
OUTSTANDING FREE PAPERS

The use of digit span test in screening for cognitive impairment in acute geriatric inpatients and 1-year follow-up for patients with delirium

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Background: Delirium with or without pre-existing cognitive impairment is under-recognised in geriatric patients in acute-care hospitals. The absence of locally validated instrument for assessment of cognitive function and the sparsity of territory-based data on the occurrence and outcome of delirium in such population hindered the planning of acute-elderly-care service development in Hong Kong. **Objectives:** This study aimed to (1) validate the Digit Span Test (DST) in the detection of delirium and dementia, (2) determine the prevalence of major cognitive disorders (MCD) including dementia and delirium, and (3) explore the 1-year outcome of delirium in elderly patients in an acute medical unit. **Methods:** This was a two-phase study. Phase 1 was a cross-sectional validation study. 144 patients aged ≥ 70 years were assessed by nurses, using the Digit Span Forwards (DSF) and the Digit Span Backwards (DSB). The DST scores were compared with the psychiatrists' DSM-IV based diagnoses. Receiver operating characteristics (ROC) curve was used to assess the clinical usefulness of DST. Phase 2 was a 1-year follow-up study of the cohort in phase 1. Outcome parameters (length of hospital stay, number of unplanned readmission, mortality rate, institutionalisation rate, and rate of evolution to dementia) were retrieved from case notes. Clinical outcomes of delirious and non-delirious groups were compared, with correction of the Charlson comorbidity index. **Results:** The prevalence rates of dementia alone, delirium alone, and comorbid dementia-delirium were 21.5%, 9%, and 9%, respectively. All patients were able to complete DST, but only 73.6% could finish mini-mental state examination (MMSE). Regarding the detection of major cognitive disorders, the ROC curve of DSB showed a sensitivity of 0.77 and specificity of 0.78 at the optimal cutoff of < 3 . Its area under curve was 0.83. Only 11.5% of prevalence delirium and 2.6% of incidence delirium were diagnosed and documented during the index admission. The detection rate of dementia up to one year after the index admission was 65.9%. The length of stay, number of unplanned readmission, and mortality rate at index admission were less favourable in the delirious (10.97D, 2.24 episodes, 10.3%) than in the non-delirious group (8.21D, 2.0 episodes, 7.0%), but not significantly.

Conclusions: Delirium and dementia are prevalent in geriatric patients presenting to acute-care medical unit, but remain under-recognised and under-diagnosed. DST is better tolerated and easier to interpret than MMSE. DSB is an effective screening tool in identifying MCD, but not to differentiate delirium from dementia. Patients with delirium tended to have poorer outcomes in terms of (1) length of hospital stay at index admission, (2) number of unplanned readmission, and (3) mortality at index admission and one year. The insignificant difference was likely limited by under-powered sample-size in secondary outcome analysis. This study serves a dual role to arouse the problem of under-recognition of delirium and to urge prospective studies to define the clinical and economical impacts of delirium to the health care system.

Efficacy of dual vaccination of pandemic H1N1 2009 influenza and seasonal influenza on institutionalised elderly: a one-year prospective cohort study

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Background: The influenza A (H1N1) 2009 pandemic was declared by the WHO in April 2009. In Hong Kong, the vaccination programme began in December 2009 in addition to the annual seasonal trivalent influenza vaccination programme. The clinical efficacy of dual vaccination was unknown. **Objective:** To study the clinical efficacy of dual vaccination on mortality and hospitalisation in institutionalised elderly. **Methods:** From December 2009 to November 2010, a prospective one-year cohort study on institutionalised elderly of 9 residential care homes for elderly (RCHE) was conducted. Elderly persons who were followed up by the Hong Kong West Community Geriatric Assessment Team and vaccinated by the Department of Health were included. Outcome measures included all-cause mortality and hospitalisation. **Results:** 711 elderly persons were included. 274 received both seasonal influenza vaccine and (H1N1) 2009 vaccine (H1N1-TIV group), 368 received seasonal influenza vaccine only (TIV alone group), and 69 received no vaccination (unvaccinated group). Baseline characteristics (including age, Charlson Comorbidity Index, Barthel Index, and hospitalisation in preceding year) were well matched between groups, except that there were fewer females

in the TIV alone group. The 12-month mortality rates of the H1N1-TIV group, TIV alone group, and unvaccinated group were 10.6%, 19.8%, and 29%, respectively. The number of institutionalised elderly needed to receive dual vaccination to prevent one death (NNT) was 11 and 6, compared with TIV alone group and unvaccinated group, respectively. Multivariate analysis demonstrated that dual vaccination for the institutionalised elderly significantly reduced all-cause mortality by 54% (hazard ratio [HR], 0.46; 95% confidence interval [CI], 0.29-0.72; $p < 0.001$) and 74% (HR, 0.26; 95% CI, 0.13-0.49; $p < 0.001$), compared with seasonal vaccination alone and no vaccination, respectively. Dual vaccination also reduced the rate of hospitalisation compared with seasonal vaccination alone (0.95 vs 1.30 hospitalisation per year, $p < 0.05$) and unvaccinated group (0.95 vs 1.52 hospitalisation per year, $p < 0.05$). **Conclusions:** Dual vaccination with both H1N1 and seasonal vaccinations provided additional protection to institutionalised elderly in reducing mortality and hospitalisation.

Hyperkalaemia in patients on enteral tube feeding

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Background: Enteral tube feeding is frequently used for elderly patients. Hyperkalaemia were found in 40% of the patients on tube feeding. Hyperkalaemia may be caused by the high potassium intake, about 4000 mg daily, from the tube feeding formula. **Objective:** To evaluate the incidence of tube feeding related hyperkalaemia and to investigate the associated factors. **Methods:** This was a retrospective medical record review of tube-fed patients in a tertiary hospital from March to April 2011. The time to start tube feeding, the type of formulae, and all other information were traced from the Clinical Management System. The primary outcome was development of hyperkalaemia within 13 weeks of tube feeding without obvious reasons. **Results:** 38 men and 43 women aged 48 to 103 (mean, 80.9; standard deviation [SD], 11.3) years were recruited. The mean daily intake of potassium and sodium was 2056 (SD, 447) mg and 1349 (SD, 428) mg, respectively, which was lower than the usual intake of the local population (3428 ± 7270 mg and 4841 ± 7572 mg, respectively) and the recommended low potassium diet for renal patients (2500 mg) and low sodium diet for heart failure patients (2000 mg). 27 (33.3%) patients were found to have hyperkalaemia; 8 of them had serum potassium of 6 mmol/L; and 24 of them were associated with hyponatraemia. Patients complicated with hyperkalaemia were older (mean age: 85.96 ± 7.39 vs. 78.33 ± 12.08 years, $p = 0.004$), had higher rate of stage 3 or above renal failure (31% vs. 6%, $p = 0.01$), lower mean sodium intake (1162 ± 421 vs. 1443 ± 404 mg, $p = 0.005$), and lower mean daily potassium intake (1859 ± 466 vs. 2155 ± 406 mg, $p = 0.004$). After adjusting for the variables, the odds ratio for developing hyperkalaemia with daily sodium intake of < 1000 mg was 8.14 (95% CI, 1.92-34.55; $p = 0.004$);

glomerular filtration rate (GFR) of < 60 ml/min was 6.36 (95% CI, 1.47-27.5; $p = 0.013$); age > 80 years was 3.74 (95% CI, 1.2-11.64; $p = 0.023$). **Conclusions:** The incidence of hyperkalaemia in patients on tube feeding was 34%. Age of > 80 years, GFR of < 60 ml/min, and sodium intake of < 1000 mg per day are risk factors. High potassium intake is not an associated factor. Extremely low sodium intake can reduce potassium excretion in the distal tubule, and hence gives rises to hyperkalaemia in susceptible patients.

Incidence of post-stroke delirium and its effect on one-year outcome

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Background: Delirium is not uncommon after stroke. It is frequently unrecognised by physicians and poorly managed. The incidence of post-stroke delirium varies from 13 to 48%, depending on the method of screening at different time periods. Stroke patients with delirium generally have poorer outcome, higher mortality, longer hospital stay, and greater risk of post-stroke dementia. This study aimed to identify the incidence of post-stroke delirium, its risk factors, and its influence on one-year outcome. **Methods:** Consecutive patients aged > 50 years admitted to the acute stroke unit of a regional hospital were recruited. Exclusion criteria were stroke secondary to cerebral venous thrombosis, a history of severe head trauma or neurosurgery before the stroke, and Glasgow Coma Scale of < 5 (excluding verbal component). Baseline demographic data, types of stroke, location of infarct (based on Oxfordshire classification), aetiology of stroke (defined by TOAST criteria), premorbid cognitive impairment (measured by IQCODE), living arrangement, comorbidity, drug history and biochemical parameters on admission were collected. Delirium was screened using the Confusion Assessment Method. Outcome measures include length of hospital stay, mortality, functional mobility (measured by modified Rankin Scale and modified Barthel Index), and placement on discharge, 6 months, and 12 months post stroke. **Results:** 265 (133 male and 132 female) subjects (mean age, 72.7; SD, 10.5 years) have completed the one-year follow-up till April 2011. 239 (90.2%) had a cerebral infarction; 163 (61.5%) had small vessels disease; and 150 (56.6%) had lacunar infarct. 73 (27.5%) were found to have delirium. Univariate analysis found that old age (78 vs 70), pre-existing cognitive impairment (40.5% vs 18.9%), large vessels disease (47% vs small vessels disease 20%), total anterior circulation infarct (86% vs PACI 45% vs lacunar 9.3%), presence of fever on admission (94% vs 22.5%), AROU (68.8% vs 22%), UTI (73% vs 25.5%), chest infection (93.8% vs 23.4%), presence of dysphagia (75% vs 18%) and visual field defect (62% vs 19.5%) were associated with post stroke delirium. Logistic regression found that presence of AROU (OR, 5.24), chest infection (OR, 16), NIHSS (OR, 1.14) and pre-existing cognitive impairment (OR, 2.62) were independent predictors of post stroke delirium. Patients with delirium have more

functional disability, higher proportion to nursing home on discharge (61% vs 11.6%) and at 6 months (60% vs 11.7%) and 12 months (66% vs 12%) and higher inpatient mortality (20.8% vs 2.6%) and one-year mortality (55% vs 23%). However, there was no significant difference on the length of hospital stay. **Conclusions:** Delirium is a common complication after stroke with treatable risk factors such as chest infection and AROU. They resulted in higher functional impairment, nursing home placement, and mortality. Prompt identification and treatment of the reversible risk factors can help to decrease unfavourable outcome.

CADENZA Community Project: Health-Social Partnership Transitional Care Model (HSP-TCM) for post-discharge elderly

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Background: The demand for health care services increases as the population ages. There is considerable pressure on doctors and nurses to discharge patients, but its consequence is high rates of hospital readmission. According to the Hospital Authority, the unplanned readmission rate increased from 7% to 11.1% from the year 2000 to 2009. Multiple factors (medical and social) lead to hospital readmission. In response to the need of the post-discharge elderly, The Salvation Army, Queen Elizabeth Hospital, and The Hong Kong Polytechnic University collaborated with 7 non-governmental organisations to initiate a research study, aiming to develop a Health-Social Partnership Transitional Care Model (HSP-TCM) for the discharged elderly.

Objectives: To examine the effects of HSP-TCM on: (1) hospital readmission, (2) perceived health outcomes (quality of life and self-efficacy), and (3) satisfaction with care. **Methods:** Patients were randomised to the study or control group. Inclusive criteria were: (1) age ≥ 60 years, (2) discharged home, (3) living alone, with spouse or daytime alone, (4) ability to speak Cantonese, (5) living within the hospital service area, and (6) ability to be contacted by phone. Patients in the study group received the following interventions: (1) pre-discharge phase: the nurse case manager (NCM) conducted a comprehensive assessment using standardised tools to identify the health concerns that needed to be followed up. (2) Post-discharge phase (28-day intervention programme): NCM and trained volunteers (TV) provided health education, home assessment, medication management, diet management, and psycho-social support: first home visit (2-4 days after discharge by NCM & TV), first telephone follow-up (7-10 days after discharge by NCM), second home visit (16-22

days after discharge by TV), second telephone follow-up (24-28 days after discharge by NCM). In addition, patients could call the NCM during the intervention period to ask for health advices and options. The NCM was supported by geriatricians and existing comprehensive referral system. Patients in the control group received usual medical care. **Results:** From October 2008 to June 2010, 555 subjects were recruited (283 in the control group and 272 in the study group). Comparing with the control group, the study group showed (1) 60.8% and 58.9% relative reduction in unplanned readmission rate on 28 days (4.1% vs 10.2%, $p=0.005$) and 84 days (7.8% vs 19.0%, $p<0.001$), respectively; (2) improvement in patient satisfaction (29.3 vs 40.7, $p<0.001$) using the satisfaction with care instrument; and (3) significant improvement in all aspects of quality of life measurement using the SF36. Regarding health cost savings, 11 patients in the study group and 29 in the control group had unplanned readmission within 28 days. Taking the mean length of stay of 4.4 days in medical department, and unit cost per hospital day (08/09) of \$3650, the cost reduction calculated was \$289 080 ($\$3650 \times 4.4 \text{ days} \times [29 - 11]$). Similar calculation for unplanned readmission within 84 days revealed cost reduction of \$529 980 in the study group. **Conclusions:** Health-social partnership transitional care is a cost effective model in reducing hospital readmission, increasing patients' perceived health outcomes and their satisfaction with care.

The effect of age and adiposity on the difference of fat-free mass measured by DXA and air displacement plethysmography (body density)

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Background: Dual energy X-ray absorptiometry (DXA) may overestimate fat-free mass (FFM) in older adults due to fat infiltration in skeletal muscles. FFM derived from the 2-compartment model using body density (BD) measurement can overcome this error. We attempted to examine the difference between DXA-measured and BD-derived FFM and test whether this difference is related to age, gender, and adiposity measures. **Methods:** 172 participants aged 20 to 76 years were examined by air displacement plethysmography and DXA to measure their BD and FFM, respectively. FFM was also derived indirectly from the 2-compartment model where: $(FM + FFM) / BD = FM / FM \text{ density} + FFM / FFM \text{ density}$. The FFM and FM density was assumed to be 1.1000 and 0.9007, respectively. The difference between DXA-measured and BD-derived FFM was calculated and the association between this difference with age, gender, and adiposity measure, namely body mass index (BMI), was examined by multiple linear regression. **Results:**

The DXA-measured FFM was 2.26 kg higher than the BD-derived FFM. In multivariate analysis, higher BMI and older age was significantly associated with greater difference between DXA-measured and BD-derived FFM. **Conclusions:** Fat infiltration into skeletal muscles in older adults may contribute to the discrepancy.

SUBMITTED FREE PAPERS AND POSTERS

Hypothermia in older patients: characteristics and prognosis

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Background: Older people are vulnerable to develop spontaneous hypothermia, and its subsequent mortality, owing to impaired thermoregulation. The mortality of older patients admitted to medical department with hypothermia ranged from 36% to 46%. Objectives: This study aimed to assess the characteristics and prognosis of older patients admitted to acute medical ward with hypothermia. **Methods:** A retrospective observational study was conducted on older patients aged ≥ 60 years admitted to the acute medical unit with hypothermia between 2005 and 2008. Their case notes were reviewed, and data were collected: demographic characteristics, severity of hypothermia, month of admission, chronic medical illnesses, age-related Charlson comorbidity index, acute medical problems on admission, investigation results, and in-patient mortality. In-patient mortality was defined as the outcome variable. **Results:** 37 men and 44 women (mean age, 80; SD, 9 years) were eligible. Most were either living with their families ($n=32$) or in institutions ($n=36$). 30 (37%) of the patients died during hospitalisation. Multivariate analysis concluded that bradycardia (odds ratio [OR], 5.26; 95% confidence interval [CI], 1.31-21.10; $p=0.02$), high serum urea levels (29.9 ± 22.6 mmol/L in non-survivor group vs. 19.2 ± 11.9 mmol/L in survivor group; OR, 1.04; 95% CI, 1.00-1.08; $p=0.05$) and hypoalbuminaemia (27 ± 5 g/L in non-survivor group vs. 35 ± 9 g/L in survivor group; OR, 0.79; 95% CI, 0.69-0.90; $p=0.001$) were independent predictors of in-patient mortality. **Conclusions:** High in-patient mortality was noted among older patients admitted to acute medical ward with hypothermia. Bradycardia, hypoalbuminaemia, and high serum urea levels were independent factors associated with mortality. This may reflect the lack of awareness among their caregivers of impaired thermoregulation in older persons.

Metformin-attenuated body fat loss in older diabetic men: a 4-year follow-up study with dual X-ray absorptiometry

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Background: Sarcopenia is associated with frailty, whereas lower body fat is associated with higher mortality in old age. Diabetes is associated with both conditions. If these conditions are due to insulin resistance, they can be counteracted by insulin sensitizers. We examined whether metformin, an insulin sensitizer, may be associated with attenuation of these adverse effects of diabetes in older men. **Methods:** 1566 men were studied using dual X-ray absorptiometry (DXA) and questionnaires for changes in body composition and health over 4 years. Percentage changes of total body fat mass, trunk fat mass and appendicular skeletal mass (ASM) were recorded. Metformin use at baseline, at years 2 and 4, and the self-reported duration of metformin use at years 2 and 4 were used for analysis. **Results:** 222 (14.2%) of the men had diabetes, 117 of whom (mean age, 72.2 years) took metformin. Their mean metformin use duration was 7.7 (standard deviation, 5.9) years and their mini-mental state examination score was 27.1. They lost a mean of 2.73% total body fat, 3.82% trunk fat, 2.96% of ASM, and 2.29% weight over 4 years. In multiple linear regressions, each additional year of metformin use was associated with less body fat loss (0.399% less per additional year, $p=0.026$), and less trunk fat loss (0.512% less per additional year, $p=0.013$), after adjustment for covariates. There was a trend towards less ASM% loss (0.139% less per additional year, $p=0.059$). **Conclusions:** The duration of metformin use may be associated with reduced body fat loss, in particular reduced trunk fat loss, in older men with diabetes.

1H magnetic resonance spectroscopy findings of normal individuals and Alzheimer's disease patients

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Objectives: Proton magnetic resonance spectroscopy (1H-MRS) is a non-invasive tool for *in vivo* metabolic study and for diagnosis of different forms of dementia. Screening for the dementia in symptomatic elderly patients is necessary for the initiation of the medications to slow the progression of Alzheimer's disease (AD) and enables patients and their family members to plan for future. MRS studies in AD reveal a decrease of N-acetylaspartate (NAA) and an increase of myoinositol compared with the healthy subjects. However, local normal reference of the neurometabolites is lacking. This study reported the findings of the 1H-MRS in the normal subjects from community. **Methods:** Normal consecutive subjects and AD patients were assessed by geriatricians using neuropsychiatric test, magnetic resonance imaging, arteriography, and spectroscopy. A single voxel sequences (TE 30ms, TR 2000 ms) was carried out via 1.5T-MRS at the posterior cingulate gyrus of each individual to study metabolites including NAA, creatine, choline, and myoinositol. The diagnosis was made using the mini-

mental state examination and cognition dementia rating by geriatricians, and the results were correlated with the 1H-MRS results. **Results:** 32 normal subjects (mean age, 61.6; standard deviation [SD], 8.90, range, 50-79 years) and 96 AD subjects (mean age, 71.8; SD, 9.55; range, 50-89 years) were recruited. Respectively for normal and AD subjects, the mean NAA was 1.242 ± 0.141 and 1.19 ± 0.180 ($p=0.192$), whereas the mean myoinositol was 0.731 ± 0.144 and 0.973 ± 0.178 ($p < 0.001$). **Conclusions:** The 1H-MRS is a useful tool for early diagnosis of dementia. The neurometabolites helps set the basis for comparison of cognitive impairment patients in order to make early diagnosis and treatment in the symptomatic elderly.

Elderly health care services reach the accident emergency department in a trustworthy manner

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Background: As life expectancy increases, the number of chronically ill patients also increases. In Hong Kong, 20% of admissions to the accident and emergency department (AED) are by older patients, who usually stay longer in AED or require subsequent medical admissions. They usually have geriatric syndromes including cognition impairment (acute or chronic), fall, or multiple comorbidities such as chronic obstructive airway disease (COPD), congestive heart failure (CHF), and diabetes mellitus. Early involvement of the geriatric team enables earlier expertise intervention and discharge and ensures patient to have proper community supports. Assessments by a nurse-led geriatric team may benefit these patients. **Objectives:** To promote nurse-led geriatric AED consultations and to assess epidemiology of these patients. **Methods:** Geriatric intervention is provided by a team comprising geriatric physicians and a liaison nurse for cross-speciality consultations. Epidemiological data were collected during the process. **Results:** 90 female and 74 male patients aged 66 to 93 (mean, 82.2; SD, 7.19) years were screened by a geriatric nurse and then assessed by geriatricians from March 2010 to March 2011. Their reasons for admission included delirium ($n=14$), dementia ($n=29$), fall ($n=16$), Parkinson's disease ($n=8$), social problem ($n=10$), elderly abuse ($n=4$), acute exacerbation of COPD ($n=41$), CHF ($n=6$), diabetes ($n=5$), decrease general condition ($n=7$), and others ($n=24$). All these patients could be benefit from geriatric team advice and commence on early discharge planning. **Conclusions:** Inter-departmental communication facilitates various service implementations. Nurse-led geriatric assessment of psychosocial and baseline medical problems as well as medication reviews prior to assessment by the geriatrician facilitates the consultation process. It facilitates inter-departmental communication and collaboration to prevent unnecessary hospital admission.

End-of-life care pathway in a non-cancer palliative unit

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Background: Most deaths in Hong Kong occur in hospitals, particularly in medical departments. To provide a dignified death for non-cancer patients and appropriate support to their carers is the core responsibility of physicians. The Liverpool Care Pathway (LCP) for the dying patients is used as a template of best practice in the end-of-life care strategy of the Department of Health of United Kingdom in 2008. The end-of-life care pathway (ECP) based on the concept used in LCP (version 12) was developed with modification to suit the local needs. It was first applied to non-cancer palliative unit. **Objectives:** To identify the quality of care for dying patients as documented in ECP and benchmark our performance with the National Care of the Dying Audit – Hospital (NCDAH) 2009 in UK. **Methods:** A retrospective audit gathered ECP data from Tuen Mun Hospital from August to December 2010. Patients were referred to the non-cancer palliative unit after recognition of specific clinical indicators of advanced diseases, and a decision made for comfort care only, modified from the gold standard framework. A multidisciplinary team agreed that the patients were dying with no reversible cause. **Results:** Of 117 deaths, 42 applied ECP. The median patient age was 80 (interquartile range [IQR], 75-85) years; 55% were female; 79% were non-cancer patients. The most common diagnosis was end-stage renal failure. The median duration in ECP was 62 (IQR, 18-103) hours. 95.4% of patients and 95.2% of carers could fully participate in communication. 88.9% of patients and 90.5% of carers were aware that the patients were dying. 88.1% of the carers fully explained the facilities available to patients with leaflets. 77.3% of patients and 78.6% of carers discussed about their spiritual needs. 71.4% of the patients were prescribed medications as needed for symptom control, in which 36.7% were given the medications. Patients' needs for the current interventions were reviewed, and unnecessary medications discontinued. 97.6% of the needs for artificial nutrition, 95.2% for artificial hydration, and 92.9% for skin integrity were assessed. 83.3% of the patients and 54.8% of carers were explained the pathway. For symptom control in the last 24 hours, 85.1 to 90.5% of the patients were free from physical and psychological symptoms, whereas 76.2% of them could receive physically adjusted environment. Our results were superior to the NCDAH 2009. **Conclusions:** ECP provides a foundation for good symptom control, spiritual, psychological, social and spiritual support. The percentages of the pathways explanation, spiritual assessments, and anticipated symptoms medication prescriptions as needed are relatively low. These require further improvement and attention. Continuous staff education and supervision is the key to success.