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# Canadian Occupational Therapists' Use of Technology With Older Adults: A Nationwide Survey

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**Abstract**

As rehabilitation specialists, occupational therapy practitioners play a gateway role regarding recommendation of various technologies for homecare. However, no study has investigated current occupational therapy practices concerning information and communication technology (ICT) for older adults in Canada. The objective of this study was to identify Canadian occupational therapists' (OTs) knowledge and practices of ICT with older adults as well as factors associated with its recommendation. A Canada-wide, cross-sectional, online survey was conducted. Of 387 OTs, only 12.4% reported recommending ICT in practice. ICTs supporting communication and cognition were the main types recommended. The reported barriers to use in practice differed between *ICT familiar users* and *nonusers*. Multivariate logistic regression analyses showed that clinicians with more years of clinical experience were more likely to recommend ICT. Clinicians' services, work environments, and client diagnosis were also factors associated with ICT recommendation. Additional research is needed to understand how to overcome barriers to ICT recommendation in OT practice.

**Keywords**

older adults, survey, occupational therapy

## Introduction

Older adults express the preference to age in place, that is, to remain living in the community, safely, independently, and comfortably, even in the event of loss of autonomy (Eckert et al., 2004). To facilitate and support an independent and active participation in daily life, the application of information and communication technologies (ICTs) seems promising. Essentially, these technologies permit the acquisition, transfer, and processing of information through various types of communication means (e.g., receiving a digital reminder for an appointment or localization information on a smartphone from a wearable GPS device) and include devices such as adapted mobile phones, robots, monitoring sensors, smart home systems, fall detection systems, telehealth, and video games. Recent literature reviews report on their potential benefits for increased senior quality of life (QoL), particularly with regard to social isolation, cognitive disorders, mobility, falls, and assistance in other activities of daily living (e.g., medication management; Khosravi & Ghapanchi, 2016; Kim et al., 2017; Siegel & Dorner, 2017). For instance, ICTs interventions (i.e., interventions using the internet, web-based applications, videoconferencing, telehealth systems, smartphones) may be effective at reducing feelings of social isolation among seniors by means of providing connection to the outside world, obtaining social support, engaging in activities of interest, and enhancing self-confidence (Chen & Schulz, 2016). Similarly, it has been proposed that ICTs bring an empowering feeling to older adults by providing them with a way to gain control over their health problems, by helping compensate for disabilities, and increasing their feeling of safety (Siegel & Dorner, 2017). However, the reviews also state that current ICT research is too heterogeneous, still at experimental stages, and that studies of better quality are

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needed to establish the evidence to support independence and aging in place. Nonetheless, numerous ICTs are already available for purchase on the market (Orlov, 2019).

While some older adults might research, try and adopt certain technologies on their own, others might receive this information and help from their health care professionals. With regard to the use and recommendation of technology for homecare, occupational therapists (OTs) play an important role (Canadian Association of Occupational Therapists [CAOT], 2016). Indeed, they are specialists at supporting individuals achieve optimal functional performance in daily life and their role has been evolving with the advances in technology (CAOT, 2016; Smith, 2017).

While technology is a central part of OT practice standards and education, to our knowledge, no study has yet investigated the current state of practice with ICT among Canadian OTs, whether they are recommending it and, if so, which are being recommended. It is also not known what factors influence their recommendation of ICT. Thus, we designed a survey to investigate current Canadian OTs' practices with respect to ICT in older adult care to describe the profiles of *users* and *nonusers*, identify facilitators and barriers faced in practice, and explore which factors influence ICT recommendation in practice.

## Method

### Study Design

A Canada-wide, cross-sectional, online survey was conducted to detail OTs' knowledge, and recommendation, of ICT. Ethics approval was obtained by the Institutional Review Board of the Faculty of Medicine, at McGill University, Montreal, Canada, and the review board of the Centre de recherche de l'Institut Universitaire de Gériatrie de Montréal, CIUSSS Centre-Sud-de-l'île-de-Montréal.

### Survey Design

*Survey development.* The list of ICTs included in the survey was derived from a technology guide (https://books.apple.com/ca/book/intervention-technoclinique-dans-le-secteur-des-services/id1324647998?l=fr) and enhanced with a search of the gray literature regarding technologies supporting homecare available on the Canadian market. The questions exploring the practice profile of respondents were based on the CAOT classifications of OT practices. The survey was created in English and French. Prior to its deployment, both versions were piloted tested with five OTs working in geriatrics for clarity and completion length.

*Survey content.* The survey contained five sections. The first section elicited information related to OTs' practice profile (i.e., primary province of employment, clientele age group, areas of clinical practice, etc.). This led to the second section focusing on knowledge, and recommendation, of ICT in practice. The third section gathered information on the different types of ICT recommended in practice. The fourth section inquired about the barriers and facilitators to their recommendation. Finally, a series of questions gathering demographic information (i.e., gender, age, number of years of clinical experience, etc.) concluded the survey. Most questions consisted of categorical, close-ended, items including an open text box space to provide further information if deemed necessary by respondents. Skip logic was integrated in the survey. As such, based on knowledge, and recommendation, of ICT in practice, respondents were prompted to complete different sections (see Supplemental Figure 1 for survey content and respondent flow).

*Definition and classification of technology.* Given the aim of this project, technology was broadly defined as products, instruments, or systems used to improve the autonomy, security, and well-being of people with disabilities. It includes technologies based on ICT, as well as smart systems used to automate or facilitate tasks. The technology categories were guided by the Human Development Model—Disability Creation Process conceptual framework ("HDM-DCP—The Model," n.d.). They consisted of (a) *Personal factors* (further divided into technologies supporting: cognition, communication, improved knowledge on health status); (b) *Participation* (further divided into: transportation, general planning and management of daily activities, prevention of burns or water damage, prevention of falls, personal care or household activities, hobbies, medication management); and the (c) *Environment* (further divided into: smart environment and telehealth, caregiver support).

### Recruitment

Provincial and territorial professional OTs' organizations were contacted to invite their licensed members to participate in the project. Organizations from eight provinces agreed to participate (i.e., College of Occupational Therapists of British Columbia [COTBC], College of Occupational Therapists of Nova Scotia [COTNS], Manitoba Society of Occupational Therapists [MSOT], New Brunswick Association of Occupational Therapists [NBAOT], Ontario Society of Occupational Therapists [OSOT], Order of Occupational Therapists of Quebec [OEQ], Society of Alberta Occupational Therapists [SAOT], and Saskatchewan Society of Occupational Therapists [SSOT]). The COTNS, MSOT, NBAOT, OEQ, and SSOT directly reached their members; the OSOT provided access to a posting on their association's website; the SAOT sent the invitation through an e-bulletin; and, the COTBC provided a list of licensed members emails to be invited by a research assistant. Occupational therapists whose email correspondence was publicly available on the CAOT website (and associated external sources) were also directly invited to participate by

a research assistant. To be eligible, clinicians had to understand English or French.

### Participant Selection

To be selected, clinicians had to report working with *geriatric* or *geriatric and adult* clients for at least 6 months as well as complete the survey entirely.

### Data Collection

The survey was deployed on the SimpleSurvey web tool (https://simplesurvey.com/). Its completion took between 10 and 15 min. Respondents gave anonymized online informed consent prior to accessing the first section of the survey. They were offered the option to start, stop, and resume the survey at a later time. The data collection began in February 2016 and spanned 4 month. An initial email invitation and a reminder to participate were sent 2 weeks apart.

### Data Analysis

Prior to data analysis, incomplete survey entries were removed. Then, survey entries were examined for duplicates, and excluded, by verifying if those that had the same IP address also reported the same information for all of the subsequent questions. For the analysis, clinicians were classified based on their knowledge, and use, of ICT in practice as (a) familiar *users*, (b) familiar *nonusers*, or (c) *nonfamiliar*. Familiar *users* are respondents who reported being familiar with ICT and using them in practice; familiar *nonusers* are those who reported being familiar with ICT but not using them in practice; the *nonfamiliar* are those who reported not knowing about ICT supporting OT practices. Descriptive statistics were completed to report on clinicians' demographic and practice profile characteristics (see Tables 1 and 2) as well as to determine the prevalence of the different ICTs recommended in practice (see Table 3). The prevalence of barriers to their recommendation was completed for *users* and *nonusers*; the prevalence of facilitators was done only for *users* (see Table 4). The work environment, area of practice, client services, and client diagnosis variables were treated as dichotomous variables. Age was categorized into three groups (between 24 and 34 years of age; 35 and 45 years of age; over 45 years of age) and years of clinical experience was dichotomized (10 years or less; over 10 years). Age was categorized to ease the interpretation of the results as well as put together people who would normally have a similar number of years of experience. Proportions were calculated for categorical variables and means and standard deviations for the continuous ones.

Among respondents reporting being familiar with ICT, we further evaluated the potential association of clinicians' demographic and practice profile characteristics (i.e., age, years of clinical experience, education, work environments, areas of practice, client services, and client diagnosis) as explanatory variables for the recommendation of ICT in clinical practice outcome (see Table 5). First, associations were assessed using $\chi^2$ tests and, based on Hosmer and Lemeshow (2000), variables with $p$ values $\leq .25$ were retained and fitted for the subsequent logistic regressions. Multicollinearity between variables was verified through binary matrices. Univariate logistic regression was then performed to investigate the contribution of potential explanatory variables on the same outcome. Statistical significance was set at $p$ values $\leq .05$ for the univariate logistic regressions. Finally, using the variables that showed statistical significance in the univariate logistic regression, a multivariate block-wise logistic regression with forward variable selection was run on to model the recommendation of ICT in clinical practice. The blocks were divided as demographic variables; areas of practice; work environments; client services; and client diagnosis. Given the statistical analyses, only variables selected by at least 10% of respondents were considered and are shown in the tables. It is important to note that this was a post hoc exploratory analysis to better understand patterns of recommendation of ICT by Canadian OTs considering that there were no previous studies investigating it. The analyses were conducted with the help of a statistician and completed on the IBM SPSS Statistics statistical software program.

## Results

The survey was deployed in February of 2016. While it was not possible to know exactly how many OTs were contacted because membership count was not tracked for every association, it is estimated that over 6,600 members were sent the invitation to participate. A total of 874 accessed it. Of these, 681 entirely completed it but 294 were excluded as they did not work with a *geriatric* or *geriatric and adult* clientele. Thus, a final sample of 387 (44.3%) was retained. The final sample included clinicians from eight provinces and the Northwest Territories. Quebec was the primary province of employment for half of them. Of the 387 respondents, 210 (54.3%) fell in the *nonfamiliar* group, 129 (33.3%) were familiar *nonusers*, and 48 (12.4%) were familiar *users*.

### *Demographic and Practice Profile of ICT* Users, Nonusers, *and* Nonfamiliar

The demographic variables (Table 1) show that the profile characteristics of the sample were representative of the average Canadian OT (Canadian Institute for Health Information, 2016): it had 39.9 years of age on average, a bachelor's degree as the highest level of education achieved and 14.7 years of clinical experience. More specifically, on average, *users* were 44.4 years old, had 19.1 years of clinical experience, and most held a bachelor's degree as their highest level of education (66.7%). In contrast, *nonusers*

**Table 1.** Clinicians' Demographic Variables ($n = 387$).

| Variables | Full sample ($n = 387$) | Familiar | | Nonfamiliar ($n = 210$) |
|---|---|---|---|---|
| | | Users ($n = 48$) | Nonusers ($n = 129$) | |
| Age, *n* (%) | | | | |
| Over 45 | 115 (29.7) | 22 (45.8) | 31 (24.0) | 62 (29.5) |
| 35–45 | 125 (10.5) | 18 (37.5) | 39 (30.2) | 68 (32.4) |
| 24–34 | 147 (38.0) | 8 (16.7) | 59 (45.7) | 80 (38.1) |
| Mean ± *SD* | 39.9 ± 10.5 | 44.4 ± 10.3 | 38.1 ± 10.5 | 38.9 ± 10.2 |
| Gender, *n* (%) | | | | |
| Female | 352 (91.0) | 41 (85.4) | 117 (90.7) | 194 (92.4) |
| Male | 35 (9.0) | 7 (14.6) | 12 (9.3) | 16 (7.6) |
| Education, *n* (%) | | | | |
| Bachelor's | 230 (59.4) | 32 (66.7) | 64 (49.6) | 134 (63.8) |
| Master's & higher | 157 (40.6) | 16 (33.3) | 65 (50.4) | 76 (36.2) |
| Years of clinical experience, *n* (%) | | | | |
| Over 10 years | 230 (59.4) | 36 (75.0) | 68 (52.7) | 126 (60.0) |
| 10 years or less | 157 (40.6) | 12 (25.0) | 61 (47.2) | 84 (40.0) |
| Mean ± *SD* | 14.7 ± 10.2 | 19.1 ± 10.1 | 12.8 ± 10.1 | 13.8 ± 10.0 |
| Province of primary employment,[a] *n* (%) | | | | |
| Quebec | 197 (50.9) | 24 (50) | 58 (45) | 115 (54.8) |
| British Columbia | 109 (28.2) | 13 (27.1) | 41 (31.8) | 55 (26.2) |
| Nova Scotia | 33 (8.5) | 5 (10.4) | 13 (10.1) | 15 (7.1) |
| Manitoba | 19 (4.9) | 2 (4.2) | 8 (6.2) | 9 (4.3) |
| Saskatchewan | 18 (4.7) | 1 (2.1) | 5 (3.9) | 12 (5.7) |
| Ontario | 6 (1.6) | 2 (4.2) | 3 (2.3) | 1 (0.5) |
| Alberta | 2 (0.5) | 1 (2.1) | 1 (0.8) | 0 (0) |
| New Brunswick | 2 (0.5) | 0 (0) | 0 (0) | 2 (1.0) |
| Northwestern Territories | 1 (0.3) | 0 (0) | 0 (0) | 1 (0.5) |

[a]There were no respondents from Newfoundland, Nunavut, Prince Edward Island, and Yukon Territories.

were, on average, 6.3 years younger, had 6.3 years less of clinical experience, and more had a master's degree as their highest degree of education (50%). The *nonfamiliar* were, on average, 5.5 years younger than *users* with 5.2 years less of clinical experience. However, the proportion of those having a bachelor's degree as their highest degree of education was alike the *users'* group (63.8%).

With respect to practice profile variables (Table 2), respondents most commonly reported working in the area of general physical health (over 50% across groups). In addition, the most commonly reported client service consisted in offering home-assistance and support services (over 40% across groups). However, *users* most commonly reported working at rehabilitation hospitals (or facilities) (33.3%), whereas most *nonusers* reported working at community health centers (34.1%) and most *nonfamiliar* reported working at general hospitals (29.5%). Finally, most users and nonfamiliar reported working with a mild cognitive impairment (MCI) clientele (83.3% and 84.3%, respectively), whereas most nonusers reported working with a clientele with dementia and its related syndromes (83.7%).

## *Types of ICT Recommended in Practice*

The ICTs recommended in practice are detailed in Table 3. Technologies pertaining to *personal factors* were the most commonly selected: 97.9% ($n = 47$) reported recommending ICT supporting communication, 79.2% ($n = 38$) supporting cognition, and 64.6% ($n = 31$) to improve knowledge on health status. Particularly, the most reported tool was websites to enable clients in obtaining information on their disease or condition (e.g., Stroke Engine or Alzheimer's Society website).

Regarding ICTs pertaining to *participation*, the highest proportion of respondents reported recommending those assisting transportation needs (64.6% [$n = 31$]) (e.g., mats/bed strips with movement detectors or GPS localization application). The most reported tools concerned alternatives to restraints using various interfaces to facilitate mobility (e.g., sensitive pads, belts with buckles, alarms, mats or bed strips with movement detectors) and the use of personal emergency response systems involving a pendant or bracelet for the detection/prevention of falls.

**Table 2.** Clinicians' Practice Profile Characteristics ($n = 387$).

| Variables | Full sample ($n = 387$) | Familiar | | Not familiar ($n = 210$) |
|---|---|---|---|---|
| | | Users ($n = 48$) | Nonusers ($n = 129$) | |
| Work environment, *n* (%) | | | | |
| Community health center | 118 (30.5) | 16 (33.3) | 44 (34.1) | 58 (27.6) |
| General hospital | 106 (27.4) | 6 (12.5) | 38 (29.5) | 62 (29.5) |
| Residential care facility | 73 (18.9) | 8 (16.7) | 30 (23.3) | 35 (16.7) |
| Rehabilitation hospital/facility | 72 (18.6) | 16 (33.3) | 23 (17.8) | 33 (15.7) |
| Assisted living residence | 22 (5.7) | — | — | — |
| Solo professional practice/clinic | 21 (5.4) | 5 (10.4) | — | — |
| Mental health hospital/facility | 18 (4.7) | — | — | — |
| Visiting agency/business | 7 (1.8) | — | — | — |
| Group professional practice/clinic | 14 (3.6) | — | — | — |
| Postsecondary educational institution | 4 (1.0) | — | — | — |
| School or school board | 0 (0) | — | — | — |
| Association/government/para-governmental | 7 (1.8) | — | — | — |
| Industry, manufacturing, and commercial | 1 (0.3) | — | — | — |
| Areas of practice, *n* (%) | | | | |
| General physical health | 260 (67.2) | 26 (54.2) | 88 (68.2) | 146 (69.5) |
| Neurological/neuromuscular | 212 (54.8) | 25 (52.1) | 73 (56.6) | 114 (54.3) |
| Musculoskeletal system | 203 (52.5) | 22 (45.8) | 67 (51.9) | 114 (54.3) |
| Palliative/end-of-life care | 133 (34.4) | 15 (31.3) | 51 (39.5) | 67 (31.9) |
| Mental health | 93 (24.0) | 13 (27.1) | 30 (23.3) | 50 (23.8) |
| Cardiovascular and respiratory system | 96 (24.8) | 11 (22.9) | 32 (24.8) | 53 (25.2) |
| Health promotion and wellness | 51 (13.2) | 5 (10.4) | 18 (14.0) | 28 (13.3) |
| Client service management | 32 (8.3) | 5 (10.4) | 13 (10.1) | — |
| Vocational rehabilitation | 36 (9.3) | — | — | — |
| Medical/legal client service management | 10 (2.6) | — | — | — |
| Digestive/metabolic/endocrine system | 29 (7.5) | — | 13 (10.1) | — |
| Teaching | 21 (5.4) | — | — | — |
| Service administration | 15 (3.9) | — | — | — |
| Research | 7 (1.8) | — | — | — |
| Client services, *n* (%) | | | | |
| Home assistance/support | 164 (42.4) | 21 (43.8) | 53 (41.1) | 90 (42.9) |
| Rehabilitation—Social integration | 79 (20.4) | 18 (37.5) | 32 (24.8) | 29 (13.8) |
| Long-term care | 98 (25.3) | 13 (27.1) | 38 (29.5) | 47 (22.4) |
| Assessment/orientation (clinics/specialized services) | 78 (20.2) | 12 (25.0) | 29 (22.5) | 37 (17.6) |
| Screening/assessment | 101 (26.1) | 10 (20.8) | 36 (27.9) | 55 (26.2) |
| Rehabilitation—Vocational | 46 (11.9) | 9 (18.8) | — | 27 (12.9) |
| Palliative care | 85 (22.0) | 8 (16.7) | 32 (24.8) | 45 (21.4) |
| Information/promoting health in the community | 44 (11.4) | 8 (16.7) | 15 (11.6) | 21 (10.0) |
| Rehabilitation—School integration | 9 (2.3) | 5 (10.4) | — | — |
| Suicide, disease, accidents, social issues prevention in the community | 19 (4.9) | 5 (10.4) | — | — |
| Assessment/orientation (hospital services) | 98 (25.3) | — | 31 (24.0) | 63 (30.0) |
| Assessment/orientation (emergency) | 11 (2.8) | — | — | — |
| Legal services | 8 (2.1) | — | — | — |
| Psychotherapy | 4 (1.0) | — | — | — |

*(continued)*

**Table 2. (continued)**

| Variables | Full sample ($n$ = 387) | Familiar | | Not familiar ($n$ = 210) |
|---|---|---|---|---|
| | | Users ($n$ = 48) | Nonusers ($n$ = 129) | |
| Client diagnosis, *n* (%) | | | | |
| Mild cognitive impairment | 323 (83.5) | 40 (83.3) | 106 (82.2) | 177 (84.3) |
| Progressive neurological disorder | 297 (76.7) | 37 (77.1) | 103 (79.8) | 157 (74.8) |
| Disorders related to aging | 288 (74.4) | 32 (66.7) | 95 (73.6) | 161 (76.7) |
| Musculoskeletal and amputation disorders | 272 (70.3) | 32 (66.7) | 93 (72.1) | 147 (70.0) |
| Arthritis and rheumatology | 263 (68.0) | 32 (66.7) | 91 (70.5) | 140 (66.7) |
| Dementia and related syndromes | 310 (80.1) | 31 (64.6) | 108 (83.7) | 171 (81.4) |
| Chronic pain | 242 (62.5) | 29 (60.4) | 87 (67.4) | 126 (60.0) |
| Traumatic brain injuries | 183 (47.3) | 26 (54.2) | 61 (47.3) | 96 (45.7) |
| Cancer | 200 (51.7) | 25 (52.1) | 71 (55.0) | 104 (49.5) |
| Visual impairment | 211 (54.5) | 24 (50.0) | 80 (62.0) | 107 (51.0) |
| Intellectual disability | 141 (36.4) | 23 (47.9) | 51 (39.5) | 67 (31.9) |
| Hearing impairment | 193 (49.9) | 21 (43.8) | 75 (58.1) | 97 (46.2) |
| Cardio-respiratory disorders | 169 (43.7) | 21 (43.8) | 61 (47.3) | 87 (41.4) |
| Speech and language impairment | 141 (36.4) | 21 (43.8) | 58 (45.0) | 62 (29.5) |
| Alcoholism and other drug dependencies | 119 (30.7) | 20 (41.7) | 39 (30.2) | 60 (28.6) |
| Mood disorders | 144 (37.2) | 18 (37.5) | 55 (42.6) | 71 (33.8) |
| Myelopathies | 103 (26.6) | 17 (35.4) | 37 (28.7) | 49 (23.3) |
| Affective disorders | 112 (28.9) | 17 (35.4) | 36 (27.9) | 59 (28.1) |
| Personality disorders | 118 (30.5) | 15 (31.3) | 41 (31.8) | 62 (29.5) |
| Genetic disorders | 85 (22.0) | 13 (27.1) | 27 (20.9) | 45 (21.4) |
| Swallowing disorders | 146 (37.7) | 12 (25.0) | 53 (41.1) | 81 (38.6) |
| Encephalopathy | 93 (24.0) | 12 (25.0) | 30 (23.3) | 51 (24.3) |
| Developmental delays | 54 (14.0) | 10 (20.8) | 17 (13.2) | 27 (12.9) |
| Psychotic disorders | 66 (17.1) | 8 (16.7) | 23 (17.8) | 35 (16.7) |
| Eating disorders (e.g., anorexia, bulimia) | 23 (5.9) | 8 (16.7) | — | — |
| Severe behavioral disorder | 46 (11.9) | 7 (14.6) | 15 (11.6) | 24 (11.4) |
| Pervasive developmental disorders | 20 (5.2) | 6 (12.5) | — | — |
| HIV | 28 (7.2) | — | — | — |
| Burns | 15 (3.9) | — | — | — |

**Table 3.** Percent of Specific ICT Recommended by Familiar Users ($n$ = 48).

| Technologies | Users, *n* (%) |
|---|---|
| Personal factors | |
| To support communication | 47 (97.9) |
| Text to speech application for websites on computers, tablets, or smartphones | 17 (35) |
| Video calls through Internet | 16 (33) |
| Communication via social media | 14 (29) |
| Adapted smartphones | 10 (21) |
| Communication notebook on tablets or smartphones | 9 (19) |
| Telephone with voice control commands | 8 (17) |
| Telephone with pictures | 6 (13) |
| Visual dictionary (with images) on tablets or smartphones | 4 (8) |

*(continued)*

**Table 3. (continued)**

| Technologies | Users, *n* (%) |
|---|---|
| To support cognition | 38 (79.2) |
| Applications for cognitive stimulation, on tablets or smartphones | 23 (48) |
| "Calendar" application on tablets or smartphones | 22 (46) |
| "Reminders" application on tablets or smartphones | 22 (46) |
| Electronic timer | 18 (38) |
| "Timer" application on tablets or smartphones | 17 (35) |
| "Notes" application on tablets or smartphones | 15 (31) |
| "Picture" application on tablets or smartphones | 15 (31) |
| Automated voice recording memos | 14 (29) |
| Serious video games | 9 (19) |
| Digital photo frame | 4 (8) |
| To improve knowledge on health status | 31 (64.6) |
| Websites that enable clients to obtain information on their disease or condition (e.g., Stroke Engine, Alzheimer's Society) | 25 (52) |
| Applications/devices to track physical activity | 11 (23) |
| Discussion forum on the web | 10 (21) |
| Application/devices to record psychological symptoms | 5 (10) |
| Application/devices to record different physiological parameters | 4 (8) |
| Applications/devices to screen for biological parameters | 3 (6) |
| Websites enabling online intervention with automated assistance (nonhuman interaction) dedicated to clients | 3 (6) |
| Participation | |
| To facilitate transport | 31 (64.6) |
| Alternatives to restraints (e.g., sensitive pads, alarms, mats or bed strips with movement detectors—using interfaces) | 23 (48) |
| GPS localization application | 8 (17) |
| Monthly subscription to GPS tracking services linked to an online application | 4 (8) |
| Application to remotely pay for parking | 3 (6) |
| To improve performance in personal care or household activities | 30 (62.5) |
| Online grocery shopping services | 21 (44) |
| Timer for cooking (e.g., Safecook™) | 14 (29) |
| Recipe websites | 13 (27) |
| Application to create grocery lists on tablets or smartphones | 9 (19) |
| Programmable coffeemaker | 7 (15) |
| Iron with automatic shutoff feature | 7 (15) |
| Robot vacuum | 6 (13) |
| Budget planning/follow-up application on tablets or smartphones | 4 (8) |
| Sleep cycle monitoring application on tablets or smartphones | 4 (8) |
| Application providing diverse recipes and assisting with the planning and organization of meals, on tablets or smartphones | 3 (6) |
| To improve or facilitate hobbies | 29 (60.4) |
| Various games on computers, tablets or smartphones | 22 (46) |
| Simplified universal remote control | 11 (23) |
| To improve detection/prevention of falls | 27 (56.3) |
| Personal emergency response system involving the use of a pendant or bracelet (with monthly subscription to a central) | 23 (48) |
| Motion-activated nightlight | 12 (25) |
| Infrared motion detector or artificial vision to signal/detect falls, with monthly subscription to a central | 9 (19) |
| To improve or facilitate medication management | 25 (52.1) |
| Medication reminder application on tablets or smartphones | 21 (44) |
| Electronic pill dispenser | 15 (31) |
| Application to create medication lists on tablets or smartphones | 3 (6) |

*(continued)*

**Table 3. (continued)**

| Technologies | Users, *n* (%) |
|---|---|
| To improve general planning and management of daily activities | 11 (22.9) |
| Applications illustrating the different steps of a task, combining visual and verbal indications | 7 (15) |
| Applications, such as Logbook, to keep record of accomplished activities | 5 (10) |
| To prevent burns or water damage | 11 (22.9) |
| Water temperature with light indicators | 4 (8) |
| Automatic control system for hot water | 3 (6) |
| Water damage/flood detector with alarm signaling | 3 (6) |
| Environment | |
| Smart environments and telehealth | 25 (52.1) |
| Alarm device connected to a phone line, enabling individuals to get help in case of an emergency | 18 (38) |
| Control of household appliances and home settings by home automation | 9 (19) |
| Video surveillance systems | 6 (13) |
| Remote control of household appliances and home settings via tablet or smartphone application | 5 (10) |
| Telecare systems | 4 (8) |
| To facilitate the role of the caregiver | 22 (45.8) |
| Website with information specifically dedicated to the caregiver | 13 (27) |
| Devices to facilitate monitoring by the caregiver | 11 (23) |
| Videoconference with the caregiver | 4 (8) |
| Websites enabling online interventions with automated assistance (nonhuman interaction) dedicated to caregivers | 4 (8) |
| Discussion forums | 4 (8) |

*Note.* ICT = information and communication technology.

Finally, for ICT pertaining to the *environment*, the majority reported recommending smart environments and telehealth technology (52.1% [$n = 25$]). Only 45.8% ($n = 22$) reported using tools to facilitate the role of caregivers. The most commonly recommended smart environment technology consisted in an alarm connected to a phone line to enable individuals to get help in case of emergency and the most commonly recommended caregiver tool consisted in referral to websites specifically dedicated to caregivers.

## Facilitators and Barriers to ICT Recommendation

Among *users*, findings revealed that the *ease of operation* of ICT was the most common facilitator (70.8% [$n = 34$]). This was followed by *the availability* of ICT (i.e., that it can be easily acquired from the industry) and by *a reasonable purchasing, use, and maintenance cost*, tied at 60.4% ($n = 29$). Moreover, *the usefulness* of ICT with respect to the needs observed in practice and *past successful achievements* with it were two facilitators selected by more than 50% of respondents (56.3% [$n = 27$] and 52.1% [$n = 25$], respectively).

On the other hand, the most cited barrier among *users* was the *lack of knowledge and training* (62.5% [$n = 30$]). This was followed by *a high purchasing, use and maintenance cost for administrators in the workplace* and by *the complexity* of ICT (50% [$n = 24$] each). For *nonusers*, the *lack of availability* (71.1% [$n = 91$]) was the most reported barrier. This was followed by *the lack of knowledge and training* (56.6% [$n = 73$]) and the *high purchasing, use and maintenance cost for administrators in my workplace* (53.5% [$n = 69$]). Other reported barriers and facilitators are detailed in Table 4.

## Factors Predicting the Recommendation of ICT

The univariate logistic regression revealed that multiple factors were significantly associated with the recommendation of ICT in practice and help discriminate between *users* and *nonusers* (Table 5). Among the demographic variables, age and years of clinical experience were associated: the odds of recommending ICT in practice increased for older clinicians as opposed to younger ones (35–45 age group, odds ratio [OR]: 3.40; confidence interval [CI]: 1.38–9.01, and over 45 age group, OR: 5.23; CI: 2.16–13.81) as well as those with over 10 years of clinical experience in comparison to those with 10 years of experience or less (OR: 2.65; CI: 1.263–5.547). As part of the practice profile variables, concerning client services, offering vocational rehabilitation services was associated with an increased odd of recommendation (OR: 2.74; CI: 1.02–7.30) while providing orientation and assessment hospital services was associated with a decreased odd (OR: .28; CI: .08–.78). As for work environments, working in rehabilitation hospitals (or facilities) increased the odds of recommendation (OR: 2.30; CI: 1.07–4.87) while working in general hospitals decreased the odds (OR: .34; CI: .12–.81). Finally, treating client conditions related

**Table 4.** Facilitators and Barriers to ICT Recommendation in Clinical Practice Among Familiar OTs ($n = 177$).

| Factors | Users ($n = 48$) | Nonusers ($n = 129$) |
|---|---|---|
| Facilitators, *n* (%) | | |
| Ease of operation | 34 (70.8) | — |
| Availability (i.e., easily acquired from the industry) | 29 (60.4) | — |
| Reasonable purchasing, use, and maintenance costs | 29 (60.4) | — |
| Usefulness with respect to the needs observed in my practice | 27 (56.3) | — |
| Past successful achievements | 25 (52.1) | — |
| Reliability | 22 (45.8) | — |
| Accessibility in my practice (i.e., the possibility to acquire it via the department or supply system) | 21 (43.8) | — |
| Availability of necessary support (technical, administrative, financial) in my workplace | 14 (29.2) | — |
| Encouragement from my superiors (moral and financial support) | 9 (18.8) | — |
| Barriers, *n* (%) | | |
| Lack of knowledge and training | 30 (62.5) | 73 (56.6) |
| Complexity | 24 (50) | 42 (32.6) |
| High purchasing, use and maintenance costs for administrators in my workplace | 24 (50) | 69 (53.5) |
| Lack of relevant information in my workplace | 23 (47.9) | 46 (35.7) |
| Lack of availability | 22 (45.8) | 91 (71.1) |
| The need to change my current practice to integrate it | 22 (45.8) | 47 (36.4) |
| Lack of support (technical, administrative, financial) at my workplace | 16 (33.3) | 53 (41.4) |
| Lack of accessibility in my practice | 14 (29.2) | 45 (34.9) |
| Lack of usefulness in the context of my current practice | 11 (22.9) | 36 (27.9) |
| Lack of sufficient and necessary administrative support to undertake the new responsibilities | 11 (22.9) | 43 (33.3) |
| (learning how to use the new technologies) | | |
| Lack of reliability | 10 (20.8) | 13 (10.1) |
| The use increases the workload | 7 (14.6) | 18 (14.0) |
| Bad experiences | 6 (12.5) | 9 (7.0) |
| Their use generates greater responsibilities | 4 (8.3) | 11 (8.5) |

*Note.* ICT = information and communication technology.

**Table 5.** Factors Associated to the Recommendation of ICT in Clinical Practice ($n = 177$).

| | Univariate analysis | | Multivariate analysis | |
|---|---|---|---|---|
| Factors | Odds ratio (*p* value) | Confidence interval | Odds ratio (*p* value) | Confidence interval |
| Age group | | | | |
| 24–34 *(ref)* | | | | |
| 35–45 | 3.40 (.009) | 1.38–9.01 | | |
| Over 45 | 5.23 (<.001) | 2.16–13.81 | | |
| Years of clinical experience | | | | |
| 10 years or less *(ref)* | | | | |
| Over 10 years | 2.65 (.009) | 1.263–5.547 | 2.43 (.021) | – |
| Client services | | | | |
| Assessment or orientation (hospital services) | 0.28 (.026) | 0.08–0.78 | | |
| Vocational rehabilitation | 2.74 (.041) | 1.02–7.30 | | |
| Client conditions | | | | |
| Dementia and related syndromes | 0.035 (.007) | 0.16–0.76 | 0.415 (.027) | 0.191–0.904 |
| Swallowing | 6.25 (.004) | 1.86–24.44 | — | — |
| Work environments | | | | |
| General hospital | 0.34 (.024) | 0.12–0.81 | 0.378 (.047) | 0.145–0.989 |
| Rehabilitation hospital or facility | 2.30 (.029) | 1.07–4.87 | — | — |

*Note.* ICT = information and communication technology.

to eating disorders (swallowing) were significantly associated with an increased odd of recommendation (OR: 6.25; CI: 1.86–24.44) while treating dementia and related syndromes had decreased odds (OR: .035; CI: .16–.76). No associations were found between areas of practice and ICT recommendation.

Given the multicollinearity between the variables of age and years of clinical experience, we chose to include the number of years of clinical experience in the multivariate logistic regression as it was believed to be more representative for ICT recommendation in practice. The regression with forward variable selection analysis (Table 5) revealed that the variables of years of clinical experience, addressing client conditions of dementia and related syndromes and working in a general hospital work environment remained statistically significant when modelled to explore which of the independently associated variables remained associated to the outcome of interest, that is, the recommendation of ICT. In this model, the odds of recommending ICT in clinical practice increased with more years of clinical experience (OR: 2.43; CI: 1.14–5.21) and decreased when addressing client conditions with dementia (OR: .415; CI: .191–.904) or working in general hospitals (OR: .378; CI: .145–.989). This model explained 13.7% (Nagelkerke $R^2$) of the variance in ICT recommendation and correctly classified 75.1% of the cases. Client services, other client conditions, and other work environments were no longer statistically significant.

## Discussion

The purpose of this study was to gain insight into current Canadian OTs' practices with respect to recommendation of ICTs as part of delivery of services with older adults. The results highlight that ICT for older adults is not well integrated in OT practice. This is reportedly due to a lack of availability of ICT and a lack in knowledge and training. This was investigated in eight provinces and one territory. The following sections discuss the knowledge, and recommendation, of ICT in practice; the barriers to ICT recommendation in practice; and, the factors which influence ICT recommendation in practice.

### *Knowledge and Recommendation of ICT*

Half of surveyed clinicians reported being unfamiliar with ICT supporting OT practices with older adults. This lack of knowledge is intriguing given that OTs play an active and primary role in promoting well-being and improving the QoL of their clients by adapting, educating, and informing them of the best devices available to maintain participation in their daily activities. Moreover, only 12.4% reported recommending them in practice. This highlights an important gap in OTs' knowledge and practices with ICT. Currently, we do not know how the topic of ICT as an adjunct tool is integrated in the Canadian OT university curriculum. Further research is needed to explore whether it includes research regarding new potential technological tools supporting and enhancing the opportunities associated with aging.

Nevertheless, the results show that OTs recommend a range of ICTs. ICTs pertaining to *personal factors* were the most recommended, with those to improve communication, followed by those to improve cognition and, finally, those to improve performance in personal care or household activities. This practice is consistent with results of studies that showed usability and acceptability of ICTs by older adults with MCI or dementia (Holthe et al., 2018) and representative of the daily activity needs that may be addressed in a clientele presenting MCI (Jekel et al., 2015)—the most commonly reported clientele condition of *users*.

Moreover, less than half of the *users* reported recommending tools to facilitate the role of caregivers. Addressing caregivers needs to support their loved ones requires further exploration in OT practice considering, on one hand, the physical and psychological toll that they experience in their role, further reflected through the fact that they are willing to pay for technologies supporting caregiving (Schulz et al., 2016), and, on the other hand, their key influence on technology acceptance and adoption by the loved ones facing a decline (Peek et al., 2017).

### *Barriers to the Recommendation of ICT*

Research in the adoption of ICTs by health professional substantiates that issues exist in practice with respect to lack of trust in technology or technical skills, high costs, and difficulty of its use (Kapadia et al., 2015). In the present study, similar barriers were reported by *users* and *nonusers*. However, interestingly, the main barrier differed between *users* and *nonusers*: whereas u*sers* reported their lack of knowledge and training as the main barrier, *nonusers* reported primarily a lack of availability of said technology. This highlights that familiarity with ICT is not sufficient for their recommendation in practice: it is also important to know *how* ICTs can be used. Indeed, the ease of operation was the most reported facilitator to technology recommendation by *users*. On the other hand, it also leads to question at which level the *availability of said technology* limits *nonusers*: is it that they are not aware of where ICTs can be obtained, that the technology itself is limited in quantity, or perhaps they are knowledgeable in ICTs but not up-to-date with the array of technological devices at their disposition?

In addition, a lack of its usefulness in their current practice was identified. Thus, other potential explanations could be that ageism remains in practice at the personal, professional, and organizational level (Klein & Liu, 2010, e.g., that older adults are less interested in ICT or cannot learn how to use it) or that ICTs are simply not relevant to their clientele (e.g., for a person with a condition that is expected to deteriorate quickly). Therefore, considering the above-mentioned barriers, the low rate of recommendation could arise because

clinicians may simply not give thought to options of ICT in their day-to-day practice.

On the other hand, while they might consider ICT options, they may face limitations at organizational level. In fact, the clinical setting can limit the opportunities of the clinician in their recommendation of ICT. In the study, this is reflected by over 30% of respondents identifying a lack of relevant information in their workplace, as well as sufficient and necessary technical, financial, and administrative support to assume their responsibilities associated with ICT. Similarly, personal barriers may play a limiting factor: a little over a third identified that ICT integration would require changes in their practice and, although identified by less than 15%, they reported having had bad experiences with technology as well as ICT generating more responsibilities and increasing their workload. These factors are consistent with those of other studies looking at OTs' practice with eHealth technologies (Nobakht et al., 2017). Thus, as expected, the recommendation of technology in practice is multifactorial and goes beyond the clinician themselves. All considered, building on current practice initiatives (e.g., CAOT, 2016, *Practice Network: Technology for Occupation and Participation*), it is important to foster awareness and to provide more knowledge and support to clinicians, as well as administrators. This may help overcome the organizational and personal barriers faced. Further research is needed to gather more in-depth understanding of the various layered barriers so as to pinpoint the right methods to overcome under-recommendation of ICT.

### *Factors Predicting the Recommendation of ICT*

In the univariate analysis, having more years of clinical experience and being older increased the odds of ICT recommendation in practice. This suggests that recommendation of technology might be learned in practice and acquired through time, especially given that higher education was not associated with increased odds. Gray and Sim (2011) elaborated on how Australia early-career health professionals (i.e., a psychologist, a medical scientist, a radiographer, and a physiotherapist) may have to rely on gaining their knowledge about clinical ICT through ad hoc, unstructured, learning from colleagues, and while on-the-job, because the curriculum had not appropriately equipped them to use technology in their workplace as health professionals. Given that only 27% of OTs familiar with ICTs report recommending them in practice bears the question of whether the Canadian school curriculum provides students with the necessary tools and knowledge about *which* and *how* technologies could be employed in practice. As previously mentioned, it is not known how content on ICTs has been integrated in the Canadian OT curricula. While there has been research on technology education trends of the United States OT curricula (Kanny & Anson, 1998) and student technology skills in Australia (Hills et al., 2016), there is a need to further explore whether Canadian OT programs' content reflect new research and determine the aptitudes of Canadian graduates to ensure that they have the necessary skills and confidence in providing ICT to their clientele. This could work as a step toward addressing the main barrier to ICT recommendation of *users* (being *a lack of knowledge and training*) as well as improving the general knowledge about ICTs in OT practice.

Results showed that OTs working with clients that have dementia or related syndromes were less prone to recommend ICT in practice, although these individuals and their caregivers might benefit from its use (Bier et al., 2018; Gitlin et al., 2010). It is wondered if this emerges from a belief that older adults with dementia and their caregivers cannot benefit from ICT or if it is that most OTs are not aware of the technologies suitable for this clientele. It is important to note that there is little to no funding available for cognitive assistive technology devices across Canada (Schreiber et al., 2017). For instance, the *Programme ministériel des aides techniques à la communication*, a program that provides technical aids in Quebec, does not include coverage of technical aids for people with Alzheimer's disease. This lack of access to funding could also be a factor influencing this result, as OTs might favor free or more affordable alternatives for their clients (e.g., using pen and paper reminders versus a digital assistant). Finally, working in rehabilitation hospitals (or facilities) also increased the likelihood of recommending technology in practice whereas working in general hospitals and providing assessment/orientation services in hospitals was associated with a decrease. This is consistent with the realities of the profession and inherent nature of the work environment: clients seen in general hospitals are quickly assessed whereas rehabilitation settings leave more room for technology use as they are environments where OTs can spend time with clients and where rehabilitative interventions are emphasized and devised. Finally, although the multivariate logistic regression exploration classified appropriately 75.1% of the cases, it only explains 13.7% of the variance in ICT recommendation in practice. Thus, more work toward a better understanding of the factors involved in ICT recommendation by clinicians is required.

## Limitations

The results of the survey have limitations. While the demographic and practice profile characteristics are representative of the average Canadian OT, given the overrepresentation from the provinces of Quebec and British Columbia, generalizability should be made with caution. Moreover, the survey was self-reported and those who volunteered may have had an interest in the topic, consequently being different from nonrespondents. Considering the limits of recall bias in a crosssectional design, it is possible that respondents may have over- or under-represented their recommendation of ICT. In addition, as there is no consensus definition of ICTs or established categorisation, it is possible that some OTs did

not understand the definition as provided in the survey, also leading to an underrepresentation of recommendation practice. Equally, some technologies might not have been selected if the OT was not familiar with the terminology used (e.g., serious video games). As such, a different survey organization and presentation of the tools could yield different results. Similarly, as the list of chosen ICTs included in the survey did not follow a systematic review of the literature, the list could be limited and a different list generated from a different review process could yield different results. Finally, due to the different organizations' regulation for clinician recruitment, there may have been discrepancies across provinces in the exposure to the survey invitation.

## Conclusion

This project is the first to provide insight on the current state of ICT recommendation among Canadian OTs working with older adults. It is important to note that while ICTs offer many new and exciting opportunities, they should be recommended according to the needs and preferences of the client. Indeed, despite advances in technology, nontechnological solutions and interventions may be better fit to address certain difficulties. Nevertheless, considering the opportunities that technology may offer to improve participation in daily life, it is important to understand current OT practices in this area. The results suggest a need to develop tools or educational programs to inform clinicians about the available technologies, their potential benefits to clients, and *how* to use them in practice. Occupational therapy programs must train OTs to analyze ICT according to occupational principles. Familiarity with ICT alone is not sufficient to drive its use in practice and there is a need to bridge the gap between the current growth of technological devices and the provision of recommendations for the homecare of seniors. On one hand, future research steps should be taken to address how to define and present the concept of ICTs to clinicians to ensure understanding and replicability of studies. On the other hand, future research work is needed to gain a deeper understanding of the situation, elucidate reasons behind OTs' attitudes toward ICT recommendation with older adults, and address the different barriers they face in practice.

### Authors' Note

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### Supplemental Material

Supplemental material for this article is available online.

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