

LETTER TO THE EDITOR

Patient's degree of adherence, challenges & preferences towards medicine taking (PACT) in Singapore

Dear Editor,

Medication nonadherence is a prevalent public health problem that compromises patients' health outcomes and increases healthcare expenditures.¹ Studies in Singapore showed that 25.7%–38.9% of patients are nonadherent.^{2,3} Studies investigating the association between patients' reasons for nonadherence and their preferences towards adherence enablers are limited. We aimed to (1) examine the prevalence and reasons of medication nonadherence among patients with different clinical conditions and settings and (2) investigate possible associations with their preferred intervention for improving adherence.

A multicentre, cross-sectional and self-administered survey was conducted at 6 primary, intermediate and tertiary healthcare institutions in Singapore from March 2022 to November 2022. Participants were identified via convenience sampling at their routine care encounters (e.g. if they were aged 21 years and above, on any long-term medication and could understand the survey language [i.e. English, Chinese or Malay]). Eligible participants completed an anonymous online survey and received remuneration. The survey consisted of participant's profile, Domains of Subjective Extent of Nonadherence tool to examine the extent and reasons of nonadherence, and preferred interventions.³ Open-ended survey responses were analysed thematically. Descriptive results were summarised by mean $\pm$ standard deviation or number (percentage). Multiple logistic regression and tetrachoric correlations were used to statistically test for associations between categorical variables. This study was approved by the National Healthcare Group Domain Specific Review Board (2021/01168).

Among 6646 potential participants approached, 1248 (19.0%) completed the survey. Participants were mostly from the ambulatory care settings—specialist outpatient centres (SOC) 553 (44.0%), polyclinics 497 (40.0%) and inpatients 198 (16.0%)—who responded unassisted (83.0%) in English (89.2%). The mean age was 54.3 ± 16.3 years and 49.8% were female. Most participants were Chinese (77.7%), had at least secondary school education (80.8%), married/partnered (63.2%), working full-time (41.9%) and were not trained healthcare workers (92.6%). Participants followed up with 1.6 ± 1.8 healthcare institutions, had 2.1 ± 1.3 chronic medical conditions, and received 3.6 ± 3.0 long-term medications and supplements.

Common medical conditions were hypertension (50.2%), hyperlipidaemia (50.0%), diabetes (26.7%), depression (9.0%) and anxiety (8.8%). Majority (91.0%) of participants self-managed their medications. Moreover, 704 (56.4%) were nonadherent and this was comparable across the different settings: SOC (59.7%), polyclinics (51.3%) and inpatient (60.1%). Age (adjusted odds ratio [AOR] 0.98, 95% confidence interval [CI] 0.97–0.99, $P=0.006$), homemaker compared to full-time worker (AOR 0.57, 95% CI 0.36–0.91, $P=0.018$), number of medications/supplements (AOR 1.08, 95% CI 1.01–1.15, $P=0.025$) and anxiety (AOR 1.74, 95% CI 1.02–2.96, $P=0.041$) were independently associated with nonadherence. More than a third of the participants cited the following reasons: "I forgot" (75.6%), "I was out of my routine" (61.5%), "I was too late with my dose" (51.7%), "I did not have my medicines with me" (49.7%), "I was asleep" (49.7%), "The medication caused side effects" (40.9%), "I could not meet the food requirements" (36.2%), and "I was afraid the medications would interact with other medications I take" (35.9%). For open-ended responses, majority of the themes included forgetfulness, competing commitments, medication administration requirements with respect to food, polypharmacy and personal experiences with medication side effects. Notably, some participants expressed the lack of motivation. Most participants felt that pillboxes (43.1%), learning how to maintain their medication list (45.2%) and having access to medication information (42.6%) would improve their medication adherence, while 35.7% felt that one-on-one sessions with a healthcare professional would help. Open-ended responses listed pillboxes and various reminders (e.g. alarm, phone calls and family) as their top choices. Some participants recognised that they need more self-discipline and that they would not miss their medications if they view it as important. Participants, who forgot their medication, preferred mobile application reminders ($r=0.158$, $P=0.026$) and alarms ($r=0.286$, $P<0.001$). Similarly, participants, who were out of their routine, felt that mobile application reminders ($r=0.133$, $P=0.040$) and alarms ($r=0.134$, $P=0.047$) would be helpful. Participants who missed their medications due to being asleep were interested in discussing with healthcare providers on their regimen ($r=0.215$, $P=0.001$) (Table 1).

The study's prevalence of medication nonadherence (56.4%) is higher than the 38.9% reported

Table 1. Tetrachoric correlation coefficient (r) of main reasons for non-adherence and preferred interventions.

Reasons for nonadherence	I forgot	I was out of my routine	I was too late with my dose	I did not have my medicines with me	I was asleep
Preferred interventions					
Tools					
Pillbox	0.006	0.056	-0.015	-0.051	-0.042
Mobile app reminders	0.158 ^c	0.133 ^c	0.126 ^c	0.188 ^b	0.084
Specialised packaging	0.099	0.087	0.017	0.044	0.135 ^c
Medicine labels	-0.029	-0.129	-0.030	0.018	0.083
Alarm	0.286 ^a	0.134 ^c	0.156 ^c	0.103	0.160 ^c
Services					
Learning how to maintain my medicine list	-0.046	-0.018	0.062	0.022	-0.018
Having access to medicine information	0.065	0.038	0.019	0.058	0.060
Getting my questions answered through interactive channels	-0.021	-0.061	0.071	0.038	0.109
Deciding on my medicines with my healthcare providers	-0.053	0.028	0.066	0.066	0.215 ^b

^a $P < 0.001$, ^b $P < 0.01$, ^c $P < 0.05$

in another study using the same adherence measure in diabetic patients in Singapore.³ Younger patients and patients with more medications/supplements tend to be more nonadherent. This could be due to multiple competing commitments as revealed in participants' open-ended responses and increased daily doses or complex dosing regimen. An overview of systematic reviews proposed that age has a concave relationship with adherence, where poor adherence was observed in the very young and very old.⁴ Those with more medications/supplements tend to be more nonadherent, which highlights the importance of medication regimen simplification.

Anxiety was a significant predictor of nonadherence, and our study suggests more support to be given to these patients. Patients with more negative emotions could be less motivated to care for themselves and adhere to complex medication regimens. However, this association varied in literature.⁵

Forgetfulness was a major reason for nonadherence. In our study, participants also shared the lack of motivation and self-discipline. This suggests that forgetfulness may have both a cognitive and motivational component.⁶ Medication adherence is a complex behaviour; hence, further studies should systematically

explore beliefs, motivation and other variables affecting adherence.⁷ Although participants who forgot their medications preferred interventions such as mobile application reminders and alarms, these reminders only target the cognitive aspect of forgetfulness and may not be effective alone.⁶ Pillboxes, learning to maintain medication list and having access to medication information were well-perceived by participants and may be useful in a multimodal intervention strategy. One-third of the participants responded that having one-on-one sessions with healthcare professionals will be useful to improve their medication adherence. One-on-one medication therapy management by pharmacists has shown effectiveness in improving medication adherence and resolving drug-related problems.⁸

The online survey could have excluded the less digitally-savvy participants, even though Singapore has a high mobile internet user penetration rate of 93.7%.⁹ Future studies should match specific interventions to participants' specific reasons for nonadherence for more targeted investigations.¹⁰ Validation of a medication adherence intervention questionnaire would also add robustness to future work in this field.

Our study reported a significant burden of medication nonadherence in Singapore. The common factors of nonadherence and patients'

preference on possible interventions will provide greater insights in planning programmes to address medication nonadherence among Singapore's ageing population and increasing multimorbidity patient population.

Acknowledgements

We would like to thank Dr Corrine Voils for the permission to use the Domains of Subjective Extent of Nonadherence (DOSE-Nonadherence) Measure. We would also like to thank and acknowledge all pharmacists who have assisted us in the administration of the survey.

Funding

This study was supported by Pharmacy Transformation Office, National Healthcare Group.

Keywords: DOSE-nonadherence, epidemiology, medication adherence, medication management, PACT

REFERENCES

1. Benjamin RM. Medication Adherence: Helping Patients Take Their Medicines As Directed. *Public Health Rep* 2012;127:2-3.
2. Lum ZK, Suministrado MSP, Venketasubramanian N, et al. Medication compliance in Singaporean patients with Alzheimer's disease. *Singapore Med J* 2019;60:154-60.
3. Liao YW, Cheow C, Leung KTY, et al. A cultural adaptation and validation study of a self-report measure of the extent of and reasons for medication nonadherence among patients with diabetes in Singapore. *Patient Prefer Adherence* 2019;13:1241-52.
4. Gast A, Mathes T. Medication adherence influencing factors—an (updated) overview of systematic reviews. *Syst Rev* 2019;8:112.
5. DiMatteo MR, Lepper HS, Croghan TW. Depression Is a Risk Factor for Noncompliance With Medical Treatment: Meta-analysis of the Effects of Anxiety and Depression on Patient Adherence. *Arch Intern Med* 2000;160:2101-7.
6. Stone VE. Strategies for optimizing adherence to highly active antiretroviral therapy: lessons from research and clinical practice. *Clin Infect Dis* 2001;33:865-72.
7. Michie S, van Stralen MM, West R. The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implement Sci* 2011;6:42.
8. Ai AL, Carretta H, Beitsch LM, et al. Medication therapy management programs: promises and pitfalls. *J Manag Care Spec Pharm* 2014;20:1162-82.
9. Statista. Mobile internet user penetration rate in selected regions in 2022. Published 2023. <https://www.statista.com/statistics/239114/global-mobile-internet-penetration/>. Accessed 16 May 2023.
10. Allemann SS, Nieuwlaat R, van den Bemt BJF, et al. Matching adherence interventions to patient determinants using the Theoretical Domains Framework. *Front Pharmacol* 2016;7:429.

Vivien Teo¹ MSc (Clin Pharm),
 Benny Kaihui Li² MSc (Healthcare Mgmt),
 Suat Fern Low³ BSc Pharmacy,
 Jing Wen Oh⁴ BSc Pharmacy (Hons),
 Kwok Foong Lam⁵ BSc Pharmacy (Hons),
 Eng Sing Lee^{6,7} PhD,
 Cheryl Wei Yan Tan⁸ PharmD,
 Poh Ching Tan⁸ MSc (Clin Pharm),
 Hui Shan Chia⁸ MSc (Clin Pharm),
 Su Yin Pang⁹ BSc Pharmacy (Hons),
 Fu Xun Marcus Heng⁹ BSc Pharmacy (Hons),
 Sin Hui Neo¹⁰ MSc (Epidemiology & Biostats),
 Tat Ming Ng¹ PharmD

¹ Pharmacy, Tan Tock Seng Hospital, Singapore

² Pharmacy, National Skin Centre, Singapore

³ Pharmacy, Yishun Community Hospital, Singapore

⁴ Pharmacy, Khoo Teck Puat Hospital, Singapore

⁵ Pharmacy, Institute of Mental Health, Singapore

⁶ Clinical Research Unit, National Healthcare Group Polyclinics, Singapore

⁷ Lee Kong Chian School of Medicine, Nanyang Technological University, Singapore

⁸ National Healthcare Group Pharmacy, Singapore

⁹ Group Pharmacy Office, National Healthcare Group, Singapore

¹⁰ Research, National Skin Centre, Singapore

Correspondence: Mr Heng Fu Xun Marcus,
 3 Fusionopolis Link #03-08, Nexus@one-north (South Lobby),
 Singapore 138543.

Email: Marcus_fx_heng@nhg.com.sg