ORIGINAL ARTICLE

Drug non-adherence and associated risk factors among Chinese geriatric patients in Hong Kong

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Objectives To study the prevalence of drug non-adherence among Chinese elderly people and its associated risk factors.

Design Cross-sectional survey.

Setting Medical and Geriatrics specialist out-patient clinic in a regional hospital.

Patients Elderly patients (≥65 years) with chronic diseases requiring regular medications were selected by systematic sampling.

Main outcome measures Drug non-adherence; potential risk factors studied include patients' factors, availability of assistance, and prescription factors.

Results Two hundred and nine elders participated with 84% response rate. Estimated mean prevalence rate of drug non-adherence was 37% (standard deviation, 7%). The risk factors for drug non-adherence were: (1) self-perceived adverse drug effects (odds ratio=2.5; 95% confidence interval, 1.2-5.2; P=0.017); (2) use of respiratory drugs (2.7; 1.0-7.5; P=0.048); (3) complicated drug regimens (7.4; 3.2-16.9; P<0.001); and (4) necessity to cut tablets (4.8; 2.1-10.7; P<0.001). Presence of caregiver/community nursing services assistance to pack medication (odds ratio=0.2; 95% confidence interval, 0.1-0.5; P=0.001), and the use of medication boxes (0.5; 0.3-1.0; P=0.050) were found to be the protective factors against drug non-adherence.

Conclusion Drug non-adherence is an important concern in patient management. Medication regimen should be simplified as far as possible, in particular to avoid cutting pills or use of different dosage at different timing. Patients receiving drugs for respiratory diseases should be the first target group for intervention. Patients should be encouraged to voice out their perceived adverse drug effects.

Introduction

With advancement in medical technology and availability of antimicrobial agents, previously life-threatening infectious diseases become amenable to cure. Since the 1960s, there was also an associated ageing of populations worldwide. Consequently, there has been a continuing epidemiological shift away from acute diseases to more chronic illnesses.[1] Thus, cardiovascular diseases, diabetes mellitus, and hypertension have become major health challenges.[2,3] It is estimated that the prevalence rates of hypertension, diabetes mellitus, and hypercholesterolaemia among community-dwelling seniors aged 60 years or above amount to 47.2%, 20.9%, and 17.9% respectively.[4] Moreover, effective management of such chronic disorders is associated with lower avoidable morbidity, mortality, and health care utilisation across many chronic conditions.[5] For effective management, lifestyle modification, good drug compliance, and the use of effective drugs are all important.[5,6] The recent CHARM[7] study also illustrated the overall favourable outcome of good adherence on all-cause mortality, irrespective of patient assignment to active treatment (candesartan) or placebo.

Although the importance of drug adherence is well-known, there are little data concerning drug adherence among chronic disease sufferers in the local population. Local studies found the rate to be as high as 50% among patients on long-term medical therapy.[8,9] Yet there was no local study on the epidemiology of drug non-adherence specifically

Key words
Aged; Chinese; Patient compliance; Prescriptions, drug; Risk factors

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among the elderly, who are the main sufferers of chronic diseases. Therefore the primary objective of the current study was to examine the prevalence of drug non-adherence among Chinese geriatric patients in Hong Kong. The secondary objective was to explore factors that may affect drug non-adherence, namely: personal factors, presence/absence of assistive devices, and prescription factors.

香港華籍年長病人不依指示服藥的情況和相關的風險因素

目的 研究華籍長者不依指示服藥的普遍情況及相關的風險因素。

設計 橫斷面研究。

安排 某地區醫院的內科和老人科專科門診診所。

患者 經系統抽樣的65歲或以上，因有長期病患而須定時服藥的病人。

主要結果測量 不依指示服藥的情況；研究的相關風險因素包括病人因素、能否獲得協助和開藥方因素。

結果 209名病人參與是次研究，回應率為84%。不依指示服藥的估計平均比率為37%（標準差，7%）。不依指示服藥的風險因素為：（一）病人認為藥物有負作用（風險比率2.5；95%置信區間為1.2-5.2；P=0.017）；（二）服用呼吸系統藥物（2.7；1.0-7.5；P=0.048）；（三）複雜的藥物療程（7.4；3.2-16.9；P<0.001）和（四）須將藥丸切開（4.8；2.1-10.7；P<0.001）。若有社區護士或他人協助將藥物裝好（風險比率0.2；95%置信區間為0.1-0.5；P=0.001），或者使用藥丸盒（0.5；0.3-1.0；P=0.050），可避免不依指示服藥的情況。

結論 不依指示服藥在病人管理上是一個重要問題。藥物療程應盡可能簡化，尤其避免要切開藥物或不同時間服食不同劑量。因呼吸系統疾病服藥的病人最先須要處理，並要鼓勵病人說出他們認為的藥物負作用。

Methods

This was a cross-sectional survey to examine the prevalence of drug non-adherence and its relationship with selected risk factors.

Subjects

The target population consisted of elderly patients (≥65 years) with chronic diseases requiring regular medications, who were being managed at a specialist out-patient department (SOPD) by geriatric and other medical specialists in a regional public hospital. All patients who attended the relevant SOPD clinic between 3 and 13 January 2006 were potential subjects. To be included, patients had to satisfy the following criteria: (1) age of 65 years or older; (2) have at least one chronic disease (eg hypertension, diabetes mellitus) for which they received long-term medication; (3) have been followed up at the relevant SOPD clinic for at least 6 months; (4) have no helper (domestic or family member) who directly supervised medication intake, although prior preparation by a helper or Community Nurse to pack daily medications was permitted; and (5) have no mental incapability/dysphasia to the extent it precluded informed consent.

Sampling procedures

One day before the scheduled follow-up, the list of out-patient attendees were pulled out from the Out-Patient Appointment System and printed out in order of booking sequence. Sampling was performed by selecting every 10th subject on the attendee list. If the named individual did not satisfy the inclusion criteria or lived in a residential care home (ie medication intake supervised by helpers), he/she would be replaced by the next patient on the list. The researcher also checked out the actual number of clinic(s) that the subject attended within the public hospital system. To check against their reported intake so as to derive the drug adherence, the list of medications dispensed to the patient by all clinics was retrieved from the computerised electronic patient record (ePR) and considered to be the gold standard.

After the list was pulled out, subjects were contacted by phone to remind them of their appointment. On the day of their follow-up and before their medical consultation, each patient was given an explanation of the aims and purpose of the current study after registration at the clinic. Patients consenting to participate in the study were asked to complete a questionnaire with the assistance of the researcher. Specifically patients were asked to describe their regimen of medications, including the number, type, and frequency of each medication, and number of pills/puff per intake. Whenever necessary, the patients were given samples of their drugs to assist their recognition process. Each interview lasted about 10 minutes.

Sample size and power estimation

The primary objective was to assess prevalence of drug adherence among these elderly participants. Assuming a non-adherence rate in the current study of as high as 50%[8] and α=0.05 (two-tailed), 171 patients were needed to give an estimate at a width of ±7.5% and with a 95% confidence interval (CI). Assuming a response rate of 85%, 201 patients were to be recruited. At the end of the survey, 209 patients actually completed the questionnaire and the absolute prevalence of drug non-adherence was 37% (see Results). We were thus able to limit the estimated width to ±6.5% at the same 95% CI.

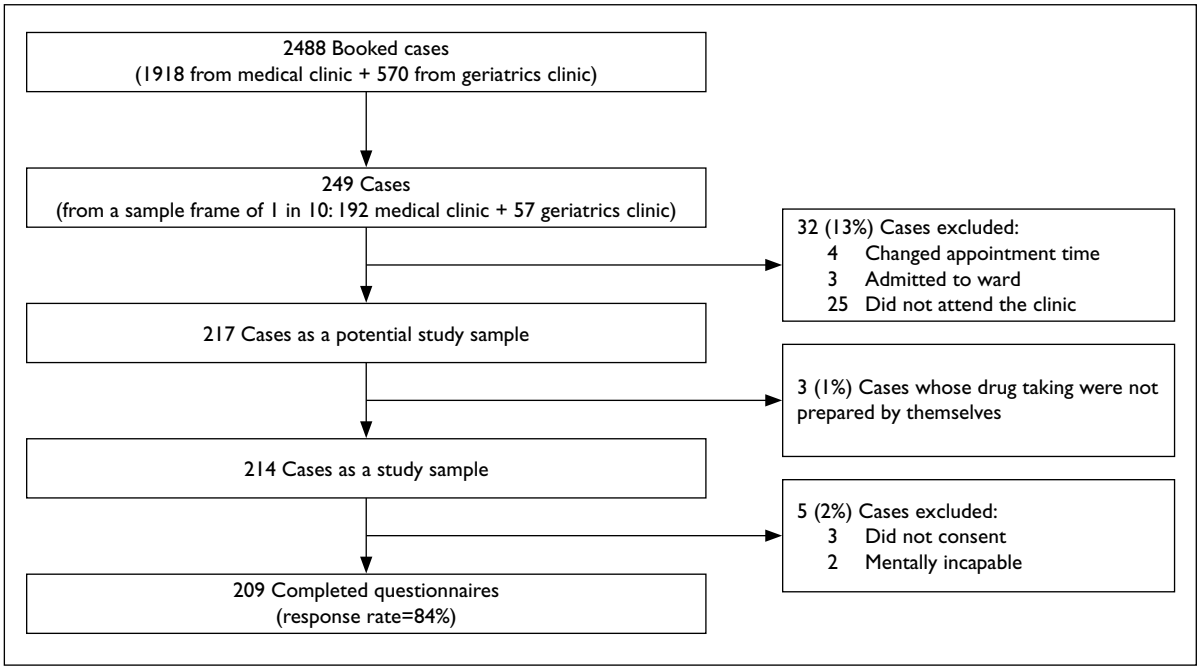

FIG. Summary on the flow of sampling

Data collection

Outcomes and predictor variables

The dependent variables under study were patient drug adherence and non-adherence. Drug non-adherence was defined as self-admitted omission of medications during the past 4 weeks on direct questioning,[10] or a deviation of recall on medication intake in the past week as opposed to recall of the complete regimen (recorded in the medication notes) and the hospital dispensing history available from the ePR.

Potential variables that might lead to drug adherence/non-adherence classified into three categories were studied. They included: patient's factors (age, sex, education level, cognition), presence/absence of assistive device/personnel in preparing medications, and prescription factors. Patient cognition was assessed by the simple clock drawing test.[11] Subjects with a score of 4 or higher were categorised as suspect/impaired.[12] Prescription factors measured (a) the number of different types of drugs (cardiovascular, respiratory, endocrine, gastro-intestinal, anti-gout, and others) to be taken, (b) the number of different frequencies (eg frusemide once daily, Slow K [Novartis, East Hanover, US] tab 1 daily, nifedipine SR 20 mg twice a day, methyldopa 250 mg 3 times a day was counted as "3" corresponding to once daily, twice a day, and 3 times a day), (c) the need to cut pills, and (d) the presence of different dosing for the same medication over different time frames (eg warfarin 2.0 mg and 1.5 mg on alternate days, or nifedipine SR 20 mg in the morning and 10 mg in the evening). Patient drug treatment regimens that entailed three or more different medication frequencies, or different dosing at different times were classified as complicated.

Statistical analysis

Patient demographic information, cognition, and drug usage were recorded as actual frequencies and percentages. Percentage of complicated regimens (as defined above) and recent change of medications within the preceding 3 months was also recorded as were other potential factors that might affect drug adherence (previous attendance of drug education/disease management class, use of drug box, and presence of caregiver).

Statistical analysis was performed to test for factors that associated with drug non-adherence by the Chi squared test (for categorical variables) or independent *t* test (for continuous variables). Age, sex, and predictor variables that showed P values of smaller than 0.1 were analysed by a logistic regression model using stepwise forward approach for adjustment. A P value of less than 0.05 was considered statistically significant. Data were analysed using the Statistical Package for the Social Sciences (Windows version 12; SPSS Inc, Chicago [IL], US).

Ethical considerations

Approval of data collection was granted from the Clinical Research Ethics Committees of both the Chinese University of Hong Kong and the Kowloon East Cluster hospitals of the Hospital Authority. Written informed consent was obtained from all

TABLE 1. Baseline characteristics of study subjects

Parameter	No. (%) (unless otherwise specified)
Personal factors	
Age-group (years)	
Young-old (65-74)	135 (65%)
Middle-old (75-84)	65 (31%)
Old-old (≥85)	9 (4%)
Male:female	104:105 (50%:50%)
Education level	
No schooling	55 (26%)
Primary schooling	98 (47%)
Secondary schooling	48 (23%)
Post-secondary education	8 (4%)
Living with caregiver (yes:no)	132:77 (63%:37%)
Ever attended education class (yes:no)	72:137 (34%:66%)
Cognition	
Clock drawing test ≥4 (impaired)	88 (42%)
Clock drawing test <4 (not impaired)	121 (58%)
Self-perceived adverse drug effects (yes:no)	56:153 (27%:73%)
Assistance/assistive device	
Caregiver/community nursing services pack medication (yes:no)	152:57 (73%:27%)
Use of medication box (yes:no)	132:77 (63%:37%)
Type of drugs taken	
Cardiovascular	190 (91%)
Respiratory	27 (13%)
Endocrine	88 (42%)
Gastro-intestinal	15 (7%)
Against gout	12 (6%)
Others	74 (35%)
Drugs regimen/prescription factor	
Change of medications in the past 3 months (yes:no)	75:134 (36%:64%)
Necessity to cut tablets (yes:no)	137:72 (66%:34%)
Complicated drug regimen (yes:no)	87:122 (42%:58%)
No. of medications (mean, SD)	4.20 (2.12)
No. of different drug-frequency regimens (mean, SD)	2.27 (0.95)
No. of follow-up clinics (mean, SD)	1.29 (0.56)

study participants.

Results

Of 2488 potential patients, 249 were selected (Fig), of whom 209 participants completed the questionnaire amounting to a response rate of 84%.

Baseline characteristics of study subjects

Patient characteristics are summarised in Table 1. The mean age of the participants in the study was 74 (standard deviation [SD], 6) years, 63% (n=132) lived with caregivers and 73% (n=152) had caregiver/community nursing services (CNS) help preparing medications. In addition, 63% (n=132) used medication boxes to assist in administration of medication.

On average, four (SD, 2) types of medications were taken by each of the subjects. They were given at a mean of two (SD, 0.95) different medication-frequency regimens and dispensed through a mean of one (SD 0.6) clinic. The three commonest conditions for which medications were used were cardiovascular diseases (91%), endocrine diseases (including diabetes mellitus) [42%], and respiratory diseases (13%). In all, 66% (n=137) of subjects required to cutting up of tablets to ingest the appropriate dose. Overall 42% (n=87) had complicated regimens.

TABLE 2a. Comparison between drug adherence and drug non-adherence groups*

Parameter	Drug adherence, n=132	Drug non-adherence, n=77	Odds ratio (95% CI)	P value
Personal factors				
Age-group (years)				
Young-old (65-74)	80	55	NA	NS
Middle-old (75-84)	44	21	NA	
Old-old (≥85)	8	1	NA	
Male:female	59:73	45:32	1.74 (1.0, 3.1)	0.055
Education level				
No schooling	37	18	NA	NS
Primary schooling	65	33	NA	
Secondary schooling	23	25	NA	
Post-secondary education	7	1	NA	
Living with caregiver (yes:no)	32:100	11:66	0.5 (0.3, 1.1)	0.086
Ever attended education class (yes:no)	49:83	23:54	0.7 (0.4, 1.3)	0.287
Cognition (CDT >4:CDT ≤3)	58:74	30:47	0.8 (0.5, 1.4)	0.482
Self-perceived adverse drug effects (yes:no)	29:103	27:50	1.9 (1.0, 3.6)	0.039
Assistance/assistive device				
Caregiver/community nursing services pack medication (yes:no)	48:84	9:68	0.2 (0.1, 0.5)	<0.001
Use of medication box (yes:no)	91:41	41:36	0.5 (0.3, 0.9)	0.023
Type of drugs taken				
Cardiovascular	124:8	66:11	0.4 (0.2, 1.0)	0.046
Respiratory	10:122	17:60	3.5 (1.5, 8.0)	0.003
Endocrine	61:71	27:50	0.6 (0.4, 1.1)	0.115
Gastro-intestinal	7:125	8:69	2.1 (0.7, 6.0)	0.169
Against gout	8:124	4:73	0.9 (0.3, 2.9)	0.795
Others	44:88	30:47	1.3 (0.7, 2.3)	0.412
Drugs regimen/prescription factor				
Change of medications in the past 3 months (yes:no)	44:88	31:46	1.4 (0.8, 2.4)	0.314
Necessity to cut tablets (yes:no)	36:96	36:41	2.3 (1.3, 4.2)	0.004
Same drug-taking with different doses at different time (yes:no)	2:130	5:72	4.5 (0.9, 23.9)	0.054
Complicated drug regimen (yes:no)	41:91	46:31	3.3 (1.8, 5.9)	<0.001

* **CDT denotes clock drawing test, NA not applicable, and NS non-significant**

TABLE 2b. Comparison of age and prescription factors (continuous variables) between drug adherence and non-adherence groups

Parameter	Drug adherence, n=132 Mean (SD)	Drug non-adherence, n=77 Mean (SD)	Mean difference (95% CI)	P value
Age	74.3 (5.9)	72.2 (5.1)	2.1 (0.5, 3.7)	0.010
No. of medications	4.1 (2.0)	4.5 (2.3)	-0.7 (-1.00, 0.20)	0.188
No. of different drug-frequency regimens	2.1 (0.9)	2.5 (1.1)	-0.4 (-0.7, -0.1)	0.011
No. of follow-up clinics	1.3 (0.6)	1.2 (0.5)	0.1 (-0.0, 0.3)	0.153

Around one fourth (27%, n=56) of the patients perceived that they might have had adverse drug effects but only 85% had ever told their clinician during clinic visits.

Estimated drug non-adherence

Accordingly, 67% (n=140) had reported no omission of medications, while 33% (n=69) self-admitted omission of medications in the past 4 weeks. When we checked against the recall of medication intake in comparison to the ePR prescription record, 13% (n=28) of them had deviated from the prescribed drug regimen. Among those who claimed to have no omission of medications (n=140), eight of them could not recall the regimen correctly. Altogether

37% (n=77) of the patients were noted to have drug non-adherence (either self-reported omissions or medication intake deviating from the record).

Factors affecting drug adherence

In summary, after classifying the patients into drug adherence and non-adherence categories, there were no statistically significant differences between the two groups with respect to their baseline characteristics with the exception of age (Tables 2a, 2b).

Factors shown to be associated with drug non-adherence included: (1) younger age (P<0.01), (2) self-perceived adverse drug effects (odds ratio [OR]=1.9; 95% CI, 1.0-3.6; P=0.039); (3) use of respiratory drugs (3.5; 1.5-8.0; P=0.003); (4) complicated drug regimens (3.3; 1.8-5.9; P<0.001), (5) the need to cut tablets (2.3; 1.3-4.2; P=0.004), and (6) increasing number of distinct drug administration frequencies (P=0.011).

On the other hand, (1) caregiver/CNS assistance to pack medications (OR=0.2; 95% CI, 0.1-0.5; P<0.001), (2) use of medication boxes (0.5; 0.3-0.9; P=0.023), (3) taking of cardiovascular medications (0.4; 0.2-1.0; P=0.046) appeared to be protective factors, with respect to drug non-adherence.

After adjustment for possible confounding

Regarding the logistic regression model used to adjust for possible confounding, only six factors remained after adjustment (Table 3). Taking respiratory drugs (OR=2.7; 95% CI, 1.0-7.5; P=0.048), the need to cut tablets (4.8; 2.1-10.7; P<0.001), complicated drug regimens (7.4; 3.2-16.9; P<0.001), and the perception of having drug adverse effects (2.5; 1.2-5.2; P=0.017) were associated with drug non-adherence.

Presence of caregiver/CNS to pack medications (OR=0.2; 95% CI, 0.1-0.5; P=0.001) and use of medication boxes (0.5; 0.3-1.0; P=0.050) were appeared to be protective factors, with respect to drug non-adherence (Table 3).

Discussion

Prevalence of drug non-adherence

The overall prevalence of drug non-adherence reported in the current study was 37% (SD, 7%). Our non-adherence rate was lower than that reported in previous local studies (about 50%[8,9]) or overseas studies (47%) undertaken by Khalil and Elzubier,[6] and were similar to those described by Iihara et al[13] (reporting a drug compliance of 33%). Reasons for difference in compliance rates might be related to difference in the tools used for assessment, in that pill counting methods were used in other studies[6,8] while the studies by Iihara et al[13] and ourselves used self-reported drug omission, which may well have underestimated the true prevalence of drug non-adherence.

Factors related to drug non-adherence

We have identified a number of factors that were associated with drug non-adherence. In the past, the effect of age on drug non-adherence had been considered inconclusive.[14-16] Our study demonstrated an apparent association with younger age-groups. Yet, after adjustment with the logistic regression

TABLE 3. Logistic regression model on potential factors associated with drug non-adherence

Parameter	Drug adherence group, n=132	Drug non-adherence group, n=77	Adjusted odds ratio (95% CI)	P value
Personal factors				
Mean age (SD) [years]*	74 (6)	72.2 (5)	NA†	0.139
Sex (male:female)	59:73	45:32	NA†	0.183
Self-perceived adverse drug effects (yes:no)	29:103	27:50	2.5 (1.2, 5.2)	0.017
Assistance/assistive device				
Caregiver/community nursing services pack medications (yes:no)	48:84	9:68	0.2 (0.1, 0.5)	0.001
Use of medication boxes (yes:no)	91:41	41:36	0.5 (0.3, 1.0)	0.050
Disease/nature of drug factor				
Cardiovascular	124:8	66:11	NA†	0.188
Respiratory	10:122	17:60	2.7 (1.0, 7.5)	0.048
Drug regimen/prescription factor				
Mean (SD) No. of different drug-frequency regimen	2.1 (0.9)	2.5 (1.1)	NA†	0.336
Necessity to cut tablets (yes:no)	96:36	41:36	4.8 (2.1, 10.7)	<0.001
Complicated drug regimen (yes:no)	41:91	46:31	7.4 (3.2, 16.9)	<0.001

* Age was treated as a continuous variable

† Factors being removed after logistic regression

model, the apparent risk factor (younger age) was eliminated.

A possible explanation might be that for older persons doctors attempt to simplify medical treatment, leaving younger subjects to contend with more complicated drug regimens, which act as confounders.

Patients' self-perceiving adverse drug effects was associated with drug non-adherence (OR=2.5; 95% CI, 1.2-5.2; P=0.017). This was consistent with studies reporting that most of the non-compliers discontinue their medication due to adverse drug effects. For instance, Chong et al[8] reported 18% non- or partial-compliance related to drug adverse effects. Whilst, Levy et al[17] reported 39% of the non-compliance they encountered for the same reason. The effect of self-perceived adverse drug effects on drug non-adherence should not be overlooked and could be a potential focus for future interventions.

Importantly, in the present study the nature of the patients' disease and types of drugs taken appeared to affect drug compliance. Only few studies reported any correlation between types of drugs used and drug adherence. For example, Malhotra et al[18] reported that anti-hypertensives and anti-asthmatic treatments were poorly complied with. Based on univariate analysis of data from the current study, we found that cardiovascular drug use was positively associated with adherence while the use of respiratory drugs was negatively associated. Increased awareness by the public on the potential fatal consequence of not complying with cardiovascular drugs could be responsible. Interestingly, the protective effect of cardiovascular drug use on compliance did not endure after adjustment. As cardiovascular drug treatment usually needs an array of medications (eg aspirin once daily, nitrate and β-blockers twice daily, statin before bedtime), the complexity of such regimens may have negated the protective effect of awareness on drug compliance.

Our finding that the use of respiratory drugs was associated with drug non-adherence (8 out of 27) was consistent with a report by Saltoun et al.[19] In our survey, patients tended to use inhalers 3 times instead of 4 times daily as prescribed. Such patients may have misunderstood instructions about different inhaler preparations (hence different frequencies) that were particularly confusing.

Our study confirmed that a complicated drug regimen was an important risk factor associated with drug non-adherence (OR=7.4; 95% CI, 3.2-16.9; P<0.001). This result was explaining Chong et al's study results,[8] in which 33% of the non-compliance could be related to forgetfulness, decreased cognitive functions, or change of medication regimens. These findings highlight the importance of simplifying drug dosage variations and decreasing the number of different frequencies for prescribing doses. Although current studies showed no significant difference in terms of drug non-compliance among elderly people with decreased cognitive functions, declining levels of cognition with increasing age should not be ignored. Ultimately, complicated drug regimens must be prone to more medication non-adherence.

The necessity to cut tablets was associated with a 5-fold increase in the risk of drug non-adherence (OR=4.8; 95% CI, 2.1-10.7; P<0.001). Although this problem does not appear to have been addressed before, we suggest it might be related to the inconvenience (as reported by Saltoun et al[19]) of halving a tablet, or that patients might not realise that pills needed to be cut before intake. Older patients experiencing reduced hand dexterity might be another reason. Further studies are needed to explore this observation.

Our study indicates that a caregiver/CNS involved in packing medication and the use of medication boxes were significantly associated with better drug adherence. These measures reduced the risks of drug non-adherence about one quarter (OR=0.2; 95% CI, 0.1-0.5; P=0.001) and one-half (0.5; 0.3-1.0; P=0.050) respectively, in comparison to patients without such support. These results were consistent with those of Barat et al[20] in which the use of compliance aids facilitated drug adherence (OR=4.4; 95% CI, 1.6-12.3). Moreover, in Becker and Green's review,[21] it was concluded that the stability and support of a family caregiver correlated strongly with patient drug adherence.

Drug non-adherence has been previously demonstrated with advancing age,[6] poor/decreased cognition,[20] recent change in medication regimen,[22] involving increased or decreased number of drugs,[23,24] and increased number of follow-up clinic attendances. Our study was not able to reveal such findings, possibly due to the prevailing culture on medication intake and service provisions to improve drug adherence in our region.

Limitation

First, like any other cross-sectional study, this investigation suffered from not having recorded the longitudinal impact of putative associations on study variables at different time points. Second, the use of self-reported omissions might underestimate the true incidence of non-adherence. Third, drug adherence should also include avoidance of non-prescribed medication, which may potentially lead to drug-drug interactions. This might be important in the local Chinese population, as they are prone to take over-the-counter medications or from traditional Chinese practitioners. This aspect was not addressed in current study. Fourth, we did not investigate the potential impact of co-morbidities and impaired

activities of daily livings on level of drug adherence in our elderly population. As the impact of drug non-adherence was not an objective of the current study, we did not collect epidemiological data on adverse drug reactions due to drug non-adherence. Lastly, although the majority of chronically ill patients were managed in government hospitals/clinics, some patients are managed elsewhere.

Conclusions

Our study estimated the prevalence of drug non-adherence among Hong Kong elderly people. Potential risk and protective factors for drug non-adherence were identified. Patients who self-perceived adverse drug effects, used respiratory drugs, had inconvenient complex drug regimens, and needed to cut pills were at increased risk of drug non-adherence. The present study results also highlighted the potential importance of caregivers/community nurses in assisting patients to pack their medication, and use of medication boxes as aids to drug adherence among the elderly. A recent study by Wu et al[9] has shown the effectiveness of telephone counselling by community pharmacists in improving compliance and reducing mortality among patients on polypharmacy. Based on our survey and the study by Wu et al,[9] the following recommendations could improve drug adherence among the elderly people: (1) patients should be encouraged to express their concerns on drugs, in particular, their self-perceived side-effects; (2) patients receiving treatment for respiratory diseases should receive special education to improve understanding about their drug treatment; (3) prescriptions should be simplified as far as possible, and the need to cut pills avoided; and (4) among those who have difficulties with drug adherence, a trained helper to pack medication and the use of medication boxes could be helpful.

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