Improving quality of care through detection for care complexity amongst community-dwelling older people receiving community nursing support: The ImPaCt study Randomised Controlled Trial

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**Aim:** To examine the effect of implementing the Patient Complexity Instrument (PCI) in addition to usual-care on complexity detection, clinical-care time allocation, and referrals to supportive services compared to usual-assessment alone.

**Design:** A parallel-group-blocked pragmatic randomised controlled trial.

**Methods:** A mixed-method study conducted within a regional Australian community nursing service. Randomisation occurred at the initial client assessment following referral acceptance for community nursing support. Older people aged 65 years and over (client participants), referred to the service from 1st of July 2020 to 30th of September 2020, eligible for Commonwealth-Home-Support-Programme funding. A convenience sample of community nurses conducting client-assessments were recruited. The intervention group included usual-assessment plus the PCI and the control group was usual-assessment alone. Chi-square test independence compared complexity ratings (low, medium, high) between groups for the hypothesis that adding the PCI to usual-assessment, has no effect on nurses’ complexity detection compared to usual-assessment alone.

**Results:** Compared to usual-assessment alone, adding the PCI did not change nurses’ level detected complexity rating. However, for older people initially assessed with low levels of complexity, the PCI indicated a need for additional clinical-care-time. The nurses feedback showed the PCI useful in prompting to identify other care factors such as level of engagement, psychosocial which were not identified by usual-assessment alone thus, enhanced complexity detection.

**Conclusion:** The addition of PCI to nurses’ usual-assessment did not improve levels of complexity ratings. However, the PCI enhanced complexity detection by pinpointing areas of care requiring referrals for additional care and extra-time required. The ImPaCt trial demonstrated the PCI as a useful tool for enhancing care for older people receiving nursing supports in the community. The PCI is a beneficial guidance resource for those new to Community Nursing role caring for older people.

**Key words:** district or community nurse, older people, ageing, care complexity, clinical decision-making, clinical judgement, quality of care, assessment, community aged-care.
Impact

What problem did the study address?

The trial addresses the limited evidence and use of standardised tools for detecting care complexity and greater dependence on nurses' clinical judgment.

What were the main findings?

The trial highlighted that the PCI could enhance community-based care for complex older people, and serves as a valuable guide for elder care, especially for those new to the community nurse role. Where and on whom will the research have an impact?

- Informing quality of care and shaping practice guidelines and policy for assessing complex community-dwelling older people.
- Enhancing clinician decision-making, facilitating care discussion and tracking client health and psychosocial trajectories.
- Informing academic research for further development of the PCI and similar tools to streamline elder care coordination and handover.

Reporting Method: The study adhered to the updated guidelines for reporting parallel group randomised trials. Reporting was conducted according to the CONSORT checklist (Schulz et al., 2010).

Patient or Public Contribution: This study was focussed on the nurses' perspective of client complexity and how this complexity is detected. During the protocol development phase, a presentation about the study was made to a consumer group from the lead researcher’s workplace. This presentation was well received with five consumers in attendance. The protocol was also presented to the Board of the lead researcher’s workplace. Four board members were in attendance and showed positive interest.

Implications for the profession and patient care

This study underscores the merit of incorporating a care complexity assessment tool into community nursing care for older people, amplifying decision-making regarding patient complexity. Future studies should explore clients’ perspectives, the PCI's effect on and implications for hospital (re)admissions and longevity at home.

Trial registration

The trial was registered with the Australian and New Zealand Clinical Trials Registry.

1 Introduction

The concept of complexity of care needs for older people is not new. In literature client or patient complexity is often associated with a nurse workload and the task the nurse conducts (Cline, 2015; Guarinoni et al., 2015). However, an older person's care could be considered complex if there are multiple factors that are connected, with a need to consider all of the interconnecting factors as dynamic and unpredictable (Guarinoni et al., 2015). Whilst there is a need to recognise and consider complexity of care of older people in the community, a definition of this complexity is not well published in literature (Thomas, 2017). Through a scoping review a definition of complexity of care was found that has been adopted for this trial (Boak et al., 2023):

“the interaction of factors in a patients’ life, including biological, psychological, social, environmental and support systems, which requires a shift in an expectation of predictable outcomes” (Thomas, 2017, p. 218).

This definition highlights the holistic nature required when considering the older person’s complexity and that outcomes can change. By considering multivariate factors, and the resulting complexity level, the challenges the older person faces are addressed in a holistic way rather than separately. This focus could shift nurses’ focus from a predominantly task-oriented approach to consistently embracing a holistic perspective.
Being able to objectively detect complexity of care could foster person-centred care (Lyndon et al., 2021). By determining the level of complexity during comprehensive assessments and utilising all available information, home visiting services, including nursing can streamline resource allocation for future care.

2 Background

2.1 The ageing population

The world-wide ageing phenomenon is a medical and social issue with healthy and successful ageing a priority in addressing this issue (Blackberry & Morris, 2023; Frost et al., 2020). Age is acknowledged in the World Report on Ageing in Health as not being an indicator of physical function and ability, more that ageing varies from person to person and is not always associated with chronological age (WHO, 2015). In the report, ageing is defined as the accumulation of molecular and cellular damage resulting in a gradual decline in physical and mental capacity, increased risk of disease and eventual death (WHO, 2015). The World Health Organization recognised that by the age of 60 years, age related impacts of sensory loss and chronic disease are the major burdens of death and disability (WHO, 2017b). As complex as ageing is, in order to support older people to remain living at home for as long as possible, we need to consider the factors that affect how they live and how they are responding to ageing (Bujold et al., 2017). These factors include consideration of health care needs, psychosocial support available, carer availability and capability, their living situation and how safe it is, and their access to additional supports (Bujold et al., 2017).

In Australia, people are living longer with more years spent in full health, however, the number of years lived in ill health are also increasing (AIHW, 2023). One in six Australians are aged 65 years or over, by 2066 this group will make up to 23% of the population (AIHW, 2023). The Older Australians Report also explains that people over 70 years of age (11% of the population) contribute to 35% of the total burden of disease and that between 70% and 89% of older people (65 years and older) are receiving home supports, depending on where they live (AIHW, 2023).

2.2 The impacts of ageing

As people age, they require more supports to safely remain in their own home. The desire to remain at home and the additional support required, has resulted in an alteration in the health and care needs of this population, with more people requiring community services including nursing care (Lyndon et al., 2021; Veldhuizen et al., 2021). The needs of older people increase to varying degrees depending on their physiological needs, social circumstances, access to resources and safety of their home environment (Bujold et al., 2017). Whilst there have been improvements in the management of chronic conditions, the increase in multimorbidity and shorter hospital stays are commonly mentioned as impacting the increasing complexity of care of people living in the community (Kuluski et al., 2017; Lyndon et al., 2021). Frost et al highlighted that traditional models of health care focus on the acute phase of a single condition and often miss the interacting factors of other conditions, ageing or how a person lives at home (Frost et al., 2020).

The availability and proximity of family members play a crucial role in an older person’s ability to remain living independently at home. Family members living far away or carers not available to help can have a significant impact on an older person’s ability to receive necessary support and care to maintain their independence, further contributing to the increasing complexity of care needs for people living in the community (Andersen et al., 2020).

Compared to younger people, older people require psychosocial support, monitoring nutrition intake, education and information, and more frequent follow-up with family members and doctors (Andersen et al., 2020). These are some of the factors that influence health status and require thorough assessment and monitoring (Kuluski et al., 2017). Consideration of health behaviours, psychosocial issues, biomedical factors, and moving away from a medical model of healthcare is needed to develop new holistic models of care provision for
older people (Kuluski et al., 2017). Such an approach starts with being able to detect the level of complexity for appropriate care to be delivered in the older person’s preferred location and a time that suits them (Thomas, 2017). Along with the biological effects of ageing there are also changes to the older person’s role in the family, social position, and the need to deal with loss. Life changes such as retirement, downsizing the family home, and death of those close are also associated with the impacts of ageing (WHO, 2017a). There are social and economic impacts of living longer such as social isolation, low income, and reduced family support (WHO, 2017b). People may start to reduce activities such as social outings, as their friends move away or die, impacting their mental health, physical wellbeing, and ability to manage at home (Andersen et al., 2020).

Community nurses working with older people and their family members are reporting that meal preparation or resource issues such as food not being available, difficulty using cooking devices (e.g., gas cooking being left on), environmental safety issues and clients not accepting pre-prepared meals as common issues (Veldhuizen et al., 2021). Issues regarding medications are also frequently reported by nurses and families, including medications not being taken, multiple doses missing from a dose administration aid, and other medications found around the home (Cline, 2015).

2.3 The role of community nurses

The model of nurses visiting the home to provide care dates back to the 1800’s when nurses had a caring and health information sharing role (Bessant, 1999). The role of these nurses (widely known as district nurses or community nurses) is now recognised broadly as highly skilled, not only in clinical care, but assessment, clinical judgement, coordination, referral, risk assessment and crisis management that provides a person-centred, preventative and coordinated model of care (Kuluski et al., 2017; Veldhuizen et al., 2021).

Preventing admissions to hospital or supporting early discharge has become a priority in the health system (Thomas, 2017; Veldhuizen et al., 2021). In recent times, the home-based service delivery has diversified to meet the challenging health and social needs of older people (Dunn et al., 2021; Guarinoni et al., 2015). Community nurses are known as being crucial in the delivery of home-based nursing care to minimise the impact on the acute healthcare system (Dunn et al., 2021; Veldhuizen et al., 2021).

Research has highlighted the need to identify the complex and multifaceted needs of community dwelling clients in the face of the changing role of family, nurses, and other caregivers (Andersen et al., 2020; Veldhuizen et al., 2021). Identification of care complexity underscores the increasingly specialised, complex clinical treatments for older people experiencing a decline in function and ability (Andersen et al., 2020).

We conducted a scoping review to explore complexity of care of older people and how complexity of care was detected. The review demonstrated there are limited studies on the detection of the complexity of care, even though there was reference to the need to explore the concept further (Boak et al., 2023). The review found two comprehensive tools for objectively measuring complexity. One of the tools, the PCI, was selected for this pragmatic trial, because the PCI has been validated in a healthcare system similar to that in Australia.

The ImPaCt study was a two-phase study, phase one was a feasibility and acceptability trial of the PCI in addition to usual assessment to enhance detection of client complexity and clinical-care time in a community nursing service. Phase two was conducting focus groups and a workshop to explore the perception of care complexity and how a tool could be used amongst health professionals (nursing and allied health). This paper includes the randomised controlled trial (RCT) report.

The primary objective of the RCT was to explore if adding the PCI to usual assessment would enhance the detection of client care complexity. The secondary objective was to explore if the complexity level derived from the PCI could influence the resource (time) allocated.
3 Methods

3.1 Study design

The ImPaCt study was an RCT with nested feasibility in which the PCI plus usual assessment (intervention) was compared to usual assessment alone (control). The study adhered to the updated guidelines for reporting parallel group randomised trials (CONSORT 2010) (Schulz et al., 2010). This RCT was registered on 15th of July 2019 with the Australian and New Zealand Clinical Trials Registry.

Detailed ImPaCt study methods have been described in the published protocol (Boak et al., 2021). At the time of this study there were no other pragmatic randomised controlled trials of complexity tools for older people in Australia.

3.2 Setting and Participants

The study was conducted within a regional community nursing service in Australia. Client participants (n=105) were older people referred to the service during 1st of July 2019 to 30th of September 2020 and eligible for Commonwealth Home Support Programme (CHSP) funding (Commonwealth of Australia, 2018). Nurse participants were the 28 community nurses employed in a community nursing service. The service provides in-home nursing care to referred older people, those 65 years and older. The key pillars of the service model of care are wellbeing and reablement, with the focus being to encourage and support clients to become independent and remain living in their own home for longer.

3.3 Data collection procedures

All Registered Nurses employed within the service as a Community Nurse were invited to take part in the trial. Introduction sessions were conducted in small groups by the lead researcher and included background of the PCI and how to use it. Pre- and post-RCT surveys were provided for completion at the start and end of data collection. These surveys provided feedback on the level of comfort with decisions made, barriers and enablers to detecting complexity (supplementary file 1, pages 1 and 4).

People aged 65 and over, eligible for CHSP funding and referred to the service were screened for eligibility by the Intake Nurse at the point of triage (table 1). The initial assessment was completed at the first visit, the assessment was then included for randomisation. The control group underwent usual practice assessment alone (usual care) while the intervention group underwent usual care plus the PCI assessment.

<table>
<thead>
<tr>
<th>Inclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clients eligible for CHSP Aged sixty-five years and over. Current needs are impacting the ability to attend activities of daily living.</td>
</tr>
</tbody>
</table>

Table Client Eligibility Criteria for the ImPaCt study

3.4 Usual care

The older person is referred to nursing service via the General Practitioner (GP) or My Aged Care (MAC) (Commonwealth of Australia, 2023). MAC provides two levels of assessment: a basic needs assessment and/or a more comprehensive assessment. The basic needs assessment is conducted by the Regional Assessment Services (RAS) (often non-health professionals) for those older people who need basic level (also called aged care entry level) supports, or the person’s needs may be found to be higher, then the more comprehensive assessment is conducted by the Aged Care Assessment Service (ACAS) (health professionals) is recommended. The outcome of either of these assessments can be various supports including nursing, home care (including domestic assistance, social support and or personal care). Nursing services are often
required more urgently which results in a GP referral directly to the service rather than waiting for the assessment by RAS or ACAS. In these cases, a referral to MAC is completed by the nurse, to ensure that one of the above-mentioned assessments are conducted and funding determined. This includes a summary of the nursing care required and why, which then supports the assessment level allocated (RAS or ACAS). When a referral is received by the nursing service, the referral is triaged and nurses conduct an additional assessment that is health care need focused, it also includes others involved in care such as family or other services. All of this information contributes to decisions on level of complexity and supports required.

Referrals were triaged and assessed for eligibility for inclusion by the Intake Nurse, who was not part of the study. The Intake Nurse’s role is to triage the referral and assign the Community Nurse the task of conducting the assessment. Older people (also referred to as clients) meeting the study inclusion criteria were flagged at this point by the Intake Nurse. Usual assessment was the initial assessment conducted by a Community Nurse in the client’s home. The assessments, combined with the referral information, included a range of clinical screens, demographic, and social questions that gave a comprehensive profile of the client. From this profile the Community Nurse used clinical judgement to determine the level of client care complexity rating (low, medium, or high). The Community Nurse then assigned the clinical-care time or additional interventions for subsequent visits. The study procedure is illustrated in Figure 1. Older people admitted within the service are referred to as clients.

![Figure ImPaCt RCT study design](image)

### 3.5 Intervention

The intervention arm included completion of the PCI in addition to usual assessment (supplementary file 1). The PCI comprised six factors namely engagement, clinical, social contact, family and carer, resources, and safety (Thomas, 2017). Each factor is scored from 1 to 5 and added to give a total score of 6 (low complexity) to 30 (high complexity). After completing the PCI, the Community Nurse adjusted the level of client care complexity rating (Post PCI complexity rating) and clinical-care time if required.
3.6 Sample size and Randomisation

Sample size was determined using initial pilot and feasibility data. A post-hoc sample size calculation was conducted on the first n=84 assessments, resulting in a minimum 138 client participants (files) required to detect a significant difference in the proportions of levels of complexity rating between the control (23.1%) vs. intervention (5.7%), odds ratio = 4.97, power = 0.8 and \( p < 0.05 \) (Boak et al., 2021).

Randomisation was conducted using a Stata-generated schedule by a researcher who was not involved in the assessment or data collection. Assessments were randomised to the control (usual care) or intervention (usual care plus PCI) group using blocks of four. Slips of paper concealing the allocation groups were sealed in sequentially numbered opaque envelopes. After completion of the usual assessment process and on return to the office, the random allocation was revealed to the Community Nurse (Figure1). If assigned to the control group, the Community Nurse completed the survey 1 (Supplementary file 1, page 2). If assigned to the intervention group, the Community Nurse completed the same survey 1, the PCI (supplementary file 1, page 4), and survey 2 (Supplementary file 1, page 3). The surveys completed by the Community Nurses were then entered into RedCap by the lead researcher.

3.7 Data analysis

Statistical analysis was conducted using SPSS 28 (IBM Corp, 2021). Comparison between groups on the primary outcome level of complexity, was conducted using Chi-square test-of-independence. When parametric test assumptions were not met then non-parametric alternatives was used for univariate and secondary outcome analyses.

For outcome analysis, new variables were created using usual assessment data for the control group and post-PCI data for the Intervention group. The new comparison variables included complexity ratings, clinical time added, and interventions added.

Primary outcome included examining the proportions of level of complexity ratings between the groups. The primary hypothesis was that the addition of the PCI does not enhance the nurses’ detection of client complexity compared to usual care alone. Analysis included comparison of the two groups on the proportion of level of complexity using chi-square test of independence.

The first secondary outcome was the addition of nursing care interventions after initial assessment. These were the required interventions for the client based on the assessment outcome and the detected level of client care complexity. The nursing care interventions were categorised as medication support, wound care, referrals & liaison, and other. The number of interventions added were also analysed. The first secondary hypothesis is the addition of the PCI does not enhance the allocation of interventions according to the client’s care complexity. Analysis included comparison of the two groups on the proportion of interventions added using chi-square test of independence.

The second secondary outcome was the clinical time in minutes. This was the time allocated to the subsequent delivery of clinical care by the nurse following their assessment and determination of the level of client complexity. The secondary hypothesis was the addition of the PCI does not enhance the allocation of appropriate care delivery (time) according to the client’s care complexity. Due to ordinal variables having skewed distributions the variables were recreated into grouped variables. Correlation analysis was conducted to determine the variables to be included in the regression analysis. A logistic regression was performed to ascertain the effects of client age, client gender, level of complexity, participant group, nurse’s age, and years as a nurse in the community on the likelihood that clinical time was added.

Logistic regression analysis was used to identify predictors of additional clinical time (dependent variable) as a resource that needed to be added after clients underwent usual assessment. The independent variables included client age, client gender, level of complexity, nurse’s age, and nurse’s years of experience as a community nurse. The level of statistical significance was indicated by \( p < 0.05 \).
3.8 Ethical considerations

Ethical approval was provided by the Ethics committee of the researcher's workplace and registered. The trial was registered with the Australian and New Zealand Clinical Trials Registry. Before the commencement of the trial the Nurses were provided with an introduction session and invited to participate at this point. Consent was obtained from nurses who wished to be involved.

4 Results

The flow of referrals and randomised assessments are shown in Figure 2. A total of 105 client assessments were performed. Thirty-four Registered Nurses (nurses) were invited to participate in the study, twenty-eight consented.

![Flow of client participants in ImPaCt study.](image)

4.1 Client participant characteristics

Referred client characteristics are presented in table 2. The groups were similar on all characteristics ($p > 0.05$). Referrals factors included in the ‘other’ category included hygiene, education, and observations. There were times where there were multiple referral factors within the one referral. The control group had 22.6% of referrals with more than one factor and 21.2% for the intervention group. There were more clients with medium or low level of complexity determined at baseline than high level.

<table>
<thead>
<tr>
<th>BASELINE VARIABLES</th>
<th>All</th>
<th>Control</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client Age (years), m(SD)</td>
<td>79.02(8.2)</td>
<td>80.13(10.2)</td>
<td></td>
</tr>
</tbody>
</table>
### Table Baseline Variable analysis for client participants

<table>
<thead>
<tr>
<th>BASELINE VARIABLES</th>
<th>All</th>
<th>Control</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, n(%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>54(51.4)</td>
<td>29(54.7)</td>
<td>25(48.1)</td>
</tr>
<tr>
<td>Female</td>
<td>51(48.6)</td>
<td>24(45.3)</td>
<td>27(51.9)</td>
</tr>
<tr>
<td>Referral reason, n(%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wound care</td>
<td>71(67.6)</td>
<td>34(64.2)</td>
<td>37(71.2)</td>
</tr>
<tr>
<td>Medications</td>
<td>31(29.5)</td>
<td>17(32.1)</td>
<td>14(26.9)</td>
</tr>
<tr>
<td>Referral reason Other</td>
<td>31(29.5)</td>
<td>17(32.1)</td>
<td>14(26.9)</td>
</tr>
<tr>
<td>Number of referral factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One n(%)</td>
<td>79(75.2)</td>
<td>41(77.4)</td>
<td>41(78.8)</td>
</tr>
<tr>
<td>Two or more n(%)</td>
<td>26(24.8)</td>
<td>12(22.6)</td>
<td>11(21.2)</td>
</tr>
<tr>
<td>Level of complexity (LOC) at baseline</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>45(42.9)</td>
<td>22(41.5)</td>
<td>23(44.2)</td>
</tr>
<tr>
<td>Medium</td>
<td>41(39.0)</td>
<td>21(39.6)</td>
<td>20(38.5)</td>
</tr>
<tr>
<td>High</td>
<td>19(18.1)</td>
<td>10(18.9)</td>
<td>9(17.3)</td>
</tr>
</tbody>
</table>

**4.2 Primary outcome - Level of complexity**

Table 3 shows the distribution of the comparison variables used in the outcome analysis. There was no difference between groups for the level of complexity, $x^2(2) = .90$, $p = .956$.

<table>
<thead>
<tr>
<th>Outcome comparison variables</th>
<th>Control, n(%)</th>
<th>Intervention, n(%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level of complexity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>22(41.5)</td>
<td>27(51.9)</td>
<td>NS</td>
</tr>
<tr>
<td>Medium</td>
<td>21(39.6)</td>
<td>17(32.7)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>10(18.9)</td>
<td>8(15.4)</td>
<td></td>
</tr>
<tr>
<td>PCI scores mean(SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (6-10)</td>
<td>11.88(5.0)</td>
<td>11.88(5.0)</td>
<td></td>
</tr>
<tr>
<td>Medium (11-15)</td>
<td>24(22.9)</td>
<td>24(22.9)</td>
<td></td>
</tr>
<tr>
<td>High (16-30)</td>
<td>17(16.2)</td>
<td>17(16.2)</td>
<td></td>
</tr>
<tr>
<td><strong>Identified additional nursing interventions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wound care</td>
<td>2(3.8)</td>
<td>10(19.2)</td>
<td>0.013*</td>
</tr>
<tr>
<td>Medication</td>
<td>6(11.3)</td>
<td>1(1.9)</td>
<td></td>
</tr>
<tr>
<td>Referrals and liaison</td>
<td>23(43.4)</td>
<td>22(42.3)</td>
<td>NS</td>
</tr>
<tr>
<td>Other</td>
<td>10(18.9)</td>
<td>10(19.2)</td>
<td>NS</td>
</tr>
<tr>
<td>No interventions added</td>
<td>20(37.7)</td>
<td>43(82.7)</td>
<td></td>
</tr>
<tr>
<td>1 or more interventions added</td>
<td>33(62.3)</td>
<td>9(17.3)</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td><strong>Clinical time added</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinical time added group</td>
<td>10.32(17.0)</td>
<td>5.67(11.0)</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Clinical time added</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zero added</td>
<td>29(54.7)</td>
<td>37(71.2)</td>
<td></td>
</tr>
<tr>
<td>Clinical time added</td>
<td>24(45.3)</td>
<td>15(28.8)</td>
<td></td>
</tr>
</tbody>
</table>

Table Outcome variable analysis
4.3 First secondary outcome - Nursing care interventions

There were two instances of wound-care additions after using clinical judgement and ten after using the PCI. There was a statistically significant difference in proportions between control and intervention groups for wound-care interventions added after usual assessment, $\chi^2 (1) = 6.195, p = .013$. The strength of the association was moderate Cramer’s V = 0.243 (Cohen, 1988). This would suggest that the addition of the PCI does enhance the allocation of wound care according to the client’s complexity in 24% of the time. Where interventions were added for wound care, this was for an additional wound found on assessment or a higher level of wound care was required. There were no instances where interventions were removed.

There were 33(62.30%) occurrences where one or more interventions were added using clinical judgement and 9(17.30%) after using the PCI. There was a statistically significant association between control and intervention groups for one or more interventions added, $\chi^2 (1) = 22.104, p < .001$. The strength of the association was large (Cohen, 1988), Cramer’s V = 0.459. This would suggest that the addition of the PCI does enhance the allocation of one or more interventions according to the client’s level of complexity. The instances of the allocation of one or more interventions and adding clinical time after detection of care complexity was higher in the control group. Because the participant file was randomly allocated to a group and the nurses were not randomly allocated the assessment, rather by chance, it is possible that the knowledge of the use of PCI improved the detection of care complexity and the subsequent allocation of interventions and clinical time overall throughout the trial.

Post hoc analysis involved pairwise comparisons using the z-test of two proportions with a Bonferroni correction. The proportion of an intervention group participant having wound care added after assessment was higher than not having the intervention of wound care added, $p < 0.05$. The proportion of a control group participant having one or more interventions added after assessment was higher than having no interventions added, $p < 0.05$.

4.4 Second secondary outcome-clinical time

Client’s age, nurse’s age, and nurse’ years of experience in the community, client gender, group allocation (intervention or control) and level of complexity rating were covariates in the regression analysis. The variable for nurse’s age and nurse’s years in the community were not correlated, so both were used in the regression analysis. There was a positive correlation between level of complexity and the number of referrals, therefore level of complexity only was included in the regression analysis.

The mean clinical care time in minutes (SD) added following assessment was 10(17) for the control group and 6(11) for the intervention group. The distribution for time was not normal. The variable was then collapsed into two categories, zero time added (1) and time added (2). Level of complexity rating was grouped in 1=low and 2=medium or high. The variable for client age, nurses age and nurse years in the community were not normally distributed and so were transformed into group variables: Client age in years 1=65-80, 2>81; Nurses age in years 1=21-50, 2>50; Nurse’s years in the community 1=1-4, 2=5 years of more

The logistic regression model was statistically significant ($\chi^2 (1, N=105) = 17.94, p < .001$). The model explained 21.4% (Nagelkerke $R^2$ ) of the variance in clinical time added and correctly classified 68.6% of cases. The odds of clinical time being added for a client with low complexity is 6.36 times higher than allocating clinical time to a medium or high complexity client, given an odds ratio of $\exp(1.85)=6.36$, 95%CI [2.53, 15.99]. This suggests that the clinical time allocated at referral triage based on the referral details only is generally correct for medium and high level of complexity, however, was underestimated for low level of complexity during triage. This would suggest that older people of low complexity, when referred for nursing services, in fact have additional needs that were uncovered during assessment using of the PCI. The area under the ROC curve was 0.71 (95%CI, .61 to .81), which is an acceptable level of discrimination according to Hosmer et al. (2013).
4.5 Nurses’ characteristics

Baseline survey data was collected from nurses on introduction to the study (pre-survey) at the same time consent was obtained (prior to education) and again at the completion of the data collection phase (post-survey). At both survey points nurses were asked about their level for comfort detecting care complexity, adjusting interventions, allocating time and the use of the PCI. A five-point Likert rating scale was used were a rating of one was not comfortable at all and five was very comfortable.

Analysis of the survey responses was conducted using SPSS. The descriptive characterises of the nurse participants (n=26) are shown in table 4. The number of client assessments conducted by the nurses ranged from 1 to 12 (mean 6.16).

<table>
<thead>
<tr>
<th>Nurses’ characteristics (years )</th>
<th>Mean (SD)</th>
<th>75th percentile</th>
<th>Test of normality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse age</td>
<td>49.81(13.20)</td>
<td>58</td>
<td>0.017</td>
</tr>
<tr>
<td>Years as a nurse RN</td>
<td>18.88(13.50)</td>
<td>30</td>
<td>0.063</td>
</tr>
<tr>
<td>Years as a nurse EN</td>
<td>5.73(9.22)</td>
<td>13</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total years as a nurse</td>
<td>24.62(14.23)</td>
<td>37</td>
<td>0.477</td>
</tr>
<tr>
<td>Years in the community</td>
<td>7.31(7.24)</td>
<td>12</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table Nurses Characteristics

Twenty-six nurses completed the pre-survey, ten nurses completed both the pre- and post-survey. The difference between responses of the ten nurses of the pre and post surveys (supplementary file 1) were analysed using the level of comfort questions for determining level of complexity, adjusting interventions, and adjusting clinical time (table 5).

Overall, there was an improvement of 30% in ratings of level of comfort of four or more for detecting complexity, adjusting interventions, and adjusting time allocation after assessment and using the PCI. A Wilcoxon signed-rank test determined that there was a statistically significant effect in the level of comfort detecting complexity after using the PCI, \( z = 2.236, p = 0.025 \). The median difference in level of comfort score was 0.5. There was not a statistically significance difference in responses to adjusting interventions or adjusting time allocated.

4.6 Enablers to detecting complexity

Nurses indicated that developing a positive relationship (rapport) with the client is an enabler to detecting care complexity. Nurses explain that this enables the person to feel comfortable to disclose information and discuss their needs. Providing nurses with the appropriate amount time to listen to the client is important in developing a rapport and can facilitate a more comprehensive assessment, this time could be spread over several visits. They stated that having access to current health information at the point of triage or assessment is important to understanding the person’s clinical background prior to entering the home. This information should also include any risks associated with entering a home. These enablers were reiterated in conversations with nurses. The service may benefit from a review of how the initial visits are conducted with a view to facilitating the development of a positive rapport with older people to ensure the clinical care meets their goals.
4.7 Barriers to detecting complexity

Nurses often indicated that clients not always being honest about their needs was a barrier. In discussions with staff about how they managed this, they said that developing a rapport is important and not expecting the full story on day one. Families often have different story about the client’s needs, due to the need to gain consent from the client, it takes negotiating skills of nurses to explain the benefits that would be available to them if they agreed to support.

4.8 Nurses feedback

The nurses offered feedback throughout the RCT. Some nurses engaged in the assessments noted that the PCI did not account for factors like chronic diseases or medication variety, suggesting a potential area for future refinement in assessing care complexity. The clinical factors considered in the PCI are related to engagement of the person in their health care. A consideration could be to expand on this and include the types of conditions and medications the person is needing to manage. Nurses suggested that a tool like the PCI could be useful as a reminder of factors to consider with a client, a guide for new nurses to community nursing or for use in clinical handover when providing a status of where the client is at in their healthcare pathway.

5 Discussion

The ImPaCt trial was the first pragmatic RCT using the Patient Complexity Instrument, let alone any standardised tool, to enhance clinical judgement of Community Nurses caring for older people in an Australian regional setting. Our findings showed that adding the PCI to the usual care assessment of complexity among older people referred to a regional community nursing service had no significant effect on to the nurses’ ability to detect levels of complexity. We found that the nurses were equally able to rate complexity using the PCI as they were when relying on clinical judgment alone. However, the PCI notably improved the quality-of-care decisions by bringing to attention aspects of nursing care that were not captured by the usual assessment method alone. For instance, how engaged the client was in their general health care, how well they understood their health conditions (rather than the types of conditions alone), how well their carers or support networks understood the care needs and if the client had access or was engaged in social activities.

In literature, studies primarily focus on nurses’ workload rather than client-centred outcomes or decision-making processes in care delivery (Veldhuizen et al., 2021). This task-oriented approach is suboptimal for nurse-led, person-centred services that emphasise how decisions are made regarding care needs or determination of care complexity (Dunn et al., 2021; Lyndon et al., 2021; Veldhuizen et al., 2021). To truly meet the needs of older community-dwelling individuals, current evidence advocates for a more holistic consideration of care complexity beyond mere tasks (Andersen et al., 2020) and the PCI embodies this approach.

In community nursing services around the world there are various assessment processes and tools, but their efficacy has not been comprehensively examined (Boak et al., 2023; Lyndon et al., 2021). The role of the community nurse goes beyond the immediate needs of the client and includes with consideration of meeting the broader healthcare needs (Lyndon et al., 2021), which can be strengthened by adopting a systematic, objective assessment approach. Considering the high level of experience and diverse skills expected of nurses working in the community (Dunn et al., 2021; Veldhuizen et al., 2021), the lack of evidence in the use of standardised and/or validated tools to enhance care complexity detection is a practice gap. Experienced nurses may possess the high level of clinical judgement experience required to determine care complexity, however, augmenting this with objective assessment tools, such as the PCI, is important because it is crucial to the how, and what of care decisions as this impacts client outcomes, but it is an area that has had limited attention (Lyndon et al., 2021).

Our trial found that the PCI combined with usual assessment enhanced the decision made to changes in
clinical care interventions and changing clinical time after assessment, particularly for older people assessed as having low complexity levels. People with low complexity are usually at the starting point of home support services and may have not developed confidence in the system or accepted the supports available to them (Kuluski et al., 2017). Even though there are limited or no studies investigating care complexity detection, the Flourish Model (FM) study underscored the need for rigor when assessing older clients in the face of ageing-related challenges (Faul et al., 2019). The FM study indicated that integrating assessments related to the social determinants of health into primary care services could enhance the emphasis on client-centred goals while also considering the care complexities surrounding older clients’ care. This is not a new concept, Bremer explored the types of interventions a community nurse does and identified that more frequent visits and the health status of clients were triggers for referrals to other services (Bremer, 1989). While the Bremer study focussed on the physiological dimensions of required care and the nursing skill set, the recommendations advocated for a preventative care model. Implementing a comprehensive tool that evaluates all facets of care complexity and is reassessed at regular intervals or when care needs shift, could be a valuable addition to this preventative approach.

Although the use of objective or standardised tools is a value add to nursing assessment, building rapport with the client is also a crucial element of care. Rapport is recognised in healthcare as crucial for effective patient-professional relationships and is linked to trust, empathy, and improved patient outcomes (Kuluski et al., 2017). The time required to develop rapport and have open un rushed conversations with the client was raised by the nurses as a barrier to detecting care complexity. The time to develop a rapport is not consistent for all older people, so allocating the right amount of time at intake, can be challenging. Ensuring that the right amount of time is allocated to subsequent visits, including time to develop a rapport, is the role of the nurse at the initial assessment. Even though there was a slight improvement in the level of comfort of adjusting time this would suggest that nurses could be more comfortable with this aspect of their role. Services implementing a tool, like the PCI, should consider the time required to complete not only the health-based assessment but the PCI as well and the need for a collaborative approach which is fostered by nurse-client rapport. This collaboration, during completion of the PCI, could provide an opportunity to brainstorm ideas and crystallise solutions.

The pre- and post-survey results suggest that the nurses were more comfortable with detecting complexity, adjusting inventions and clinical time after using the PCI with three nurses rating four or more in the post-survey, compared to the pre-survey. Of those who completed both surveys five nurses reported an improvement of a least one point on the Likert scale in their level of comfort with detecting care complexity, adjusting interventions, or adjusting time for clinical care according to the detected level of complexity and using the PCI. One nurse responded they were not at all comfortable (one point of the Likert scale) with adjusting clinical time during the pre-survey, but during the post-survey responded they were very comfortable (five points) with adjusting clinical time. This same nurse also reported an increase in level of comfort across all survey questions and had less community experience than other nurses. This could suggest that the PCI could assist nurses new to the service. The survey results suggested that most of the nurses were more comfortable in making decisions related to complexity, interventions, and time after conducting an assessment and using the PCI. Decisions made by nurses are a result of the level of skill and knowledge that nurse has, which directly impacts the level of comfort or confidence in making decisions. (Dunn et al., 2021; Lyndon et al., 2021).

There was an overwhelming perception by the nurses that the PCI was user-friendly and provided an objective complementary contribution to nurses’ clinical judgement of complexity of older people. Objective tools that are user-friendly could support decision-making and contribute to a more consistent approach to assessment and support clinical judgement decisions (Kuluski et al., 2017; Lyndon et al., 2021).
5.1 Strengths of the study
A key strength of this study is its elevation of the client complexity concept, sparking group discussions on its meaning and implications for elderly care, in a real-world practice environment. These conversations have evolved to encompass the whole person, with real practical impact on the way the nurses view complexity.

This study was conducted in a service that has commonality with other home-based health services and was the first of its kind in an Australian community setting. It should be feasible to generalise the interventions in similar settings such as Allied Health and Primary Care and expand to other countries where similar programs exist.

5.2 Limitations of the study
The study had several limitations, including potential conflict due to the researcher’s managerial role in the community nursing service the study was conducted. Workforce shortages and external factors like staff leave, service model changes during the study, and the COVID-19 pandemic led to extended data collection timelines and timely recruitment challenges.

5.3 Recommendations
This study demonstrates that the PCI is a feasible, well-accepted tool for enhancing care complexity detection and supporting clinical judgment in older patients. The following are recommendations that provide actionable insights aimed to refine the PCI and contribute to community nursing best practices:

- Conducting a larger, effectiveness-implementation hybrid type III trial, potentially incorporating workshops to further explore effectiveness and implementation of the PCI and its impact on care decisions and outcomes in the care of complex older people.
- Performing a sensitivity analysis against a gold standard like the geriatric assessment to consider inclusion of factors such as chronic diseases and medication.
- Expanding the PCI’s usage beyond nursing to include other disciplines like Allied Health Professionals and Primary Care.
- Using the study findings to inform policy, specifically in defining quality indicators for community nursing care that reflect home-based service provision.

6 Conclusion
Use of the PCI in community nursing did not alter the nurses’ capability to gauge levels of complexity. The tool enhanced assessment quality by spotlighting care needs not discerned through clinical judgment alone, thus aiding efficient allocation of resources, optimising interventions. The PCI serves as a user-friendly tool that complements nurses’ clinical judgement when identifying care complexity in community-dwelling older people. Feedback from the nurses completing client complexity assessment reiterated the importance of establishing a positive rapport with older people. This is a crucial element of nursing care in accurately detecting care complexity ahead of using any validated tools like the PCI, as it encourages the client to openly share information and discuss needs.

References


IBM Corp. (2021). *IBM SPSS Statistics for Windows (Version 28.0).* In IBM Corp.


