The Effect of Learning Styles on Adverse Events in Home Hemodialysis Patients

Bourne L. Auguste, Abdullah Al-Muhaiteeb, and Christopher T. Chan

Clin J Am Soc Nephrol 13: 782–783, 2018. doi: https://doi.org/10.2215/CJN.12161017

Division of Nephrology, University Health Network, Toronto, Ontario, Canada

Correspondence: Dr. Christopher T. Chan, Division of Nephrology, University Health Network, 200 Elizabeth Street, 8N Room 846, Toronto, ON M5G 2C4, Canada. Email: christopher.chan@uhn.ca

Better clinical outcomes in home hemodialysis (HD) have led to a significant growth seen over the last two decades. By augmenting frequency and duration of dialysis, home HD improves BP control, reduces left ventricular hypertrophy, and enhances middle molecular clearance (1,2). However, HD training, its technical complexity, and adverse event risk pose significant challenges for wider adoption. Serious adverse event rates in home HD were recently reported to be 0.06 events per 1000 dialysis treatments (3).

Patients on home HD have diverse educational experiences and learning styles. VARK is a validated questionnaire that examines an individual's preferred learning preferences (4,5). Individuals can have any of the following: visual (V), auditory (A), reading-writing (R), and kinesthetic (K). One learning preference can be referred to as unimodal, two can be referred to as bimodal, and more than two can be referred to multimodal. For instance, someone can be a non-V bimodal learner with only the following combinations: AR, AK, or RK. Questionnaire results can help individualize instruction, enhancing educational experiences of learners (4). Similarly, tailoring training to learning styles of patients on home HD is an important tool that may improve knowledge retention and patient outcomes.

Current instructional methods, including at our own institution, are not individualized. Training ranges 8–12 weeks, and it includes instructional videos and manuals supported by hands-on teaching with 1:1 nursing care. Instructions cover basic concepts of dialysis, focusing on troubleshooting vascular access problems. After completing the training, patients must pass written examinations that interrogate one's understanding of concepts related to access and complications. Given the strong V content of our current material, we hypothesized that V learners at our institution had better outcomes over a 6-month period after initial home HD training compared with non-V learners.

We conducted an observational study examining adverse events and individual learning preferences using the VARK questionnaire (Version 7.8) among 61 adult patients on prevalent home HD (trained from January 1, 1997 to December 31, 2016) at the Toronto General Hospital in Toronto, Canada. All patients completed questionnaires between March 2016 and 2017 and were observed for 6 months. We received research ethics approval for this study from the University Healthy Network Research Ethics Board (16–5144-AE). Enrolled patients provided informed consent to participate in study and have their electronic medical records reviewed for demographic and clinical data related to hospital admissions, dialysis vintage, and complications.

We found no significant differences between V and non-V learners in age, sex, vascular access, diabetes, smoking, prior kidney replacement therapy, training duration, and health literacy. We identified 26 non-V and 35 V patients (Table 1).

Adverse events, defined as any arteriovenous fistula or graft needle dislodgement, access-related thrombosis, damage to central venous catheter, air embolism, symptoms on dialysis requiring hospitalization, and bacteremia, were the primary outcome of interest. Only adverse events occurring from the start of home HD up until 6 months after study enrolment were considered. There were no deaths during the study period.

The average age was 49 ± 12 years old, and 32 patients were men. Adverse event rate for all groups was 0.08 events per patient-year; 77% of non-V learners had at least one adverse event compared with 51% of V learners. Additionally, non-V learners were four times more likely to have a single adverse event compared with V learners, and after adjustment, this likelihood increased to 6.5 times (6.49; 95% confidence interval, 1.42 to 29.61; $P=0.02$) (Table 1). Non-A groups showed a trend toward more adverse events, whereas no strong trends were seen in R and K groups.

In this pilot study, we show that different learning styles in patients on home HD exist and that they are associated with adverse events. Although our results show a higher likelihood of adverse events in non-V learners, one particular learning style should not be considered as maladaptive, but rather, this highlights potential areas to enhance quality of training currently rendered. Adverse events may be more prevalent when the instructional method of home HD training and patient learning styles are incongruent. These novel findings illustrate that differences in learning styles exist and that they should be considered during patient training.

Major study limitations include the following. (*1*) VARK evaluates one aspect of learning and does not factor in personality, motivation, or other traits. (*2*) There are a lack of validation studies for VARK in

Table 1. Likelihood of an adverse event across different learning styles

Learning Style	No. of Patients, *N* (%)	Age, yr, Mean±SD	Training, d, Mean±SD	Patients with Any Adverse Event[a,b]	Patients with Adverse Event, %	Unadjusted OR[c]	Adjusted OR[c,d]
V							
V learners (VARK, VAR, VAK, VRK, VK, VR, V)	35 (57)	47±11	57.9±39.6	18	51		
Non-V learners (ARK, AR, AK, K, R, RK)	26 (43)	52±14	60.6±31.4	20	77	4.13 (1.17 to 14.52) *P*=0.03	6.49 (1.42 to 29.61) *P*=0.02
A							
A learners (VARK, VAR, VAK, ARK, AR, AK)	38 (62)	50±12	54.5±36.7	24	63		
Non-A learners (VRK, VR, VK, RK, R, K)	23 (38)	48±14	66.8±34.3	14	61	1.47 (0.47 to 4.64) *P*=0.51	2.17 (0.56 to 8.32) *P*=0.26
R							
R learners (VARK, VAR, VRK, ARK, VR, AR, RK, R)	44 (72)	50±12	58.0±38.7	28	64		
Non-R learners (VAK, VK, AK, V, K)	17 (23)	48±13	61.9±29.1	10	59	1.12 (0.33 to 3.80) *P*=0.86	1.41 (0.35 to 5.73) *P*=0.63
K							
K learners (VARK, VAK, VRK, ARK, AK, VK, RK, K)	47 (77)	49±13	60.0±37.5	31	66		
Non-K learners (VAR, VR, AR, V, R)	14 (23)	52±11	56.1±32.0	7	50	0.76 (0.22 to 2.70) *P*=0.66	0.96 (0.22 to 4.10) *P*=0.95

P value <0.05 indicates statistical significance. OR, odds ratio; V, visual; A, auditory; R, reading-writing; K, kinesthetic.
[a]Adverse events were predominantly bacteremia related to access (approximately 55.5% of patients); access clotting, needle dislodgement, and catheter damage (each accounting for approximately 10% of patients); and air embolism requiring hospitalization (one patient).
[b]Adverse events included vascular access complications, bacteremia, and any other dialysis-related events that required hospitalization since starting home hemodialysis.
[c]OR comparing the likelihood of a single adverse event for any patient within the different subgroups. Reference groups for ORs are V, A, R, and K learners.
[d]Adjusted for access type, duration of training (in days), diabetes, dialysis vintage, visual impairment, auditory impairment, and peripheral neuropathy.

dialysis populations. (*3*) This was a small, single-center observational study with limited event rate. (*4*) There was uncertainty of interaction between different learning styles. (*5*) We captured all bacteremia as adverse events, possibly introducing overestimation of effect in findings. (*6*) Long home HD vintage possibly allowed learning adaptations in certain individuals over the years. Despite these limitations, VARK provides insightful information that learning style differences exist.

As home HD grows, more patients are tasked with performing complex procedures at home. Ensuring that knowledge is conveyed in a format that suits individual learning preferences is pivotal. VARK questionnaires may identify learners at risk and consequently, areas of deficiency in current instructional methods. Future multicenter studies comparing learning styles, instructional method, and adverse event rates to confirm our preliminary findings are required.

Disclosures

None.

References

1. Nesrallah GE, Lindsay RM, Cuerden MS, Garg AX, Port F, Austin PC, Moist LM, Pierratos A, Chan CT, Zimmerman D, Lockridge RS, Couchoud C, Chazot C, Ofsthun N, Levin A, Copland M, Courtney M, Steele A, McFarlane PA, Geary DF, Pauly RP, Komenda P, Suri RS: Intensive hemodialysis associates with improved survival compared with conventional hemodialysis. *J Am Soc Nephrol* 23: 696–705, 2012
2. Chan CT, Floras JS, Miller JA, Richardson RM, Pierratos A: Regression of left ventricular hypertrophy after conversion to nocturnal hemodialysis. *Kidney Int* 61: 2235–2239, 2002
3. Wong B, Zimmerman D, Reintjes F, Courtney M, Klarenbach S, Dowling G, Pauly RP: Procedure-related serious adverse events among home hemodialysis patients: A quality assurance perspective. *Am J Kidney Dis* 63: 251–258, 2014
4. Leite W, Svinicki M, Shi Y: Attempted validation of the scores of the VARK: Learning styles inventory with multitrait–multimethod confirmatory factor analysis models. *Educ Psychol Meas* 70: 323–339, 2009
5. Thepsatitporn S, Pichitpornchai C: Visual event-related potential studies supporting the validity of VARK learning styles' visual and read/write learners. *Adv Physiol Educ* 40: 206–212, 2016

Published online ahead of print. Publication date available at www.cjasn.org.