations were completed using Microsoft Excel. Core elements of the spreadsheets are available online (28).

Finally, we mapped competencies onto occupations to illustrate the implication of model outputs for possible membership of the primary care team by occupation and to estimate the cost of delivering best-practice diabetes care. For this task, we mapped competencies reflecting “current practice,” defined as the occupation holding the highest level of competency, based on the educational objectives of undergraduate training in the current (2012) Australian clinical education and training environment.

RESULTS—The delivery of best-practice diabetes care in the primary and

community care setting to a catchment of 1,000 persons with diabetes is estimated to require a multidisciplinary team that can collectively demonstrate competency across 18 areas and be able to deliver 33,780 clinical contact hours per annum. The results are presented in Table 2. This is equivalent to a mean 33.75 contact hours per person with diabetes per year across all clinical areas or just under 40 min per person per week. There is considerable variation around this mean. For example, a person with type 1 diabetes experiencing major life stresses (e.g., recently widowed) and needing assistance with medications (e.g., because of cognitive impairment) requires an estimated 135 min per week, while a person with established type 2 diabetes but no complications or threats to self-care requires an estimated 13 min of clinician time per week on average.

The competency areas that required the greatest clinical contact times in mean hours per person per year were dietary advice and management (5 h), home nursing (4.8 h), diabetes education (4.2 h), preventative care and surveillance (3.1 h), psychological care (3.0 h), and exercise prescription and management (2.9 h) (Table 2). Nearly 40% of contact time is attributed to “core diabetes management” (level 2), 23% to the management of complications (level 3), and 37% to addressing threats to self-care (level 4).

Across the three levels of the WEB model, the required clinical contact time varied for each competency (Table 2). For level 2, clinical demand associated with basic diabetes management was, as expected, dietary management, preventative care and surveillance, diabetes education, case management and care coordination, exercise prescription and management, and specialist pharmacy management. Total contact time for medical care was not high, despite high numbers of consultations, owing to short consultation time. For level 3, diabetes complications or events, highest competency requirements related to psychological care, home nursing, lower-limb care, diabetes education, and exercise prescription and management. For level 4, which addresses factors impacting on self-care capacity, the greatest demand was for competency in home nursing (predominantly related to wound management and medication support), dietary advice and management, social support, exercise prescription and management (associated with physical disability), and psychological care.

Table 2—Total contact hours per competency per annum required to deliver best-practice diabetes care in the primary care setting to 1,000 persons with diabetes^a

| Competency | Level 2 attributes: core diabetes management | Level 3 attributes: complications | Level 4 attributes: threats to self-care | Total hours per year by competency ^b |
|--------------------------------------|----------------------------------------------|-----------------------------------|------------------------------------------|-------------------------------------------------|
| Dietary advice and management | 2,450 | 480 | 2,070 | 5,000 |
| Home nursing | ^c | 1,500 | 3,320 | 4,820 |
| Diabetes education | 2,190 | 880 | 1,130 | 4,210 |
| Preventative care and surveillance | 2,330 | 650 | 130 | 3,110 |
| Psychological care | ^c | 1,840 | 1,190 | 3,030 |
| Exercise prescription and management | 950 | 670 | 1,280 | 2,890 |
| Social support | 560 | 170 | 1,660 | 2,390 |
| Lower-limb care | 730 | 870 | 300 | 1,900 |
| Clinical medical care | 870 | 330 | 270 | 1,470 |
| Case management/care coordination | 1,220 | ^d | 10 | 1,230 |
| Specialist pharmaceutical management | 940 | ^d | 80 | 1,020 |
| Ethnic/migrant cultural competence | ^c | ^c | 700 | 700 |
| Eye care | 550 | 80 | 10 | 640 |
| Dental care | 540 | 0 | 5 | 550 |
| Enabling functional independence | ^c | 310 | 160 | 470 |
| Orthotic support | 0 | 0 | 230 | 230 |
| Indigenous cultural competence | ^c | ^c | 110 | 110 |
| Perinatal care | 35 | 0 | <5 | 40 |
| Total | 13,380 | 7,790 | 12,610 | 33,780 |

Data are *n*. ^aWith attributes similar to those of the Australian population with diabetes. ^bTo derive mean contact hours per person by competency, simply divide by 1,000. ^cFor level 4 attributes, hours will support basic diabetes care or management of complications but have not been allocated there, as they apply only to persons with specific threats to self-care. ^dHours allocated to level 1 but is also to support management of complications, i.e., level 2.

The estimated total contact hours imply just over 22 FTE clinical positions for 1,000 persons with diabetes or 1 clinician/46 people with diabetes. What this might mean for the composition of the primary care team is reported in Table 3, based on mapping of competencies onto occupations, reflecting the highest competency level implied by the educational objectives of current undergraduate training in Australia. The results, in terms of primary care team composition, are reported in Table 3 and the budget implications in Table 4.

It was found that half of the multidisciplinary primary care team positions would be taken up by just two occupations: nursing at 7.9 FTE (3.15 FTE for district nursing, 2.75 FTE for diabetes education, and 2.03 FTE for practice nursing) and dietetics at 3.4 FTE (see Table 3). For district nurses, most of the workload was attributed to the management of impaired cognitive ability

(primarily for medication management) and diabetic foot disorder (for wound management). The workload of diabetes educators was largely taken up in the management of established type 1 and type 2 diabetes but was also taken up in addressing diabetes self-care issues that arise in the context of major social insults (such as death of a partner) and in advice on sexual dysfunction (the most common complication of diabetes). Much of the workload of practice nurses was attributed to the preventive care and surveillance role. Medical care provided by the general practitioner (GP) (or primary care physician) was estimated to account for 1.75 FTE positions, which for 1,000 persons represents a caseload of 570 persons with diabetes per GP. The GP was identified as contributing 8% of the total time of the care team but a higher percentage of consultations and cost. Psychosocial care, in this example assumed to be delivered by a psychologist or social worker

(but might also be delivered by other professionals with relevant competencies), was identified with 3.5 FTE positions, making up ~15% of the care team.

The cost of delivering diabetes care by the multidisciplinary primary and community care team identified in Table 3 was estimated at 2,052 million Australian dollars (AUD) per annum (2012). This equates to 2,052 AUD (~2,145 USD) per person with diabetes (Table 4). Over half of the salary cost was attributed to four occupations: GPs, nurses (i.e., district nurses, diabetes education, and practice nurses), and dietitians. GPs accounted for 18.6% of the estimated salary cost, though making up just 8% of the diabetes primary health care workforce owing to considerably higher salaries. Psychosocial care was estimated to account for 14.5% of the primary care team cost.

The annual primary care cost at just over 2,000 AUD per person seems modest relative to the mean cost of 1 day in hospital at 1,625 AUD (30) (adjusted to 2012 values using the health component of the consumer price index) or ~15 months' supply of two common medications for people with diabetes (a cholesterol-lowering drug plus an anti-diabetes agent) (31).

CONCLUSIONS

Overview of key findings

1. The application of an original health workforce planning model to diabetes has demonstrated the feasibility of implementing an evidence-informed needs-based health workforce model, drawing predominantly on existing datasets. This represents a major advance over commonly used clinician-to-population ratios for health workforce and health services planning.
2. The composition of the multidisciplinary care team required to support best-practice care derived by the model is ~50% clinical diabetes care (medical/nursing, pharmacy, podiatry, and dental), ~25% to support more healthy lifestyle behaviors (predominantly dietetics and exercise physiology), and 25% to deliver psychosocial care.
3. The model estimates a required primary care team of 22 FTE for 1,000 persons with diabetes at a mean estimated cost per person for 12 months of ~2,000 AUD (2,090 USD), which is equivalent to the cost of 1.25 days in hospital or ~15 months' supply of two

Table 3—Number of FTE positions by occupation^a to deliver best-practice diabetes care in the primary and community care setting to 1,000 persons with diabetes

| Occupation ^a | FTE positions | Main areas of management: clinical role and patient attribute (% of clinical workload) |
|------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dietitian | 3.25 | Dietary advice and management for persons with established type 1 and type 2 diabetes (44%), review of dietary advice in response to social insults (13%) |
| District nurse | 3.15 | Medication compliance support for persons with impaired cognitive ability (68%), community nursing for diabetic foot disorder (31%) |
| Diabetes educator | 2.75 | Diabetes education for persons with established type 1 and type 2 diabetes (54%), social insults (11%), sexual dysfunction (10%) |
| Practice nurse | 2.03 | Preventive care and surveillance in persons with established diabetes (64%) |
| Exercise physiologist | 1.9 | Exercise prescription and management in persons with established type 1 and type 2 diabetes (21%), impaired physical ability (13%), morbid obesity (13%), eating disorder (10%) |
| Psychologist | 1.98 | Psychological support related to sexual dysfunction (45%), eating disorder (22.3%), diagnosed mental health disorder (18.3%), morbid obesity (8.5%) |
| General practitioner | 1.75 | Medical care (58%) and case management and care coordination (42%) |
| Social worker | 1.56 | Social support in response to social insults (54%), poor mental well-being (15%) |
| Podiatrist | 1.25 | Foot care for persons with established type 1 and type 2 diabetes (34%), diabetic foot disorder (22%), neuropathy (17%) |
| Pharmacist | 0.67 | Specialist medications advice for established type 1 and type 2 diabetes (92%) |
| Ethnic/migrant health worker | 0.45 | Care of persons of an ethnic/migrant background (100%) |
| Optometrist | 0.42 | Eye check/eye care for established type 1 and type 2 diabetes (85%), eye complication (13%) |
| Dentist | 0.36 | Dental care for established type 1 and type 2 diabetes (99%) |
| Occupational therapist | 0.3 | Enabling functional independence for persons with vision impairment (eye complication [35%], neuropathy [31%]) |
| Orthotist | 0.15 | Preparing orthoses for persons with impaired physical ability (100%) |
| Aboriginal health worker | 0.07 | Care of persons with an indigenous background (100%) |
| Community midwife | 0.02 | Type 2 diabetes in pregnancy (68%), gestational diabetes mellitus (25%) |
| Total | 22.06 | |

Data are *n*. ^aOccupation listed reflects the profession most likely to hold the highest level of competency for that activity, based on educational objectives of current undergraduate training in Australia. This does not take into account possibility for role substitution, diversity of staff experience and specific training, or workforce supply. FTE would change if another occupation group delivered the competency with a different level of productivity.

common medications for this population (an antidiabetes agent and a cholesterol-lowering drug).

- The breadth of the proposed skill base of the primary care team and especially the inclusion of psychosocial capability should better address the diversity of clinic populations and improve outcomes, particularly in more disadvantaged populations.

Limitations

A number of simplifications with model implementation need to be noted. First, it is a static model (or potentially steady state). It reflects a population and its health status and other attributes at a particular point of time (most inputs were from 2006) and best-practice care as described in 2011 by our clinical experts, also drawing on earlier published guidelines. However, we note that a change in clinical best practice does not necessarily mean a change in the desirable competencies of the primary care team.

While we have used a rolling clinical panel with a diverse membership and a Delphi technique to elicit consensus and informed the deliberations with the best published guideline evidence, it is possible that another expert group would have arrived at a somewhat different set of care protocols. In publishing the model, we would invite other constituencies to replicate the application to reflect the characteristics of their own populations and perhaps a different understanding about the translation of best-practice care objectives into number and length of consultations for each competency.

The clinical panel did not include formal patient representatives. However, a number of members of the clinical panel did have diabetes and brought their experience as patients to the discussion.

Multidisciplinary care team

This research supports the need for a multidisciplinary team that covers a wide

range of competencies for the delivery of diabetes care. The proposed team is not dissimilar to that which can be inferred from published clinical practice guidelines for diabetes, which suggests a core primary care team of 3–10 members across the disciplines of diabetes education, dietetics, exercise therapy, medicine, nursing, dentistry, optometry, pharmacy, podiatry, and mental health (25–27). Guidelines also mention the need for indigenous or ethnicity-specific health workers, depending on the clinic population. The major professional areas left out relate to competencies for addressing threats to aspects of self-care capacity, notably social work.

While it might be argued that the competencies we have included in the primary care team could be covered through referral, this is not consistent with a quality multidisciplinary team model, which ideally includes all those involved in patient care (at the primary

Table 4—Salary cost of primary and community care team for delivery of best-practice diabetes care to 1,000 persons with diabetes (AUD in 2012)

| Occupation ^a | Full-time annual salary | FTE positions required (n) | Total annual salary cost | Total wages cost (plus 15% of wage on costs) |
|---------------------------------------|-------------------------|----------------------------|--------------------------|----------------------------------------------|
| GP | 209,546 ^d | 1.75 | 366,710 | 366,710 |
| District nurse | 73,000 ^c | 3.15 | 229,950 | 264,440 |
| Diabetes educator | 79,000 ^c | 2.75 | 217,250 | 249,840 |
| Dietitian | 70,443 ^b | 3.25 | 228,940 | 263,280 |
| Practice nurse | 73,000 ^c | 2.03 | 148,190 | 170,420 |
| Exercise physiologist | 70,443 ^b | 1.90 | 133,840 | 153,910 |
| Psychologist | 70,443 ^b | 1.98 | 139,480 | 160,400 |
| Social worker | 70,443 ^b | 1.56 | 109,890 | 126,370 |
| Podiatrist | 70,443 ^b | 1.25 | 88,050 | 101,260 |
| Pharmacist | 70,443 ^b | 0.67 | 47,200 | 54,300 |
| Dentist | 91,074 ^b | 0.36 | 32,790 | 37,700 |
| Optometrist | 70,443 ^b | 0.42 | 29,590 | 34,020 |
| Ethnic/migrant health worker | 51,500 ^c | 0.45 | 23,175 | 26,650 |
| Occupational therapist | 70,443 ^b | 0.30 | 21,130 | 24,300 |
| Orthotist | 70,443 ^b | 0.15 | 10,570 | 12,150 |
| Aboriginal health worker | 51,500 ^c | 0.07 | 3,610 | 4,160 |
| Community midwife | 73,000 ^c | 0.02 | 1,460 | 1,680 |
| Subtotal | | 22.06 | | 2,051,590 |
| Total (cost per person with diabetes) | | | | 2,052/person |

^aOccupations reflect the professions most likely to hold the highest level of competency in the area based on educational objectives of undergraduate training. It does not take into account possibility for role substitution, possible differences in productivity, diversity of staff experience and training, or supply. ^bSouth Australian Government wages parity (salaried) enterprise agreement 2010. Allied Health Professionals classified as Allied Health Professional, level 2, year 2; dentists classified as dental services officer, level 1, year 7 (Department of Premier and Cabinet, Adelaide [www.decd.sa.gov.au/hrstaff/files/links/ea_salaried_2012.pdf]). ^cNursing/midwifery (South Australian public sector) enterprise agreement 2010. District/practice nurse classified as registered nurse, level 1, year 10; diabetes educator classified as clinical nurse, level 2, year 10; community midwife classified as registered midwife, level 1, year 10; aboriginal and ethnic/migrant health workers classified as enrolled nurse (certificate), year 7 (Department of Premier and Cabinet). Nursing/Midwifery (South Australian public sector) enterprise agreement 2010 (Department of Premier and Cabinet, Adelaide [www.industrialcourt.sa.gov.au/index.cfm?objectid=2094264E-E7F2-2F96-3A9806387E2D98A8]). ^dAverage gross personal earnings of GPs across Australia in 2008 (ref. 42).

care level). This should include social work, occupational therapy, and all other allied disciplines—not just the core medical/nursing team—both to develop a special understanding of the particular issues facing people with diabetes (or related chronic conditions) and to provide for a close working relationship between all members of the care team. Further, as this analysis suggests, the required input from the psychosocial disciplines is considerable; their membership as part of the core team simply makes sense.

Multidisciplinary team and disadvantage

A focus on the medical care team would undoubtedly leave the quality of care for certain subpopulations with diabetes, particularly those experiencing challenging social issues, poor mental health and well-being, and physical or intellectual

disabilities, with inadequate quality care and poorer outcomes than necessary. These factors impact on glycemic control (16,17,19), the effectiveness of clinical care, and disease progression, as well as health-related quality of life (32). Incorporating into the diabetes team health professionals with demonstrable competency in delivering psychosocial care is fundamental if optimal outcomes are to be achieved, especially in people with diabetes with multiple disadvantages that constitute threats to self-care. For example, 42% of adult Australians with diabetes report medium, high, or very high levels of psychological distress (33). If the considerable disparity in health outcomes observed between persons from higher and lower socioeconomic status is to be redressed, ensuring that the primary care team has the competencies to deal with threats to self-care will be critical.

Regional variation in workforce/team requirements

The structure of the model makes it possible to incorporate local data that capture the health status and other attributes of a local community. In Australia, the widespread use of information technology-based clinical care systems results in a high capacity to populate the model with local data.

In translating competencies into occupations, knowledge of the regional workforce would be a valuable input. However, in identifying the core competencies and broad skill areas that need to be covered within the care team, the model may also highlight specific training needs. The model parameters could also be modified to take into account different delivery modes, such as the use of internet-based care options or group delivery of care.

Comparison with current care team

A comparison between our estimate of need with workforce supply for the management of diabetes in Australia could not be completed because of limitations with published workforce data (11). Given the strong medical focus of primary care in Australia, modified in recent years to fund greater access to allied health and psychology services and practice nursing, it is almost certain that there will be a considerable gap in access to other members of the care team, especially social work, dietetics, diabetes education, dental, and pharmacy. These services are predominantly funded by state governments, with funded places and thus access limited by prescribed budget caps, contrasting with open-ended funding by the Australian Government of GPs through the Medicare Benefits Schedule plus extensive funding for practice nursing and psychology. However, the funding model being largely fee for service for individual practitioners does not encourage genuine multidisciplinary team care.

Training of health professionals

The competencies identified through this research match many of those seen in the chronic disease self-management literature (34,35). These models encourage health professionals to become coaches and facilitators of self-management rather than treatment providers. A challenge in preparing the future workforce of health professionals is to ensure that principles of interdisciplinary team care and chronic disease self-management are incorporated

into health professional education and embedded within contemporary curricula. But support through appropriate models of primary care funding is also critical if the primary care is to be allowed to achieve the right balance. The ideal funding model is through a needs-adjusted capitation formula with services purchased/delivered through a fundholder with community and patient input to priorities (36,37).

This research could be used to inform the educational objectives of possible new cross-disciplinary health professionals for working with clients with chronic disease to reflect competencies identified in the WEB model. For example, Rosenthal et al. (38) discuss the community health worker as an emerging concept to consider in redefining and redesigning primary care services. The competencies described in the WEB model could inform the set of competencies and skills for a community health worker to work more effectively with people with chronic disease, especially those with multiple disadvantage. Training workers who can competently cover more than one competency would enable a reduction in the number of members of the multidisciplinary team required to deliver best-practice care. This would be an advantage in terms of level of coordination required and would be more convenient for the patient. Many practitioners from different occupations may have the knowledge, skills, and experience to support clients with diabetes. The WEB model, with its description of patient attributes and associated competency requirement, opens the way for workforce development to address these attributes through appropriate skills and competences rather than simply considering professional labels. The onus is on the practitioner to demonstrate skill and capacity to manage selected patient attributes rather than presumed by virtue of professional designation. For example, a social worker, psychologist, nurse, or occupational therapist may have the skills to support clients with issues related to psychosocial insults, and so, rather than identifying the profession in recruitment materials, the area of management of psychosocial issues becomes the focus. It is then up to the practitioner to provide evidence of skills and knowledge in that area, rather than relying on assumptions that the professional label provides that evidence.

The WEB model's articulation of competencies required for chronic disease care reflecting particularly on self-care

capacity is timely, given the shift in focus of health care policy from a disease and occupational service model to a patient-centered care approach (39). This allows the development of care teams around the patient's needs rather than the professions' need to specialize. Flexibility of team construction is also useful to reflect changing workforce and population composition over time (40,41). The WEB model supports examination of the competencies required from a patient-centered approach that better reflects the extreme diversity in clinic populations. It also demonstrates the advantage of using competencies to define the team, rather than starting with professions or occupations. If family members or others have the competencies and preparedness to deliver needed care (such as medication support), this could potentially substitute for a clinician in the primary care team.

Need for feedback loop

In implementing the model in a specific local area, the primary care team mix defined by the model would need to be carefully monitored against actual demand. Demand for services will reflect, for instance, the extent to which the target population chooses to access services and mode of service delivery. Patients may find the estimated schedule of consultations too onerous or simply consider the suggested level of consultations unnecessary. If this is the case, understanding why will be important.

Mode of delivery could potentially have a large impact on workforce needs. For example, the provision of group consultations or extensive use of internet/phone-based care would change the optimal team configuration. In applying the model in a particular service delivery context, where mode of delivery can be described, adjustment to reflect this is of course desirable. However, it is important to distinguish when an alternate service model reflects best-practice care and when it represents a compromise imposed by limited funding.

Summary

The delivery of best-practice diabetes care requires a broad multidisciplinary health care team, with the necessary skills and competencies to effectively address the biopsychosocial needs of the population with diabetes. These include not just medical care requirements but also the competencies to address the many factors

that impact on self-care capacity. We argue that one reason quality of diabetes care is often observed to be poor with failure to achieve clinical targets, especially in more disadvantaged groups, is the narrowness of the multidisciplinary team. While the composition of the primary care team does not guarantee the delivery of best-practice care, which in addition requires a sound clinical quality-assurance system, appropriate funding, and well-trained clinicians, the achievement of good chronic disease outcomes for patients will remain elusive in the absence of a primary care team with the appropriate mix of competencies. The WEB model helps define those competencies.

Application of the WEB model to other conditions is a possible extension of this research and could be used to define global primary and community care workforce needs. Discussions with health workforce planning agencies have confirmed the value and originality of the model for those seeking an evidence-based approach to health workforce and health services planning.

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L.S. conceived the original plan for the study and the article, devised the research design, supervised implementation of the research, and had major carriage of manuscript preparation and finalization. M.J.L. jointly developed the WEB model, jointly planned the research, had responsibility for day-to-day management, undertook the analyses, reported the results, and contributed to manuscript preparation and finalization. E.M. and C.T. contributed to the overall research design, the refinement of the WEB model, and manuscript preparation. L.S. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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