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COMPASS-CP: An Electronic Application to Capture Patient-Reported Outcomes to Develop Actionable Stroke and Transient Ischemic Attack Care Plans

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Abstract

Background: Patient-reported outcomes (PROs) are clinical tools that measure patients' goals of care and assess patient-reported physical, mental, and social wellbeing. Despite their value in advancing patient-centered care, routine use of PROs in stroke management has lagged. As part of the pragmatic COMprehensive Post-Acute Stroke Services (COMPASS) trial, we developed COMPASS-CP, a clinician-facing application that captures and analyzes PROs for stroke and

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TIA patients discharged home and immediately generates individualized electronic care plans (CP). In this report, we: 1) present our methods for developing and implementing COMPASS-CP PROs, 2) provide examples of care plans generated from COMPASS-CP, 3) describe key functional, social, and behavioral determinants of health captured by COMPASS-CP, and 4) report on clinician experience with using COMPASS-CP in routine clinical practice for care planning and engagement of stroke and TIA patients discharged home.

Methods and Results: We report on the first 871 patients enrolled in 20 North Carolina hospitals randomized to the intervention arm of COMPASS between July 2016 and February 2018; these patients completed a COMPASS follow-up visit within 14 days of hospital discharge. We also report user satisfaction results from 56 clinicians who used COMPASS-CP during these visits. COMPASS-CP identified more cognitive and depression deficits than physical deficits. Within 14 days post-hospitalization, less than half of patients could list the major risk factors for stroke, 36% did not recognize blood pressure as a stroke risk factor, and 19% of patients were non-adherent with prescribed medications. Three-fourths of clinicians reported that COMPASS-CP identifies important factors impacting patients' recovery that they otherwise may have missed, and two-thirds were highly satisfied with COMPASS-CP.

Conclusions: The COMPASS-CP application meets an immediate need to incorporate PROs into the clinical workflow to develop patient-centered care plans for stroke patients and has high user satisfaction.

Keywords

stroke; transient ischemic attack; patient-reported outcomes; post-acute care; transitional care; care plan; Cerebrovascular Disease/Stroke; Transient Ischemic Attack (TIA); Quality and Outcomes; Health Services

INTRODUCTION

Patient-reported outcomes (PROs) systematically assess patient-reported physical, mental, and social wellbeing.[1,2] Defined as "any report of the status of a patient's health condition that comes directly from the patient, without interpretation of the patient's response by a clinician or anyone else,"[2] PROs are captured by asking patients questions about symptoms, physical, cognitive, and social function, and quality of life.[3] They provide clinicians with valuable information about the patient's health literacy, goals of care, satisfaction with care, and adherence to prescribed medication or therapy.[4,5]

Capturing the voice of the patient through PROs and immediately incorporating this information into individualized care planning is critical to advancing patient-centered care. The Centers for Medicare and Medicaid Services (CMS) emphasizes that a key goal of care management is to incorporate patients' goals of care and social and functional factors that influence their ability to self-manage for recovery, health, and independence.[6] The Medicare Merit-based Incentive Payment System (MIPS) reimbursement model emphasizes the importance of the routine collection of PROs and individualized care planning in the provision of value-based care.[7] In addition, the American Heart Association (AHA) emphasizes the role of social and functional determinants of health in cardiovascular outcomes and the importance of measuring and incorporating these factors into risk factor management and treatment plans.[6,8–10]

Nonetheless, clinicians' use of PROs to inform routine clinical decision-making and care planning has been slow.[11–13] Indeed, fewer than one in five hospitals routinely use PROs in the healthcare decision-making process.[14] Providers and staff are often resistant to incorporate PROs into the clinical workflow, given their already limited time, staff, and financial resources.[15] Although incorporating PROs into routine clinical practice does not lengthen patient visit times appreciably,[16,17] achieving buy-in from healthcare providers remains challenging.[18] PROs that are not perceived as relevant, meaningful or interpretable by clinicians or researchers will not be endorsed and implemented.[19] Furthermore, even when PROs are collected, translating those results into actionable clinical decision-making can be challenging.[20] Incorporating PROs into clinical care requires real-time analysis and scoring of data, and guidance in interpreting and communicating them.[11] To date, few applications support this real-time analysis, scoring, and interpretation,[12] and effective incorporation of PROs into electronic health records (EHR) has been slow to progress.[13] Despite commercially-available EHR platforms and a call for increased incorporation of PROs in EHR, embedded PROs have been limited to multiple static forms or simple branching questionnaires that are burdensome to both the patient and the clinician.[21] Further, responses cannot be immediately analyzed and used to inform care. In addition, the incompatibility of EHR and information technology (IT) systems among providers hampers sharing of PROs and care plans across the continuum of care.[14,22] Finally, providers, systems, and payers cite strong concerns over the IT costs needed to incorporate PROs into clinical care.[21] Thus, an application for real-time utilization of PROs that overcomes these numerous challenges could have a profound positive influence on authentic shared decision-making and individualized care planning.

A team of patients, caregivers, multidisciplinary clinicians, and clinical researchers of the COMprehensive Post-Acute Stroke Services (COMPASS) study developed COMPASS-CP,[23] an electronic care plan generating application that captures multiple factors including social, behavioral, and functional determinants of recovery, health, and independence through PROs (Figure 1).[23,24] COMPASS-CP is designed to be administered by a clinician in a clinical or home setting. It also assesses caregiver abilities and resources critical for patients during the post-stroke care period. COMPASS-CP can be used as a web-based or iPad application. Its questionnaires are simple to administer but are designed to yield a comprehensive overview of factors that can impair a patient's ability to manage his or her health and recovery.

The unique algorithms in COMPASS-CP generate a personalized care plan in real-time clinical practice, immediately identifying, prioritizing, and recommending interventions or support services that could benefit the patient. This information drives recommendations and coordination of appropriate medical, rehabilitation, or community resources to improve the patient's function, independence, and quality of life. Personalized care plans are available to patients, caregivers, and all care providers.

The COMPASS-CP prototype was developed as part of a Patient-Centered Outcomes Research Institute (PCORI) pragmatic trial of the COMPASS care model. [23,24] The COMPASS-CP application is specific for stroke, a condition which requires early supported discharge and coordinated post-acute care management.[25,26] The onset of stroke is sudden, and survivors and their caregivers are frequently ill-prepared.[27–29] Functional limitations after mild stroke or transient ischemic attack (TIA) are frequently not fully recognized until patients return home and try to resume their daily lives,[30–32] making self-management of health and full recovery more difficult.[1,23,33] We posit that post-discharge care management that identifies and addresses social and functional deficits and contexts of recovery may improve stroke knowledge, secondary risk factor management, and quality of life, and reduce the likelihood of severe stroke complications.[34]

Here we present our methods to capture PROs among COMPASS participants and methods for administering PRO questionnaires, capturing responses electronically, and analyzing data in real-time to inform individualized care. We also provide examples of care plans generated from COMPASS-CP. We then describe key social and functional determinants of health, knowledge of cardiovascular risk factor management, medication management, access to care, and caregiver health and needs among those enrolled to date in the intervention arm of COMPASS (n=871). Finally, we report clinicians’ experience with using COMPASS-CP in routine clinical practice for care planning and engagement of stroke and TIA patients discharged home.

METHODS

COMPASS Study

COMPASS-CP is an integral part of the COMPASS model, which is being evaluated in the COMPASS pragmatic trial, the methods and design of which have been published.[23,24] The COMPASS study was approved by the Wake Forest University Health Sciences institutional review board (IRB), which acts as a central IRB for 36 participating hospitals. Local IRB approval was granted by 5 additional sites. Informed consent is obtained on the 90-day outcomes data collection call for all patients and at the clinic visit for patients at intervention hospitals.[35]

At the conclusion of COMPASS trial and after analysis by the study team, the data, analytic methods, and study materials will be made available to other researchers for purposes of reproducing results or replicating procedures, upon reasonable request to the corresponding author and in accordance with PCORI’s Policy for Data Access and Data Sharing.[36]

COMPASS-CP PROs and Care Plans

It is not feasible, in the confines of a single clinic visit, to utilize currently available standardized assessment measures to capture all domains expected by CMS for transitional care, chronic care management, and the annual wellness visit (Figure 2).[37–40] Therefore, we developed questions that capture information within the CMS-recommended domains and other highly relevant factors (e.g., cognitive function, health literacy, medication management and adherence, cardiovascular risk factor management, knowledge of stroke warning signs) (Figure 1) that are feasible to query within the time constraints of a clinic visit.

The multidisciplinary COMPASS team—including neurologists, primary care physicians, advanced practice providers, nurses, pharmacists, therapists, social workers, Area Agency on Aging staff, and patient and caregiver stakeholders—selected candidate questions by reviewing the Institute of Medicine's recommendations for social and functional factors to be included in EHR; [41] CMS's recommended factors for assessments for transitional care, chronic care, and the annual wellness visit (Figure 2);[37–40] and comprehensive care management indicators specified by the Medicare Access and CHIP Reauthorization Act.[8,39]

We vetted candidate questions with patients, caregivers, and clinicians from Wake Forest Baptist Health (WFBH) clinical stroke team's transitional care clinic, where COMPASS-CP was integrated into the clinical workflow. This process included a focus group with three patients and two caregivers, followed by an in-person meeting with an expert in health literacy and health disparities to ensure questions are accessible and culturally sensitive. From there, in an iterative process, two advanced practice providers and a nurse coordinator provided continuous feedback based on their experiences implementing COMPASS-CP at the WFBH clinic until questionnaires could be administered efficiently and care plans could be generated and communicated effectively. Additionally, we asked our home health partners to review and provide feedback on questions to capture medication management, cardiovascular risk factor knowledge, symptom management, and access to primary care and rehabilitation services. (Figure 1) We also developed an assessment of caregiver health, stress, and needs that might impact a caregiver's ability to support the patient, which is triggered if the patient reports requiring assistance with managing medications, preparing meals, doing housework, bathing, or dressing. Factors considered were those deemed most likely to impact stroke patients' and caregivers' ability to manage and optimize patients' recovery, health, and independence. Next, we evaluated the questions for comprehension, literacy levels, and time to administer. Final questionnaires are provided in Supplement 1.

We then developed a web-based application that included the script, questions, validation rules and skip patterns to capture PROs with minimal burden for patients, caregivers, and clinicians. COMPASS staff administer web-based PRO questionnaires to the patient or proxy at two time points: over the phone by a nurse 2 days after hospital discharge, and in person by a nurse during a clinic visit 7 to 14 days post-discharge. Questionnaires were administered in English. For Spanish-speaking participants, interpreters assisted in administering questionnaires. The 2-day call takes approximately 10–15 minutes to complete, although it can take longer (30–45 minutes) for higher acuity stroke patients. Questionnaires at the clinic visit, on average, take less than 15 minutes to complete. The entire visit, including care plan coaching, can be completed within 60 minutes. Data are collected electronically via iPad or computer. Clinicians complete a 60-minute tutorial on COMPASS-CP and access to a web-based training demonstration before the tool is implemented at each trial site.

Embedded algorithms within COMPASS-CP integrate and assess electronic data and immediately generate actionable, individualized care plans. Figure 3 provides examples of the algorithms used for patients for whom falls and financial assistance needed to purchase medications were identified as important concerns. In addition, care plans are linked to a stroke-specific Community Resources Directory (CRD), systematically created for all counties served by COMPASS hospitals, and embedded in the COMPASS-CP algorithm. The CRD provides information on local resources that are available to meet a patient's specific social, economic, behavioral, or environmental needs as identified by COMPASS-CP. These services and supports include home and community-based services, such as disease-specific support groups, caregiver support groups, adult day care, transportation, home delivered meals, and behavioral health services, and include evidence-based health and wellness programs such as chronic disease self-management and diabetes self-management education services. To populate the CRD, clinicians and community-based service providers at each hospital help to identify resources within the communities they serve, with special attention given to resources that provide services to those under age 60, the uninsured with no ability to pay, patients living in rural areas, patients with cognitive deficits, and those with limited access to transportation.

The COMPASS-CP algorithms evaluate the data captured in questionnaires and identify factors likely to influence recovery, health, and independence of the stroke survivor across each dimension of care (Figure 1) and needed referrals for community-based resources. These are used to generate the patient-facing COMPASS care plan, entitled “Finding My Way Forward for Recovery, Health, and Independence.” Care plans provide education, recommendations, and referrals across essential domains of self-management and care, anchored to the four cardinal directions of a compass:[23]

Numbers: Know your blood pressure, hemoglobin A1C, cholesterol etc.

Engage: Be active in mind, body and spirit through physical, cognitive, and social activity.

Support: Seek support for your and/or family stress, finances for medications, and transportation.

Willingness: Be willing to manage your medications and lifestyle.

COMPASS staff incorporate input and priorities from the patient and caregiver to create an individualized electronic care plan. The COMPASS nurse then shares the care plan with the patient and/or caregiver at the end of the 7–14 day clinic visit. Care plans are made available to the patient's primary care physician (PCP) and post-acute care providers and uploaded into their respective EHRs in PDF form Supplement 2 provides an example of a care plan generated by COMPASS-CP.

PROs, care plans, and provider reports that list domains of concern are generated from the COMPASS-CP dashboard as shown in Supplement 3 and the processes are integrated into the clinical workflow as depicted in Supplement 4. A diagram of the COMPASS-CP architecture is included as Supplement 5.

Clinician User Experience

After launching the COMPASS Care model among hospitals in the intervention arm, we surveyed 56 clinicians from 19 of the 20 hospitals using COMPASS-CP to assess their satisfaction with the application in: (1) efficiency in Care Plan development, (2) identifying factors impacting patient self-management and caregiver needs, (3) patient/provider communication, (4) patient/caregiver engagement, and (5) patient satisfaction with care. Clinicians rated their satisfaction in each domain on a 5-point Likert scale (Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, or Strongly Disagree). Surveys identified the type of clinician completing the questionnaire (nurse, nurse practitioner (NP), or physician assistant (PA)), the setting in which COMPASS-CP was used (neurology clinic, PCP office, or other), and how long the clinician has been using COMPASS-CP (less than 1 month, 1–2 months, 3–5 months, or 6 months or longer).

Statistical Analyses

We used SAS version 9.4 to analyze responses from all assessments. (SAS Institute, Cary, NC). We summarized data descriptively as frequencies (percentages) and means (standard deviations), as appropriate.

RESULTS

Patient Characteristics

Between July 2016 and February 2018, 871 patients were enrolled in the COMPASS intervention arm and returned within 14 days of their stroke or TIA for transitional care clinic follow-up visits. Patient characteristics are shown in Table 1. Half (50.0%) of patients with documented National Institute of Health Stroke Scale (NIHSS) scores had scores of less than 2. Data from the 7–14 day follow-up clinic visit revealed a continued presence of stroke risk factors.

Using COMPASS-CP to electronically capture PROs via nurse interview produced a complete set of data for each patient. Table 2 summarizes the factors identified by COMPASS-CP nurse-led interviews that could limit recovery, health, and independence. At the 7–14 day clinic visit, none of the 871 patients could list all seven key stroke risk factors (high blood pressure, smoking, diabetes, atrial fibrillation, heart disease, high cholesterol, and physical inactivity), and 70.5% did not receive a home health referral. Of those who did not receive a home health referral, 77.2 % were also not referred to outpatient therapy at hospital discharge.

In addition to physical concerns, COMPASS-CP identified a third of patients with possible depression using the PHQ-2 screening tool,[23] patient stress, limited social support, and lack of follow-up with a primary care physician. Other issues identified included low medication adherence and/or financial challenges to medication management, polypharmacy (≥5 medications per day), and uncertainty about the purpose of prescribed medications. Nearly 40% of participants showed signs of cognitive dysfunction.

For over a third of caregivers, COMPASS-CP triggered the nurse to complete a caregiver assessment. Of these, over a third reported health issues that could interfere with caregiving (Table 2).

In the clinical evaluation portion of the clinic visit, COMPASS-CP captured lifestyle management factors and other variables impacting patients' ability to manage their health (Table 3). COMPASS-CP identified nearly half of patients with low physical activity, almost a fifth with post-stroke communication deficits requiring speech therapy, and 6.0% without an able or willing caregiver.

Clinician User Experience and Satisfaction

We invited all COMPASS staff at the 20 intervention hospitals who were involved in the 7–14 day follow-up visit to participate in a survey querying their experience and satisfaction with using COMPASS-CP. We received survey responses from 44 of 59 clinicians (79%), representing 19 of 20 hospital units randomized to the intervention arm (95%).The follow-up visits were conducted in a range of settings: 9 in a neurology clinic, 1 in a cardiology clinic and the others in hospital based transitional care clinics or in primary care offices. Thirty-nine responders (89%) had used COMPASS-CP for 3 months or more. Of the 44 respondents, 27 were nurses, 11 were NPs, 5 were PAs, and 1 was a paramedic.

Approximately two-thirds of responding clinicians agreed that COMPASS-CP was an easier way to generate a care plan for patients than their usual methods and that the tool improved patient engagement in managing his/her recovery (Table 4). Three quarters reported that COMPASS-CP identified important patient needs that they otherwise would have missed, and that the caregiver assessment added value to the care plan. Over half reported that COMPASS-CP improved their communication with patients and caregivers, and nearly half felt that COMPASS-CP improved overall patient satisfaction with care.

DISCUSSION

Through COMPASS-CP, we have provided a pragmatic means to systematically assess the multiple factors that influence recovery, health, and independence of post-acute stroke and TIA survivors.[5] Further, COMPASS-CP makes these data immediately actionable by using this information to generate individualized electronic care plans at the point of clinical care. There are numerous challenges to implementing PROs into clinical practice,[11–13,20] and, to date, few practical solutions to the problem of how to seamlessly achieve the routine collection, electronic integration, application, and communication of PRO data in chronic disease care management.[42–45] COMPASS-CP is a feasible tool for overcoming barriers to the efficient and effective implementation of the CMS requirements for care plans, including: (1) improving capture of patient-reported social and functional determinants of health, (2) promoting data-driven decision-making, (3) providing a user-friendly tool to generate a comprehensive care plan at the point of care, (4) creating a care plan that is interpretable and directly actionable, and (5) providing a care plan shared with patients, caregivers, and providers across the continuum of care, regardless of the interoperability of health informatics systems.

COMPASS-CP expands the domains of health beyond those captured with PROMIS, the Neuro-QOL, or instruments recommended by the international consensus panel on stroke outcomes.[46,47] COMPASS participants who returned for a transitional care visit report significant challenges and residual deficits within 14 days of stroke. The COMPASS-CP application made this information available, understandable, and immediately actionable through the generation of electronic care plans and a list of relevant local community-based resources so the clinician can help patients and caregivers identify and access needed services. Our results demonstrate that integrating PROs into a web-based application is feasible in the stroke clinical workflow and that provider satisfaction is high. An unsolicited comment from a clinician underscores the value that COMPASS-CP can bring:

> “We initiated [COMPASS-CP] today. What a difference it made, we significantly reduced our time from check in to check out. You can’t imagine what a sense of accomplishment that was…. [The patient’s] anxiety was reduced and she trusted our plan of care.”

This study has several limitations. Our study includes only patients whose first language is English or Spanish. For patients that are Spanish-speaking only, an interpreter assists the clinician in administering the questionnaires. In the future, we plan to translate questionnaires into Spanish and other languages. Although all staff members at COMPASS sites were invited to participate in the survey, and 79% did so, a potential limitation of all survey research is volunteer bias, which could impact generalizability. The purpose of this manuscript is not to describe deficits in all stroke/TIA patients discharged home; rather, it is to document that COMPASS-CP processes and methods can successfully document significant residual deficits in those who returned for a clinic visit 7 to 14 days after hospital discharge.

Future Directions

In its current form, COMPASS-CP is an application built on a research platform that is not yet fully integrated into EHRs. Its future scalability and sustainability will require full integration into the EHR. We have selected Substitutable Medical Applications and Reusable Technologies Fast Health Interoperability Resources (SMART on FHIR®) as the architecture for the development of an EHR-integrated application,[48] and we are collaborating with health IT vendors to validate the application within their systems. This (SMART on FHIR®) application will ensure that that COMPASS-CP is available to stroke centers of excellence. Further, although the COMPASS-CP application is tailored to meet the complex needs of stroke and TIA patients discharged home, it may be a valuable template for stroke patients discharged to other locations, and those with other complex chronic conditions who require early supported discharge planning and coordination of post-acute services.[24]

Enrollment in COMPASS ends in spring 2018.[23] Thereafter, we will determine if individuals who receive the COMPASS care model and an individualized care plan have improved functional status, the COMPASS study’s primary outcome. We also will compare medication and blood pressure management, reduced readmissions, and improved patient satisfaction among those who were and were not randomized to the COMPASS intervention.[23]

Conclusions

The COMPASS-CP application supports implementation of CMS's new value-based payment models and meets an immediate need to incorporate PROs in clinical practice, develop patient-centered care plans, and assist patients and caregivers in accessing needed services. Our analyses of the factors identified in a cohort of mild stroke and TIA patients reveal that patients and caregivers have numerous challenges that hamper patient recovery, health, and independence. Evaluation of the implementation and user satisfaction of COMPASS-CP suggests that PRO-informed care plans are a viable solution to identify and address factors that can limit stroke survivors' self-management of recovery, health, and independence. Our continued development of the (SMART on FHIR®) application will be the next step to test whether COMPASS-CP is scalable beyond the COMPASS research study.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Disclosures

Drs. Duncan, Bushnell and D'Agostino and Mr. Rushing are co-founders of CareDirections. Other authors report no conflicts.

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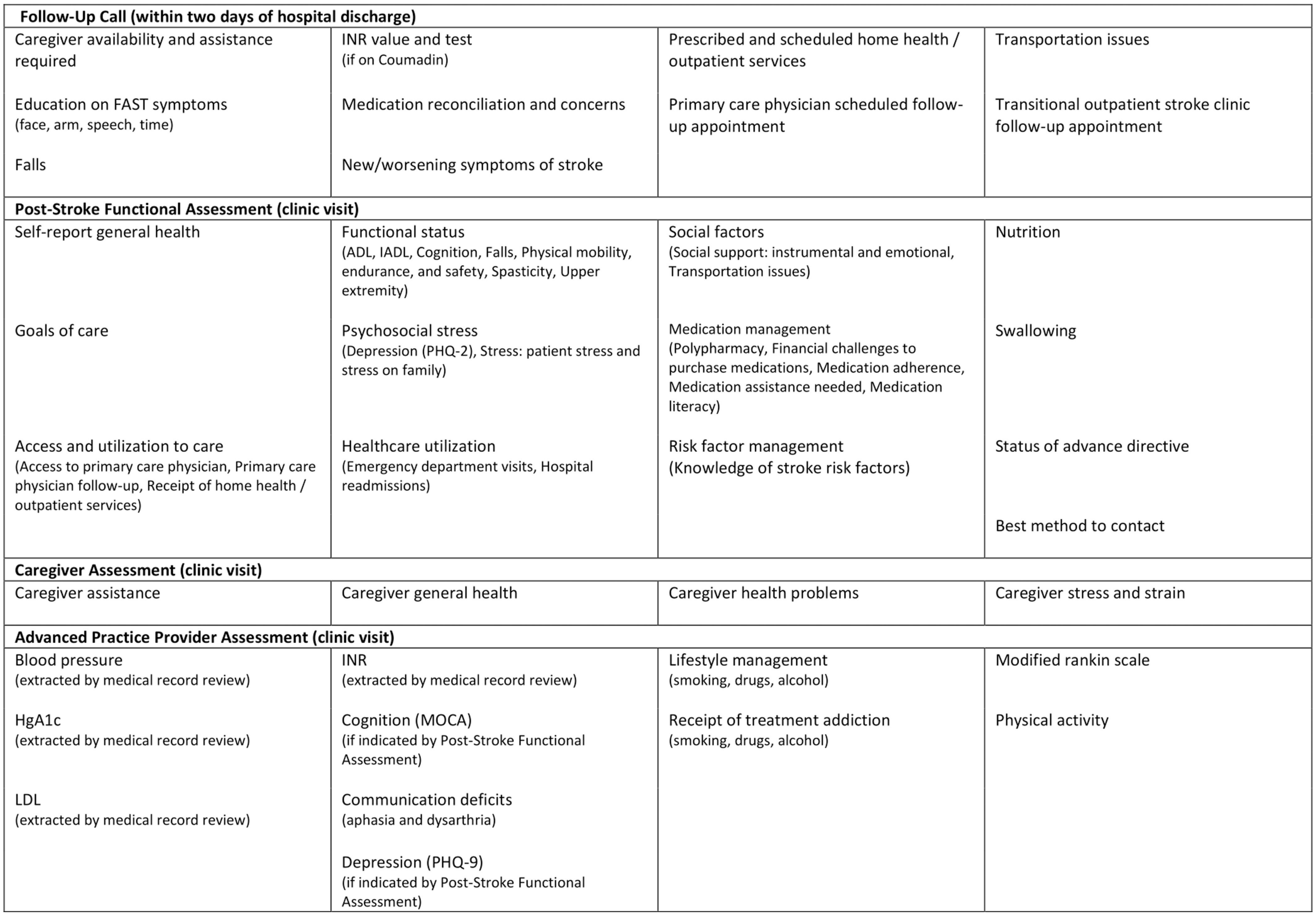
What is Known

- Capturing the voice of the patient through patient-reported outcomes (PROs) and immediately incorporating this information into individualized care planning is critical to advancing patient-centered care.
- Despite their value in advancing patient-centered care, PROs are still not routinely used stroke management in the US.

What the Study Adds

- COMPASS-CP, a clinician-facing application that captures and analyzes PROs in real time, meets an immediate need to incorporate PROs in clinical practice, develop patient-centered care plans, and assist patients and caregivers in accessing needed services.
- Integrating PROs into a web-based application is feasible in the stroke clinical workflow, and provider satisfaction with using COMPASS-CP is high.
- PRO-informed care plans are a viable solution to identify and address factors that can limit stroke survivors' self-management of recovery, health, and independence.

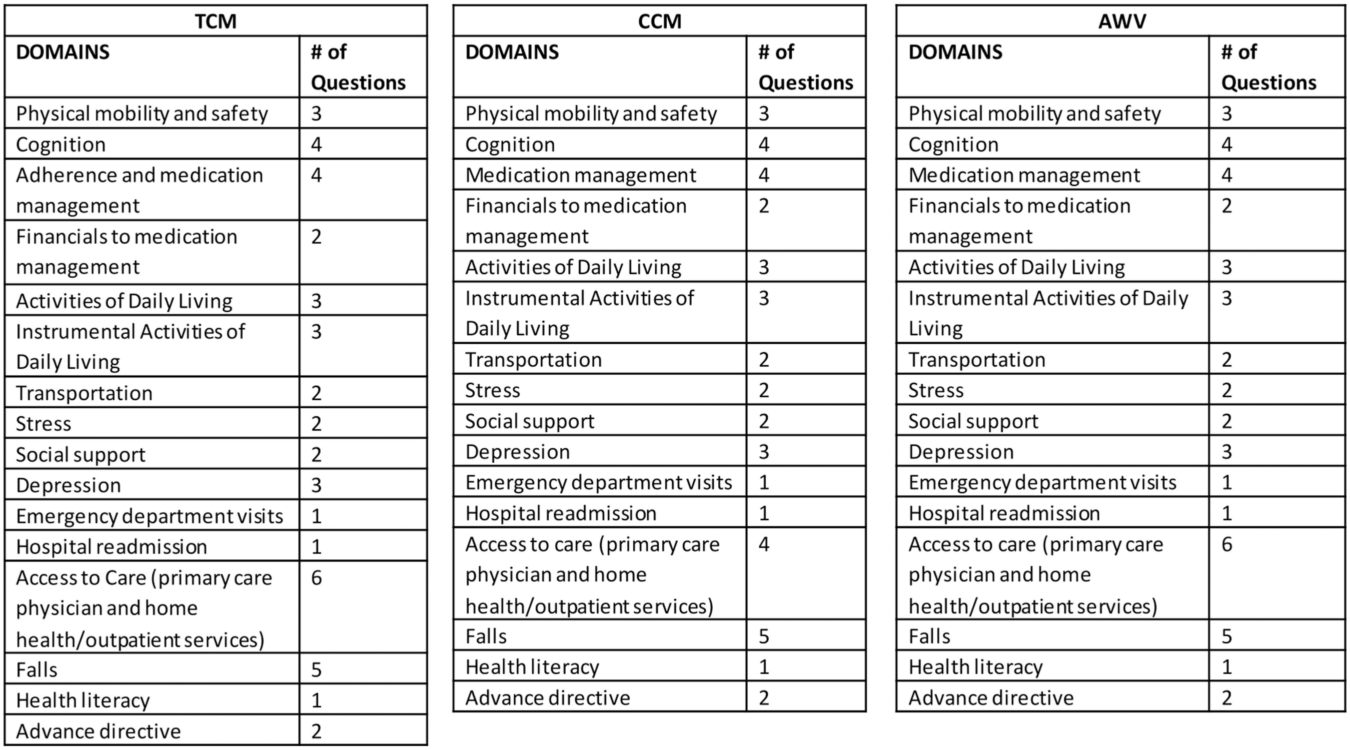


Follow-Up Call (within two days of hospital discharge)			
Caregiver availability and assistance required	INR value and test (if on Coumadin)	Prescribed and scheduled home health / outpatient services	Transportation issues
Education on FAST symptoms (face, arm, speech, time)	Medication reconciliation and concerns	Primary care physician scheduled follow-up appointment	Transitional outpatient stroke clinic follow-up appointment
Falls	New/worsening symptoms of stroke		
Post-Stroke Functional Assessment (clinic visit)			
Self-report general health	Functional status (ADL, IADL, Cognition, Falls, Physical mobility, endurance, and safety, Spasticity, Upper extremity)	Social factors (Social support: instrumental and emotional, Transportation issues)	Nutrition
Goals of care	Psychosocial stress (Depression (PHQ-2), Stress: patient stress and stress on family)	Medication management (Polypharmacy, Financial challenges to purchase medications, Medication adherence, Medication assistance needed, Medication literacy)	Swallowing
Access and utilization to care (Access to primary care physician, Primary care physician follow-up, Receipt of home health / outpatient services)	Healthcare utilization (Emergency department visits, Hospital readmissions)	Risk factor management (Knowledge of stroke risk factors)	Status of advance directive
			Best method to contact
Caregiver Assessment (clinic visit)			
Caregiver assistance	Caregiver general health	Caregiver health problems	Caregiver stress and strain
Advanced Practice Provider Assessment (clinic visit)			
Blood pressure (extracted by medical record review)	INR (extracted by medical record review)	Lifestyle management (smoking, drugs, alcohol)	Modified rankin scale
HgA1c (extracted by medical record review)	Cognition (MOCA) (if indicated by Post-Stroke Functional Assessment)	Receipt of treatment addiction (smoking, drugs, alcohol)	Physical activity
LDL (extracted by medical record review)	Communication deficits (aphasia and dysarthria)		
	Depression (PHQ-9) (if indicated by Post-Stroke Functional Assessment)		

Figure 1.

Domains measured in the COMPASS study post-discharge follow-up after stroke or transient ischemic attack.

*ADL = Activities of Daily Living; IADL = Instrumental Activities of Daily Living; LDL = Low-density Lipoproteins; HgA1c = Hemoglobin A1c; INR = International Normalized Ratio; MoCA = Montreal Cognitive Assessment; PHQ-9 = 9-item Patient Health Questionnaire



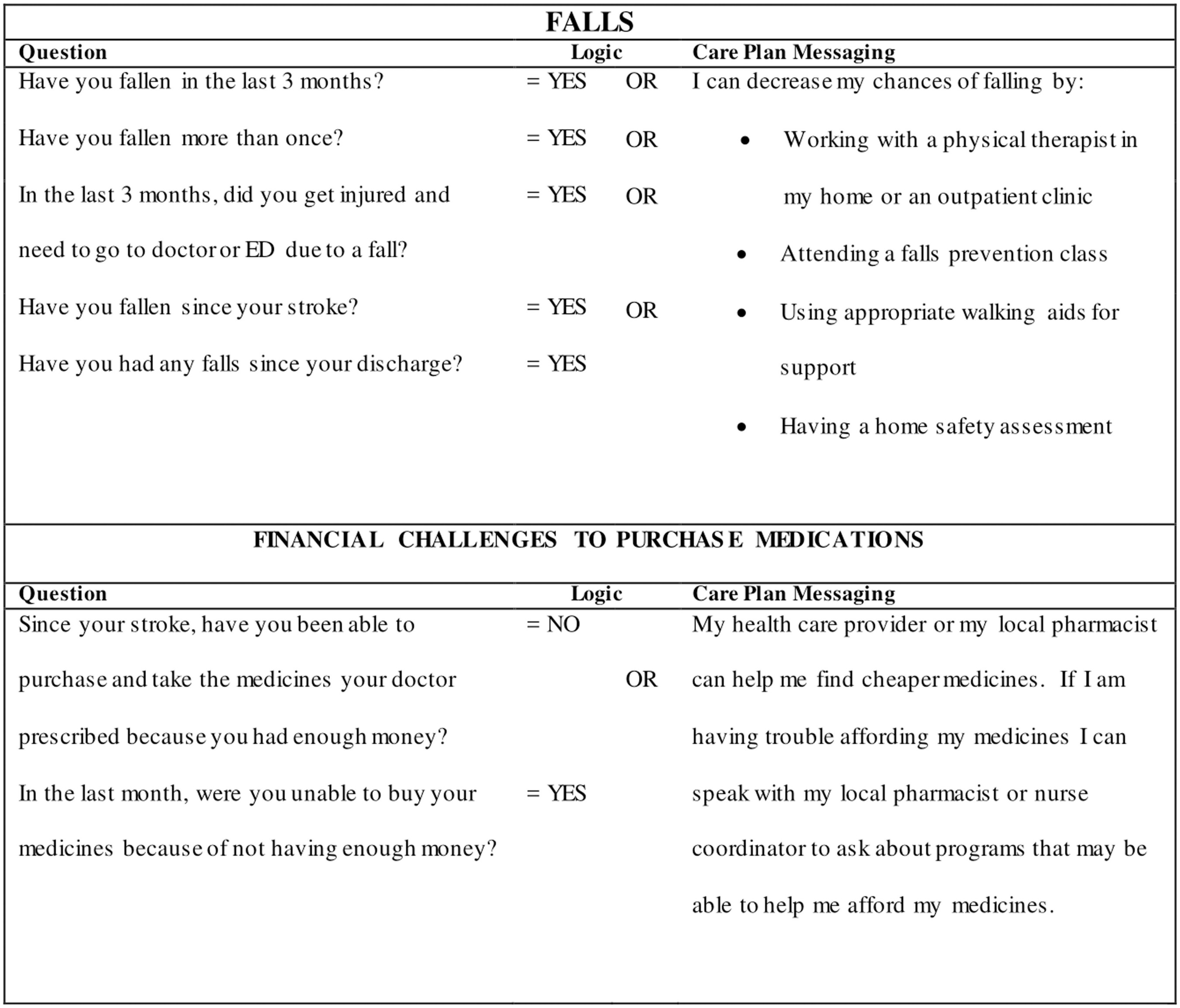
TCM	
DOMAINS	**# of Questions**
Physical mobility and safety	3
Cognition	4
Adherence and medication management	4
Financials to medication management	2
Activities of Daily Living	3
Instrumental Activities of Daily Living	3
Transportation	2
Stress	2
Social support	2
Depression	3
Emergency department visits	1
Hospital readmission	1
Access to Care (primary care physician and home health/outpatient services)	6
Falls	5
Health literacy	1
Advance directive	2

CCM	
DOMAINS	**# of Questions**
Physical mobility and safety	3
Cognition	4
Medication management	4
Financials to medication management	2
Activities of Daily Living	3
Instrumental Activities of Daily Living	3
Transportation	2
Stress	2
Social support	2
Depression	3
Emergency department visits	1
Hospital readmission	1
Access to care (primary care physician and home health/outpatient services)	4
Falls	5
Health literacy	1
Advance directive	2

AWV	
DOMAINS	**# of Questions**
Physical mobility and safety	3
Cognition	4
Medication management	4
Financials to medication management	2
Activities of Daily Living	3
Instrumental Activities of Daily Living	3
Transportation	2
Stress	2
Social support	2
Depression	3
Emergency department visits	1
Hospital readmission	1
Access to care (primary care physician and home health/outpatient services)	6
Falls	5
Health literacy	1
Advance directive	2

Figure 2.

Domains recommended for assessment by CMS Transitional Care Management (TCM), Chronic Care Management (CCM), and Annual Wellness Visit (AWV).



FALLS

Question	Logic	Care Plan Messaging
Have you fallen in the last 3 months?	= YES OR	I can decrease my chances of falling by:
Have you fallen more than once?	= YES OR	• Working with a physical therapist in my home or an outpatient clinic
In the last 3 months, did you get injured and need to go to doctor or ED due to a fall?	= YES OR	• Attending a falls prevention class
Have you fallen since your stroke?	= YES OR	• Using appropriate walking aids for support
Have you had any falls since your discharge?	= YES	• Having a home safety assessment

FINANCIAL CHALLENGES TO PURCHASE MEDICATIONS

Question	Logic	Care Plan Messaging
Since your stroke, have you been able to purchase and take the medicines your doctor prescribed because you had enough money?	= NO OR	My health care provider or my local pharmacist can help me find cheaper medicines. If I am having trouble affording my medicines I can speak with my local pharmacist or nurse coordinator to ask about programs that may be able to help me afford my medicines.
In the last month, were you unable to buy your medicines because of not having enough money?	= YES	

Figure 3.

Examples of COMPASS-CP algorithms for falls and financial challenges to purchase medications.

Table 1.

Characteristics of COMPASS patients at hospital discharge (extracted from medical records), July 2016-February 2018, N=871.

Characteristic	n (%)
Age 65 years or Older	526 (60.4)
Male	443 (50.9)
Race	
White	686 (78.8)
African-American	159 (18.3)
Other	24 (2.8)
Unknown	2 (0.2)
Hispanic [*]	16 (1.8)
Discharge Diagnosis	
Ischemic Stroke	573 (65.8)
Transient Ischemic Attack	268 (30.8)
Intracerebral Hemorrhage	18 (2.1)
Ischemic Stroke with Hemorrhage	4 (0.5)
Stroke, Not Otherwise Specified	8 (0.9)
Insurance [†]	
Medicare Fee for Service	437 (50.2)
Medicare Advantage	78 (9.0)
Medicaid	99 (11.4)
Private	244 (28.0)
VA/CHAMPUS[‡]	28 (3.2)
Self-Pay/No Insurance	75 (8.6)
Not Documented	7 (0.8)
Aphasia at Presentation [**]	196 (22.5)
Atrial Fibrillation and Discharged on Anticoagulant[§]	41 (57.7)
Ambulatory Status at Discharge	
Independent	641 (73.6)
With Assistance	47 (5.4)
Unable to Ambulate	4 (0.5)
Not Documented	179 (20.6)
Stroke Severity (NIHSS)[‡]	
0	280 (32.2)
1	155 (17.8)
2	105 (12.1)
3–4	119 (13.7)
5–7	56 (6.4)
>7	46 (5.3)
Not Documented	110 (12.6)

[*] Compared to ‘No/Not documented.’

[†] Categories not mutually exclusive.

[‡] VA = Veterans Affairs; CHAMPUS = Civilian Health and Medical Program of the Uniformed Services; NIHSS = National Institutes of Health Stroke Scale.

[§] 71 patients had history of AF at discharge and non-missing data on discharge medications

[**] Denominator = 680.

Table 2.

Behavioral and lifestyle risk factors identified by COMPASS nurse via COMPASS-CP questionnaires, July 2016-February 2018.

Behavioral and Lifestyle Risk Factors	**N**	**n (%)**
Know your Numbers—Lack of Knowledge of Stroke Risk Factors[*]		
High Blood Pressure	871	315 (36.2)
Smoking	871	651 (74.7)
Diabetes	871	689 (79.1)
Atrial Fibrillation	871	801 (92.0)
Heart Disease	871	760 (87.3)
High Cholesterol	871	472 (54.2)
Physical Inactivity	871	756 (86.8)
Engage		
Physical Mobility and Safety Concerns	871	292 (33.5)
Fall in Last 3 Months	871	200 (23.0)
ADL Limitation[†]	871	181 (20.8)
IADL Limitation[†]	871	149 (17.1)
Depression (PHQ-2) [†]	871	308 (35.4)
Upper Extremity Deficits	871	179 (20.6)
Patient Stress	871	273 (31.3)
Family Stress	871	90 (10.3)
Support [††]		
Limited Instrumental Social Support	871	282 (32.4)
Limited Emotional Social Support	663	60 (9.0)
Willingness		
Low Medication Adherence (MGLS) [†]	871	169 (19.4)
Cognitive Deficits	871	330 (37.9)
Financial Challenges to Medication Management	871	159 (18.3)
Polypharmacy (≥5 medications/day)[‡]	871	639 (73.4)
Access to Care		
Does not Have PCP[†]	871	62 (7.1)
Has not Seen PCP in Last 3 Months [†]	871	122 (14.0)
Has seen PCP in Last 3 Months but Not Since Stroke[†]	871	199 (22.8)
No Home Health Referrals at Hospital Discharge	759	535 (70.5)
No Outpatient Therapy Referrals at Hospital Discharge[§]	536	414 (77.2)
Self-Rated Health [**]		
Poor or Fair	867	174 (20.1)
Caregiver Wellbeing [‡‡]		

Behavioral and Lifestyle Risk Factors	**N**	**n (%)**
Caregiver Stress	328	112 (34.1)
Poor or Fair Self-Rated Health [**]	298	34 (11.4)
Health Issues or Responsibilities that Interfere with Caregiving [§]	295	61 (20.7)

[*] Unless otherwise noted, "No Response" was included in the numerator to avoid missing potential care concerns.

[†] ADL = Activities of Daily Living; IADL = Instrumental Activities of Daily Living; MGLS = 4-item Morisky Green Levine Medication Adherence Scale; PCP = Primary Care Physician; PHQ-2 = 2-item Patient Health Questionnaire

[‡] Numerator includes patients that responded "Don't know" and "No Response".

[§] Excludes patients prescribed home health services, as they are ineligible to receive outpatient therapy services; measured at 2-day follow-up call.

[**] Denominator excludes "No Response"

[††] Instrumental social support = having someone to help bathe/dress, etc. for 30 days if assistance is needed; Emotional social support = having a network of family/friends who visit as often as the patient would like.

[‡‡] COMPASS-CP triggered provider to complete Caregiver Assessment

Table 3.

Key behavioral, social, and clinical risk factors, and additional services needed, identified by advanced practice provider and entered into COMPASS-CP during follow-up clinic visit, July 2016-February 2018 [*]

Domain	N	n (%)
Behavioral / Lifestyle Risk Factors [†]		
Low Physical Activity (<20 minutes/day)	793	374 (47.2)
Current Smoking	807	147 (18.2)
Alcohol Use Over Recommended Daily Limit[‡]	807	29 (3.6)
Current Recreational Drug Use	807	20 (2.5)
Social Risk Factors [†]		
No Able and Willing Caregiver	802	48 (6.0)
Clinical Risk Factors [†]		
Communication Deficits Requiring Speech Therapy	805	79 (9.8)
Systolic Blood pressure >140 mmHg	805	298 (37.0)
LDL Cholesterol > 100 mg/dL	634	317 (50.0)
Diabetic with Hemoglobin A1C > 8.0%	478	84 (17.6)
International Normalized Ratio < 1.9 or 3.1 [§]	114	96 (84.2)
Need for additional services identified		
Assisted Living	871	49 (5.6)
Skilled Nursing Facility	871	4 (0.5)
Home Health Occupational/Physical Therapy	871	426 (48.9)
Home Health Speech Therapy	871	104 (11.9)
Home Health Nursing	871	764 (87.7)

[*] These questions did not require complete data entry to proceed, so sections could be skipped, leading to some missing values.

[†] Excludes those with missing advanced practice provider form or missing or invalid response.

[‡] For alcohol use, the threshold for women is 1 drink/day, and for men, 1–2 drinks/day.

[§] Among patients anticoagulated with warfarin and with prothrombin measurements taken

Table 4.

Clinician User Satisfaction with COMPASS-CP Application (N=44)

COMPASS-CP User Survey Question	Strongly Agree or Agree	Neither Agree Nor Disagree	Disagree or Strongly Disagree
Using the eCare Plan app is an easier way to develop a comprehensive care plan for the patient that the way I used to develop a care plan.	67%	23%	9%
The eCare Plan app improves my efficiency in evaluating and managing the patient's care during the 7–14-day clinic visit.	56%	35%	9%
The eCare Plan app improves my efficiency in evaluating and managing the patient's care during the 30- and 60-day follow-up calls.	37%	51%	12%
The eCare Plan app makes my job easier.	58%	28%	14%
The eCare Plan app identifies important factors impacting the patient's recovery and ability to self-manage that I might have missed.	74%	16%	9%
The caregiver assessment adds value to the care plan for the patient.	77%	16%	7%
The community resource directory linked to the eCare Plan app helps patients get the referrals they need.	56%	33%	12%
The eCare Plan app improves the patient's communication with me during the 7–14 day clinic visit.	54%	33%	14%
The eCare Plan app improves the caregiver's communication with me when the caregiver assessment is triggered.	63%	28%	9%
The eCare Plan app engages the patient to manage his/her health.	65%	23%	12%
The eCare Plan app has increased patient satisfaction with care.	48%	43%	9%
Overall, I am satisfied with the eCare Plan app.	66%	21%	14%

NOTE: "eCare Plan app" = COMPASS-CP.