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Effectiveness of different models of health care delivery in the primary care setting of general outpatient clinics in Hong Kong

Key Messages

1. The advanced practice nurse (APN) model of care demonstrates significant outcome improvement for stable hypertension (HT) patients and demonstrates similar outcomes of care to those of physicians for stable type-2 diabetes mellitus (DM) patients.
2. The APN model of care provides high levels of satisfaction for both HT and DM patients.
3. The APN model of care improves patient knowledge of diseases, which has implications for self-care in both HT and DM patients.
4. Both doctors and nurses demonstrated their acceptance of the APN model of care for patients with chronic diseases.
5. The APN model of care indicates the need to examine the policy of medication prescription by nurses to maximise the effectiveness of care for stable patients with chronic diseases.

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Introduction

The effectiveness of advanced practice nurses (APN) in providing primary care for patients has been studied. In patients with similar health status seen by a physician or APN, patient satisfaction was higher with nurse-led care.¹ Although the costing of such models of care is complex,² the APN model of care is cost effective in terms of patient outcomes, with benefits outweighing the costs.³ In Hong Kong, research on the effectiveness of APNs in providing primary care for patients with chronic diseases is limited.

The aims of this study were to evaluate the effectiveness of three different models of health care in primary care settings, particularly the APN model of care for patients with type-2 diabetes mellitus (DM) or hypertension (HT), using patient outcomes (physiological measures, health-related quality of life [HRQoL], satisfaction with care, knowledge of the disease, complications and drug adherence), costs and health care utilisation rates, and patient and health care professional perceptions of the quality of care.

Methods

This study was conducted from December 2004 to November 2006. The case study design was selected. It enabled in-depth investigation of the case from which detailed descriptive information may be obtained and relationships between different phenomena may be examined. These phenomena did not lend themselves to investigation by experimentation. The case study design also defined the case and the units of analysis for that case. In this project, the case was defined as the model of care provided by the general outpatient clinics (GOPCs). The units of analysis for each case were defined as the patients, nurses and physicians.

An economic evaluation of the models of care was also undertaken using primary (physiological measures) and secondary (such as knowledge about the disease and levels of satisfaction) outcomes, which were measured using a cost-effectiveness analysis. A cost-utility analysis was used to measure HRQoL.

Sample and setting

Three GOPCs were selected from one cluster of hospitals. Case study 1 consisted of a newly developed APN clinic integrated into a family medicine clinic. Case study 2 consisted of a family medicine clinic. Case study 3 consisted of the traditional model of care, in which patients were seen by doctors who did not necessarily have a family medicine training. Recruitment of patients was undertaken using a total population patient sample of those attending for type-2 DM or HT during the study period. To achieve a reliability coefficient of 0.70 with an acceptably narrow 95% confidence interval, 130 patients were required for each disease group in each case (Fig).

From each case study, a purposive sample of approximately 30 patients was selected for a semi-structured telephone interview, and 10 HT and five DM patients were randomly selected for observation of care. A convenience sample

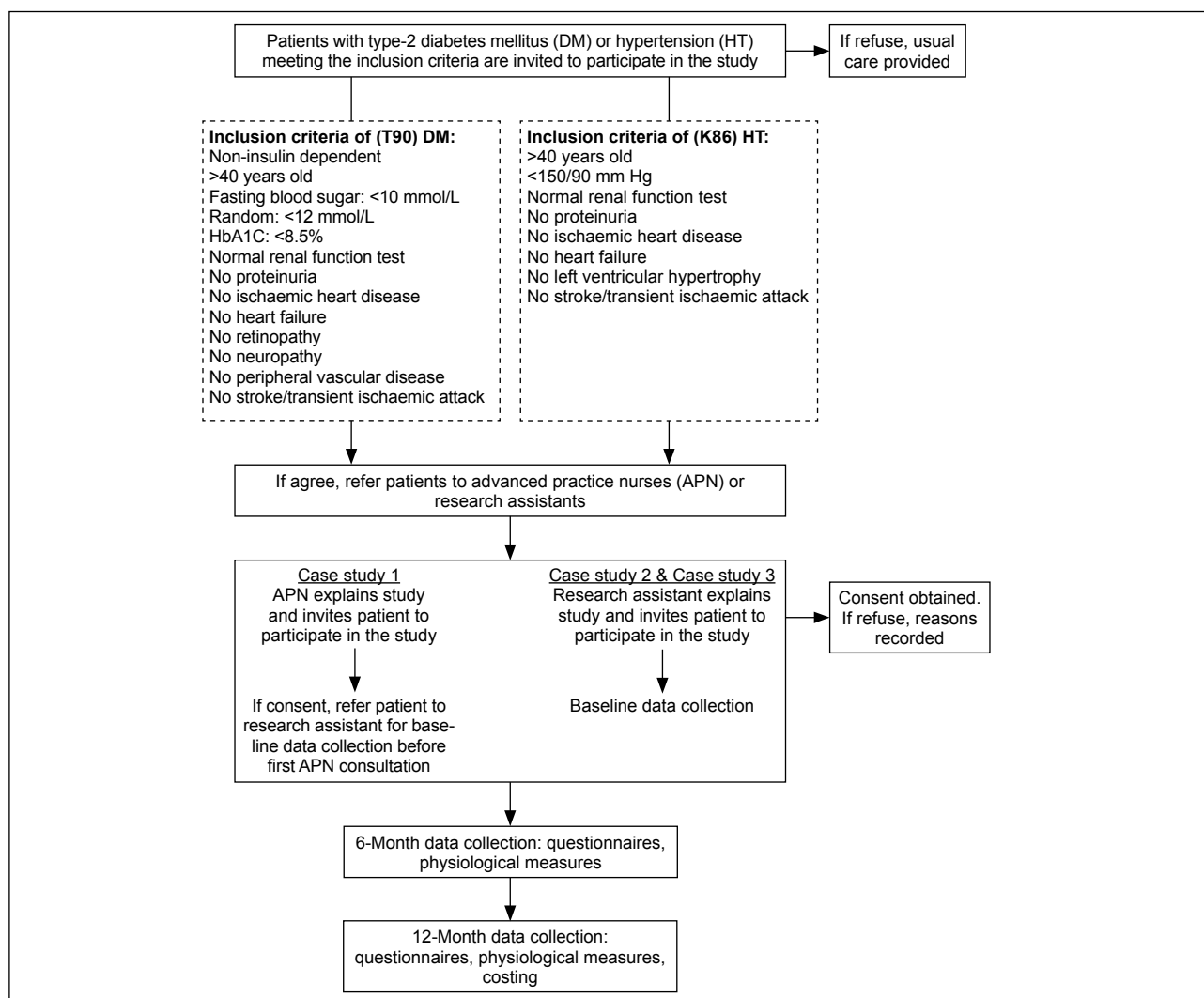


Fig. Patient recruitment procedure

of seven health care professionals was selected from each case study to participate in a semi-structured face-to-face interview. The APN in case study 1 was also interviewed.

Study instruments

Both quantitative and qualitative methods of data collection were used. Data collection methods also reflected the focus on outcomes and process of care. Outcomes were assessed using quantitative measures, including physiological measures, the Short Form-36 (SF-36), satisfaction with nurse and physician care, drug adherence, knowledge levels, complications and health care utilisation which were administered at three points of time. The processes of care were assessed using qualitative methods, including observations of the care and semi-structured interviews with patients and health care staff.

Results

Patient characteristics

Of the 828 eligible patients, 644 agreed to participate giving a response rate of 78%. The overall attrition rate for patients

was 16% over the 12-month period and ranged from 9.9% in case study 1 to 21.4% in case study 3. Table 1 demonstrates the number of patients recruited to each disease group in each case study.

Due to the rigorous inclusion criteria for the DM patients to ensure that patients with unstable blood sugar levels were not recruited to the APN clinic, the sample size of DM patients was smaller than the estimated 130. An additional recruitment period was required for case study 3 to ensure equivalence in sample sizes in the three models of care.

In case study 1, 73 (25%) of 285 patients referred by physicians refused to participate because they preferred consultation with a physician. The only significant differences in the socio-demographics of the 3 case studies were those of gender (more women being recruited in case study 1, $P=0.001$) and educational level (patients attending case study 2 having a higher level of education, $P=0.042$).

Table 1. Number of patients recruited to each disease group

Disease group	Case study 1	Case study 2	Case study 3	Subtotal
Hypertension	152	145	153	450
Diabetes mellitus	60	67	67	194
Subtotal	212	212	220*	644

* The total patient number included 56 patients who were recruited during the second round of recruitment

Table 2. Blood pressure changes over time in each case study*

Blood pressure	Case study 1 (n=136)	Case study 2 (n=121)	Case study 3 (n=119)
Baseline			
<140/90	117 (86.0)	95 (78.5)	91 (76.5)
≥140/90	19 (14.0)	26 (21.5)	28 (23.5)
6-Month			
<140/90	119 (87.5)	95 (78.5)	72 (60.5)
≥140/90	17 (12.5)	26 (21.5)	47 (39.5)
12-Month			
<140/90	125 (91.9)	91 (75.2)	77 (64.7)
≥140/90	11 (8.1)	30 (24.8)	42 (35.3)

* Data are presented as No. (%)

In addition, more patients in case study 3 were living with partners only ($P=0.027$).

Primary outcomes

Physiological measures for HT patients included systolic and diastolic blood pressure (SBP and DBP) and body mass index (BMI). At 12 months, the decrease in the BMI (≥ 0.5) of HT patients was significant more in case study 1, compared with case studies 2 ($P=0.013$) and 3 ($P<0.001$). At 12 months, the SBP of HT patients in case studies 1 and 2 had improved more than in case study 3 ($P=0.002$). A binary variable indicating high blood pressure overall (either SBP of ≥ 140 or DBP of ≥ 90) versus normal blood pressure (SBP of <140 and DBP of <90) was created. The changes over time in the proportions of patients in each case study falling into these categories are shown in Table 2. Among the HT patients, the between-group difference in the change in proportions were significant for case study 1 vs case study 3 from baseline to 12 months ($P=0.013$). Patients in case study 1 showed the most improvement in the proportion of HT patients.

Physiological measures for DM patients included glycated haemoglobin (HbA1c), fasting blood sugar (FBS) and BMI. The HbA1c levels of DM patients remained stable between baseline and 12 months in case studies 1 and 2, but increased in case study 3 ($P=0.001$). Changes in FBS results over time between the case studies were not significant.

Secondary outcomes

Secondary outcomes included HRQoL, patient satisfaction with nurse and physician care, drug adherence, complications of and knowledge about the disease.

The multivariate RMANOVA analysis demonstrated a significant improvement in the mean total scores of the mental component summary (MCS) scale of the SF-36

from baseline to 12 months for case study 1 relative to case studies 2 and 3 for DM patients ($P=0.001$). Changes in physical component summary (PCS) over time were not significantly different between groups. Nonetheless, patients in case study 1 had improved slightly, whereas in others they remained steady or declined. There was no significant difference in mean scores for patient medication adherence between the three case studies at 12 months; patients in all three case studies demonstrated a high level of adherence.

The mean total scores for patient satisfaction with nursing care improved significantly in case study 1 relative to the other two case studies for both disease groups at 12 months ($P<0.001$). Scores for patient satisfaction with physician care also yielded similar findings ($P<0.001$).

Patient level of knowledge about their disease improved significantly over the study period in case study 1 than the other two case studies. The mean total knowledge score of HT patients in case study 1 improved significantly at 12 months ($P=0.005$). Scores for DM patients in case study 1 also yielded similar results ($P=0.004$).

The primary outcomes identified for the economic evaluation of the three models of care were improvement in blood pressure and BMI for HT patients, and the percentage of DM patients with improved BMI and HbA1c. For secondary outcomes, scores and percentage of patients with improved scores were used. The SF-36 scores for HRQoL were divided into PCS and MCS subscales. A cost-effectiveness analysis was adopted for the first three outcomes, whereas a cost-utility analysis was considered appropriate for the HRQoL outcome measures.

The cost-effectiveness analysis for the HT patients demonstrated that case study 1 was better than case study 2 or 3. For the DM patients, case study 1 was better than or no different from case study 2. Case study 1 was better than case study 3 in terms of all outcomes, but had higher costs. For example, with respect to BMI, an additional \$2346 was needed for one more improved case in case study 1 compared to case study 3. It was \$2695 with respect to HbA1c. The additional cost was \$48 for one higher point in the satisfaction score with nurses. The cost-utility analysis for HT patients demonstrated that case study 1 was no more expensive than case study 2 or 3, but yielded better or similar outcomes. For the DM patients, the MCS of the SF-36 of case study 1 was better than case study 2, or case study 1 required an additional \$120 to have a score improvement of one compared to case study 3.

Process of care

Process evaluation focused on patient and staff perception of the different models of care assessed by observation and semi-structured interviews with patients and staff.

Observation of care included the total amount of time that patients spent during their visit to the GOPC. A comparison

of the proportion of average time spent in consultation with the physician or APN demonstrated that out of an average total patient time of 51 minutes 32.5% was spent with the APN, compared to 4.3% out of 98 minutes spent with a physician in case study 2, and 6.3% out of 59 minutes spent with a physician in case study 3. This indicated a significant positive correlation between the duration of consultation and satisfaction with nurses at 6 months ($r=0.385$, $P=0.043$ for HT patients; $r=0.617$, $P=0.019$ for DM patients) and 12 months ($r=0.385$, $P=0.043$ for HT patients; $r=0.488$, $P=0.015$ for DM patients).

Semi-structured interviews were undertaken following completion of the last questionnaire at 12 months. Most of the interviews lasted approximately 20 minutes. Content analysis identified nine major categories common to the three case studies (Table 3). Patient perceptions were influenced by their experience of the different models of care. The category 'necessity to see the doctor' provides an example. Among those who attended the APN clinic (case study 1), 11 (41%) patients considered that it was necessary to see the doctor at every visit and 14 (52%) stated that it was unnecessary. *"I thought that it is not necessary (to see the doctor)...the nurse (APN) talked about your condition and your daily life.... She asked you what leisure activities you had and what you ate.... Teaching you not to eat too much high cholesterol and fatty food and dessert. She was like a very close friend."* (case study 1, #93:52-62)

In case study 3, 22 (76%) patients described the need to see the doctor at every visit, as they had very little contact with nurses and were unsure about the care they could offer. *"Nurses only measure blood pressure.... They also did the blood taking but nothing else."* (case study 3, #71:28)

The category 'difference in care between doctors and nurses' was also influenced by patient experiences of the different models of care, but identified patients' association of nursing care with giving advice and education which they valued. However, it also highlighted a recurrent difficulty of nurses not being able to prescribe medication. *"The nurse in the clinic...she explained to you what you should not eat. Nurse told you in more detail. Doctors were not free and didn't tell you.... Seeing nurses is better than seeing doctors.... Not much big difference...but if you had a cough, nurses would not prescribe antitussive syrup to you and you needed to ask doctor to prescribe it to you."* (case study 1, #70:70-74)

Semi-structured face-to-face interviews were also undertaken with a convenience sample of health care workers in each case study. Interviews lasted approximately 50 minutes. Content analysis identified six major categories common to the three case studies (Table 4).

The findings reflected the professional experience and context of care of the health care workers. The category 'autonomy in practice' provided an example of how the

Table 3. Categories common to the three case studies in terms of patients

Categories
Appropriate health professional to provide care
Necessity to see the doctor every time
Difference in care between doctors and nurses
Preference to see doctor or nurse
Attitude of doctors and nurses
Best thing about the model of care
Worst thing about the model of care
Quality of care
Use of yellow diary

Table 4. Categories common to the three case studies in terms of health care workers

Categories
Perceptions of nursing roles
Quality of service
Continuity of care
Autonomy in practice
Need for further training
Expansion of nursing roles

experience of the participants influenced their perceptions of the models of care and in particular the role of nursing within that model. This was illustrated by the APN in case study 1 who described her role in patient assessment as contributing to her autonomy in practice saying: *"I can give a thorough assessment to my patients...I am referring to those assessment requiring special training, such as for DM patients, we may have some complicated screening, such as we may need to measure the AC ratio..."* (case study 1, APN:144-172)

Doctors in case study 1 also described how patient assessment contributed to the professional autonomy of nursing.

Prescribing medication, a subcategory identified in the category of 'autonomy of practice' was an important consistent finding. Nurses expressed their frustration at not being able to manage the prescription of patients with chronic disease. Indeed, the APN described how her lack of prescribing rights limited the full extent of their professional autonomy when working with primary care patients having chronic diseases. This frustration existed, despite the team having worked together to develop a system to minimise any inconvenience to patients attending the nurse-led clinic. Doctors were ambivalent about nurses' roles in prescribing medication with one doctor saying: *"Also at the end we're the ones who give out prescriptions, or adjust dosage, change the drug regimen, etc. I think apart from this there is no big difference between us... based on the knowledge side and the nurses are further trained. The difference is that when they made the decision...they can't give a prescription to adjust medication. But if they're given this responsibility I think the authority and responsibility between doctors and nurses are very unclear."* (case study 1, D2:122)

A common finding from the analysis was the generally positive response of both doctors and nurses to expanding

the role of nurses to allow nurses to run clinics such as that in the APN clinic in case study 1. Factors supporting such expansion of care included the increasing number of patients with chronic disease, the need to focus on patient psychological care and an increasing focus on prevention. One doctor said: "...as it is now the nurse clinic is a DM clinic, but in future, will there be more chronic diseases followed up in nurse clinics?... As long as patients are stable, I think they can be seen and handled by nurses in charge." (case study 1, D1:193-198)

One registered nurse in case study 2 expressed her views about expanding nursing roles saying: "*I think nurse-led clinic.... For example, extending nurse consultant.... Actually, many nurses have rich experience and have already trained in a particular area. I think not only the patients, but colleagues or registered nurses could also consult the nurse.*" (case study 2, RN2:501-507)

Indeed, both doctors and nurses in the three case studies were supportive of the expansion of nurses' roles, particularly because of the need to share workloads to cope with the increasing demands of patients with chronic diseases.

Discussion

Despite the low recruitment of the DM patients and differences in gender and educational levels between the three groups, the findings from the outcome and process evaluation demonstrated the contribution of the APN model. This entailed care provision for stable patients with HT and DM in primary care settings. Notably, the higher educational levels in case study 2 indicated changes in patient outcomes resulting from the model of care rather than the educational level. The low recruitment for the DM patients was due to inclusion criteria to ensure that DM patients referred to the APN clinic were stable. Such findings indicated the difficulty experienced by patients in the community, with respect to stabilising their HbA1c levels.

In HT patients, primary outcomes indicated the contribution of the APN model to patient care. The decrease in the BMI at 12 months in case study 1 was significantly more than that in other two case studies. This highlighted the contribution of the APN model in the management of weight reduction. Patients in case study 1 showed the most improvement in achieving an optimal blood pressure. Thus, the care provided by the APN in managing stable HT patients was similar to that of physicians, which concurred with the research by Laurant et al.⁴ Among patients in case studies 1 and 2, the contribution of the APN was less clear for the DM patients, yet HbA1c levels remained stable from baseline to 12 months. There was deterioration in those attending the traditional model of care (case study 3). Such findings indicated similar outcomes of care for stable DM patients, whether managed by a physician or an

APN. There was, however, no significant difference in the FBS result at 12 months between the three models of care, which concurred with the finding of a systematic review by Loveman et al.⁵

In terms of health care utilisation and economic evaluation, the results were less conclusive, and concurred with previous research demonstrating the complexity of undertaking economic evaluations of such models of care.²

Patient perceptions of the care in different models of care were influenced by factors determining their perceived need for the service, in particular the specific health need at the time of consultation. For those attending routine follow-ups in the APN clinic, the patients were consistently positive about the quality and level of care provided by the nurse, as reported in other studies.¹ Prescription of medications was the reason that patients in each model of care needed to see the doctor, despite there being no change in their medications in many instances. The findings among health care workers also demonstrated the model of care influencing their perceptions of the role and contribution of nursing to patient care. A consistent finding among nurses was the frustration experienced about their lack of autonomy in clinical practice, particularly in referring patients for services and managing patient medications.

The APN model of care may provide a suitable model of care for monitoring patients with stable HT or DM in the community.

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