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Care coordination in homecare and its relationship with quality of care: A national multicenter cross-sectional study

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ABSTRACT

Introduction: As health care complexity increases, skilled care coordination is becoming increasingly necessary. This is especially true in homecare settings, where services tend to be highly interprofessional. Poor coordination can result in services being provided twice, at the wrong time, unnecessarily or not at all. In addition to risking harm to the client, such confusion leads to unnecessary costs. From the patient's perspective, then, professional coordination should help both to remove barriers limiting quality of care and to minimize costs. To date, though, studies examining the relationship between care coordination and care quality have faced multiple challenges, leading to mixed results. And in homecare contexts, where the clients are highly vulnerable and diverse care interfaces make coordination especially challenging, such studies are rare.

Objectives: Therefore, the aim of this study was to explore the relationship, from the perspectives of clients and of homecare professionals, between coordination and quality of care. For both groups, we hypothesized that better coordination would correlate with higher ratings of quality of care. For the clients, we predicted that higher coordination ratings would lead to lower incidence of unplanned health care use, i.e., emergency department (ED) visits, unscheduled urgent medical visits and hospitalizations.

Design and methods: This study is part of a national multi-center cross-sectional study in the Swiss homecare setting. We recruited 88 homecare agencies and collected data between January and September 2021 through written questionnaires for agencies' managers, employees ($n = 3223$) and clients ($n = 1509$). To test our hypotheses, we conducted multilevel analyses.

Results: Employee-perceived care coordination ratings correlated positively with employee-rated quality of care ($OR = 2.78$, $p < .001$); client-perceived care coordination problems correlated inversely with client-reported quality of care ($\beta = -0.55$, $p < .001$).

Client-perceived coordination problems also correlated positively with hospitalizations ($IRR = 1.20$, $p < .05$) and unscheduled urgent medical visits ($IRR = 1.18$, $p < .05$), but not significantly with ED visits. No associations were discernible between employee-perceived coordination quality and either health care service use or client quality-of-care ratings.

Discussion: While results indicate relationships between coordination and diverse aspects of care quality, various coordination gaps (e.g., poor information flow) also became apparent. The measurement of both care coordination and quality of care remains a challenge. Further research should focus on developing and validating a coordination questionnaire that measures care coordination.

What is already known

- Poor care coordination can lead not only to client harm, but also to additional health care use and unnecessary costs.
- Care coordination can contribute significantly to quality of care; however, studies so far lack a clear conceptual model and are rare in the homecare setting.

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What this paper adds

- In accordance with the conceptual model used in this study, results indicate positive correlations between care coordination and care quality.
- Various coordination gaps in homecare came to light. The most prevalent was inadequate information flow.

1. Introduction

Ongoing demographic change, the rise in (multiple) chronic conditions, and advances in the management of those conditions have led to growing numbers of homecare clients in many countries (Bundesamt für Statistik, 2021; Kristinsdottir et al., 2021). In this context, homecare services include a wide range of formal nursing and other health care services provided in the client's home. These can include medical treatments and therapies, basic care (e.g., personal hygiene), or domestic services (e.g., household support). In addition to the growing number of homecare clients, the increasing complexity of clients' care demands is challenging health systems (Hernansanz Iglesias et al., 2021; Kristinsdottir et al., 2021). This increase has two main contributors. First, in spite of multimorbidity and diminished physical and cognitive capacities, clients are living longer (Garmendia Prieto et al., 2022; Kristinsdottir et al., 2021). Second, the range of available services has also increased. Not only are there more services in general, but also more specialized services and more therapy and treatment options (Pierucci et al., 2021; WHO et al., 2018). Given that clients with multiple chronic conditions need a broad range of providers and services to manage the relevant diseases and symptoms, those services' successful coordination is key to reach care goals (Norlyk et al., 2022; Rowe et al., 2016).

Based on Espinosa et al.'s (2004) definition, care coordination can be understood as the "effective management of dependencies between subtasks, resources (e.g., equipment, tools, etc.) and people" (p. 6). Without adequate coordination, services can be provided twice, at the wrong time, unnecessarily or not at all (WHO, 2018; WHO et al., 2018). Possible outcomes include not only harm to the client, but also unnecessary costs. Therefore, care coordination contributes meaningfully to the quality of care and is an increasingly important field of research (WHO et al., 2018). In defining quality of care, Campbell et al. (2000) focus on "whether individuals can access the health structures and processes of care which they need and whether the care received is effective" (p. 1614). A recent review by Joling et al. (2018) listed over 500 indicators that reflect structure, process or outcome quality of community care for older people. Examples include budget resources, individualized care plans, advanced care planning, pain, pressure ulcers, falls, medication problems, hospitalizations, use of emergency services, or satisfaction with care services.

While many such indicators have been used in studies examining the relationship of successful coordination with quality of care, results are mixed. For example, some studies have found that specialized care coordination programs reduced emergency department (ED) visits and post-discharge re-hospitalization, enhanced health-related quality of life and patient satisfaction with care and reduced costs (Breckenridge et al., 2019; Conway et al., 2017; Penm et al., 2017; Tricco et al., 2014). Other studies did not find any relationships between care coordination and quality indicators such as number of clinical visits, hospital stay length(s), incidence of ED visits, health-related quality of life or patient satisfaction with care (Conway et al., 2017; Penm et al., 2017; Tricco et al., 2014).

The operationalization and measurement of care coordination present challenges that may explain such mixed results (Conway et al., 2017; Duan-Porter et al., 2021; Gorin et al., 2017; Joling et al., 2018; Weaver et al., 2018). One of the most serious of these challenges is the assumption that an intervention that addresses the coordination process (e.g., the introduction of case discussions) will also automatically enhance care coordination as an outcome (cf. Fig. 1). As a result, studies make direct connections between intervention components of the coordination process (e.g., case management, regular feedback, promotion of self-management to patients, provision of equipment) and patient or economic outcomes, but without considering the degree of coordination actually attained as an intermediate result (Gorin et al., 2017; Tricco et al., 2014). This logical leap, which confuses the process of coordination, i.e., "coordinating," with its intended outcome, i.e., coordination, makes it difficult to find consistent results on either the process or the outcome. To overcome this problem, Möckli et al. (2023) built the **C**are C**oor**din**a**tion (COORA) framework, which distinguishes between the process of coordination, the direct outcomes of that process (improved synchronization of tasks or services, i.e., coordination) and other relevant targets including patient outcomes (e.g., ED visits, satisfaction with services received, increased sense of well-being, cf. Fig. 1), or economic outcomes (e.g., reduced expenditures) (Möckli et al., 2023). In the COORA model, coordination is specified as the (desired) result of a process, i.e., the extent to which work dependencies between the different involved professions are effectively managed toward a specific goal, e.g., the care goal agreed upon with the patient (Espinosa et al., 2004; Malone and Crowston, 1994; Zackrison et al., 2015). While successful coordination mostly goes unrecognized, the lack of it is usually quite noticeable (Malone and Crowston, 1994), and can be measured via coordination problems including delays or conflicting information (Möckli et al., 2023). Still, it might be possible to measure successful coordination in terms of accurate and timely exchange of information, the avoidance of duplication of tasks, the ability of all members to complete their tasks, or the absence of delays (Zackrison et al., 2015). For this study we will use just one part of the COORA framework and will focus only on coordination as an outcome and patient outcomes (dashed rectangle in Fig. 1). Detailed information on the COORA framework can be found elsewhere (Möckli et al., 2023).

In homecare, information on how coordination actually functions remains scarce. Moreover, to the best of our knowledge, no published studies have explored how coordination correlates with our main outcome of interest, i.e., improvements in quality of care in homecare settings. In addition, this study adds to the literature by using multiple perspectives to explore the relationship between coordination and quality of care, including a comprehensive view based on both clients' and homecare employees' perceptions.

Accordingly, the aim of this study is to explore the relationships, i.e., regarding selected patient outcomes, between homecare coordination and quality of care from the perspectives of both clients and care workers. We have formulated the following hypotheses based on the COORA framework (Möckli et al., 2023):

1) Higher employee-reported coordination is associated with higher homecare employee-rated quality of care.
2) Higher homecare client- and employee-reported coordination is associated with higher client-rated quality of care.
3) Lower client- and employee-reported coordination is associated with higher unplanned health care use by the client (i.e., emergency department visits, unscheduled urgent medical visits, hospitalizations).

2. Methods

2.1. Study design

This descriptive correlational sub-analysis is part of the SPOT^{nat} study, a national multicenter, cross-sectional study in the Swiss homecare setting. Detailed information on the design can be found in the study protocol (Möckli et al., 2021).

2.2. Setting and participants

The sample of homecare agencies was drawn from a random sample stratified by major geographic Swiss region and profit status. For small

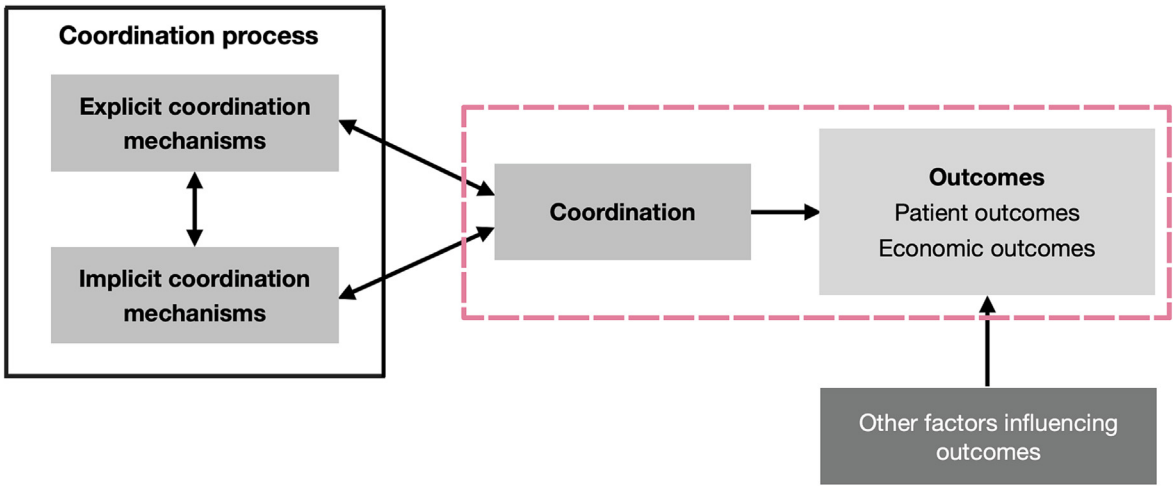

Fig. 1. Adapted part of the Care Coordination (COORA) framework.

and mid-sized homecare agencies (≤100 employees), all homecare employees were included. For larger agencies (>100 employees), random samples of 100 employees were taken to reduce the study burden. At the employee level, homecare employees were included if they were at least 18 years old, worked in direct or indirect client care, had worked for the participating agency for at least three months, and understood written German, French, or Italian. For this sub-analysis, we only included employees who reported that exchanges with other professions were within their scope of practice.

We also included random samples of 50 homecare clients per agency who were at least 60 years of age and were receiving care from their homecare agency at the time of the data collection. For organizations with fewer than 60 homecare clients, we included all clients. No formal power analysis was conducted, as many parameters, including cluster effects of the different outcomes in the home care setting, were unknown. For a multilevel analysis focusing on fixed effects, a sample of at least 30 groups of at least 30 individuals each is assumed to be sufficient (Hox, 2010). For more details, see the SPOT^{nat} study protocol (Möckli et al., 2021).

2.3. Variables

2.3.1. Independent variables

2.3.1.1. Employee-perceived coordination among healthcare providers. To measure coordination from the homecare employee perspective, we used self-developed items to assess in situ interaction and alignment of work within the care team (Espinosa et al., 2004; Zackrison, 2017). These were developed based on the COORA framework (c.f. Möckli et al. (2023)). Therefore, we asked the homecare employees eight Likert-style questions on how often in general the following conditions applied: (1) Relevant information is reported in a timely manner by other professionals; (2) Client care activities are well-aligned between the involved professionals; (3) There are duplicated or mainly-overlapping activities between professionals; (4) No or no current prescriptions/medication/medication lists are available; (5) Not all or not the right medications are available at a client's home; (6) No one from the homecare team is involved in a client's discharge from an inpatient stay; (7) Homecare employees do not feel sufficiently informed about a client's condition (e.g., information is not available or only partially documented); and (8) Homecare employees receive important information about the client too late. As two items were positively and six items negatively formulated, the six negative ones were reverse-coded. All items were rated on a fully-anchored 5-point (0–4) Likert scale ranging from "never/almost never" to "very often." Therefore, higher values mean better synchronization, reflecting fewer coordination problems. After checking the scale's unidimensionality, we calculated a total score using the mean across all items. The Cronbach's α value was 0.81; principal axis factoring showed a shared variance of 38% with item loadings between 0.32 and 0.83.

2.3.1.2. Client-perceived coordination problems. We assessed coordination problems from the clients' perspective by using the "Role Clarity & Coordination between Clinics" subscale from the "Patient-Perceived Continuity of Care from Multiple Clinicians" (CC-MC) (Haggerty et al., 2012). The three items assessed (1) whether there were times when the health care team gave the clients conflicting health-relevant information or advice; (2) whether the health care team did not seem to work well together; and (3) whether the health care team did not seem to know who should be doing what. All three items were rated on a 5-point Likert-type scale ranging from "never" (=0) to "very often" (=4). The Cronbach's α of these items was 0.73; principal axis factoring revealed a shared variance of 49%, with factor loadings between 0.54 and 0.77.

Before calculating a score for this scale, the author dichotomized each item's rating to indicate the presence or absence of a problem: "never" and "almost never" were recoded to 0 (="no problem"); and "sometimes", "often" or "very often" were recoded to 1 (="indication of a problem") (Haggerty et al., 2012). After this step, the sum of the allocated values over the 3 items was calculated (possible range: 0–3), using listwise deletion. With higher values representing more pronounced coordination problems, the final scale showed a highly right-skewed distribution, with 78.5% of values located in the lowest answer category.

2.3.2. Outcome

To assess quality of care we used three distinct approaches:

1) Employees' rating of care. We assessed the ratings of care from the employee perspective using a single item. The homecare employees were asked to rate the quality of care offered to clients. Answer options ranged from "very bad" to "very good" on a 4-point Likert-type scale. As the lowest category was only chosen by one person, responses were transformed to 3 instead of 4 categories (0 = (very) bad, 1 = good, 2 = very good).
2) Clients rating of care. Second, we assessed the overall rating of care from the client perspective by using one item of the "Home Health Care Consumer Assessment of Healthcare Providers and Systems Survey" (HHCAHPS) (Agency for Healthcare Research and Quality, 2018). Clients were asked to rate the care from the agency from 0

to 10, where 0 was the worst home health care possible and 10 the best possible.

3) Clients' health care service use. To assess health care service use, we adapted items from the Swiss Health Survey 2017 questionnaire (Bundesamt für Statistik, 2020). Clients were asked to indicate how many unscheduled urgent medical visits (needing urgently to see a doctor (including same-day appointments and urgent home visits), but not ED visits), ED visits, and hospitalizations (staying overnight in hospital or in a specialized clinic) they had had in the 2020 calendar year.

2.3.3. Demographic characteristics

We asked homecare agencies about their size (number of full-time equivalent posts, total number of clients and hours of care provided in 2020), profit status (non-profit, for-profit), catchment area (rural, suburban, urban), staffing (percentage of registered or higher-qualified nurses in relation to all other professions in nursing and care) and area of service (postal codes to allocate the language region German, French, Italian).

Regarding the selected homecare employees, we gathered information on age, gender (male, female, non-binary), employment percentage, years of experience in their current homecare agency, and educational background. The latter we divided into two groups for this sub-analysis: 1) nurses with a university/college degree and registered nurses (RNs) (BScN or at least a 3-year diploma program) and 2) nursing and care staff with lower levels of training in the nursing field (licensed practical nurses (LPNs), certified nurse assistants (CNAs), nurse aides (NAs), administrative staff, students/trainees and other professions working in client care). The language region (German, French, Italian) was assigned according to the postal code of their local agency office.

Clients were asked their age, gender (male, female, non-binary), living situation (alone, not alone), type of services used (nursing care and/or other services), health status (rating of own health from 1 (="poor") to 5 (="excellent") (Agency for Healthcare Research and Quality, 2018)) and perceived burden of health care expenses (how burdensome health-related expenses are for the monthly budget from 0 to 10, with 0 indicating "not at all burdensome" and 10 indicating "extremely burdensome"). As for the homecare employees, the language region (German, French, Italian) was assigned according to the postal code of the local agency office that served each.

2.4. Data sources/measurement

We collected our data between January and September of 2021 through paper and pencil questionnaires for the homecare employees, clients and agencies. Each agency was given three months to complete the data collection and was responsible to deliver the questionnaires to their employees and clients. To ensure confidentiality and reduce social desirability bias, each questionnaire was accompanied by a stamped return envelope. Study participants were asked to mail the questionnaires directly back to the research institute. To enhance the response rate, each homecare agency was informed about its employees' response rate three and six weeks after the start of data collection and sent additional information material such as flyers, presentations, and argumentation lists. For employees who were non-native speakers of the language used for correspondence, a glossary was provided for important or potentially problematic terms. Clients' relatives were actively encouraged to help complete the questionnaires, while homecare workers were not allowed to do so. Questionnaires were coded to allocate them to their respective agencies but not to the individuals who answered them. After data entry, correctness of data was checked in a random sample of 5% and deemed accurate.

The Ethics Committee of Northwestern and Central Switzerland (EKNZ) issued a *Declaration of No Objection* [Req-2020-00110]. We obtained informed written consent from all participating homecare agencies. For the employees and clients, the first page of each questionnaire informed them of the voluntary nature of participation, data confidentiality, and the consideration of informed consent when returning the completed questionnaire.

2.5. Data analysis

To assess how the data were distributed, descriptive statistics, e.g., frequencies, means, and standard deviations were used.

To explore the relationships between independent and outcome variables, we conducted separate multilevel regressions for each outcome. This allowed us to take into account the hierarchical structure of the data (employees within agencies, resp. clients within agencies). Complete data sets were constructed for each outcome by deleting missing values listwise. To build the regression models, we first performed intercept-only regressions, with each agency serving as a second-level (i.e., random intercept) variable. The result allowed the calculation of each outcome variable's intraclass correlation coefficient (ICC) (1), i.e., the amount of variance in individual-level responses explained by group-level properties (Bliese and Halverson, 1998). Second, the independent variables were added to the multilevel model. Last, covariables were added to the model. For employee characteristics, covariables included gender, employment percentage, years of experience in current homecare agency, educational background and language region. For client characteristics we included gender, age, living situation, type(s) of services used, health status, burden of health care expenses (only for health care use outcomes), and language region.

For the *employee ratings of overall quality of care* variable, we ran ordinal logistic multilevel regressions using the R "ordinal" package (Christensen, 2022). For over-dispersed *health care service use* variables, we performed negative binomial multilevel regressions using the R statistical software "glmmTMB" package (Brooks et al., 2017) and checked the regressions for zero-inflation, i.e., inflation resulting from frequent zero values; we found none in any of the three regression models (van den Broek, 1995). For the *client-perceived quality of care* variable, we ran linear multilevel regressions with the R "lme4" package (Bates et al., 2015). To produce regression models for the client outcome variables (i.e., health care service use and client-perceived quality of care), we aggregated the employee-perceived coordination scale data by calculating a mean score for every agency. Each agency's mean score was then assigned to each of its clients (disaggregated on the client level).

To test for multicollinearity among each model's independent variables, we determined the variance inflation factor (VIF), indicating that no multicollinearity was present (Thompson et al., 2017). We determined the model fit using both the Akaike information criterion (AIC) to reflect the conformity of the fitted model to the used data considering a penalty term (Cavanaugh and Neath, 2019), and Nakagawa's R^2 by using the R "performance" package (Lüdecke et al., 2021). The marginal R^2 indicates only the variance of the fixed effects, while the conditional R^2 takes both fixed and random effects into account (Nakagawa and Schielzeth, 2013). To check whether the results would change the model's conclusions, we conducted several sensitivity analyses. For details see Appendix B. Data were analyzed with the R software, version 4.2.1 (R Core Team, 2022).

3. Results

From the 88 participating homecare agencies, 3223 employees (response rate 73.6%) and 1509 clients (response rate 35.3%) completed and returned the questionnaires. One agency did not participate in the client survey as they had only around 10 clients at the time of data collection; therefore, only 87 agencies were included in the final client data analysis. After removing employees who did not fulfill the inclusion criteria concerning exchanges with other professions as part of their scope of practice, a final sample size of 1784 employees remained for analysis, with a median of 12.5 (interquartile range (IQR) 7.0–27.3) employees per agency. According to the inclusion criteria for the client

Table 1
Description of respondents' characteristics and independent and outcome variables.

Variable	n (%)	Mean (SD)	Missing n (%)
Homecare agencies	88		
Status			0
Non-profit	62 (70.5)		
For-profit	26 (29.5)		
Catchment area			0
Rural	39 (44.3)		
Suburban	32 (36.4)		
Urban	17 (19.3)		
Language region			0
German	67 (76.1)		
French	14 (15.9)		
Italian	7 (8.0)		
Size			
Number of full-time equivalent (FTE) posts		45.6 (57.5)	0
Total number of clients in 2020		557.2 (734.7)	3 (3.4)
Hours of care provided in 2020		41,404 (42,582.3)	2 (2.3)
Staffing			
Percentage of RNs or higher-educated staff over all personnel in the nursing and care sector		29.4 (13.7)	4 (4.5)
Number of visits conducted by RNs (or higher-educated staff) within the last 50 homecare visits		17.7 (10.6)	10 (11.4)
Employees	1784		
Age		44.6 (12.1)	58 (3.3)
Gender			16 (0.9)
Female	1625 (91.9)		
Male	140 (7.9)		
Non-binary	3 (0.2)		
Employment percentage (%)		70.0 (21.3)	31 (1.7)
Years of experience in current homecare agency		6.5 (6.7)	89 (5.0)
Educational background			13 (0.7)
Nurses with university/college degree and RNs	1085 (61.3)		
Nursing and care staff with a lower level of training in the nursing field	686 (38.7)		
Language region			0
German	1148 (64.3)		
French	549 (30.8)		
Italian	87 (4.9)		
Coordination variables, employees[b]			
Employees were asked: In general, how often (responses of "often" or "very often")			
1) … do you possess relevant information from other professionals at the right time to provide appropriate care/care to clients?	1193 (67.6)		19 (1.1)
2) … are client care activities well aligned with other professionals?	1180 (66.9)		20 (1.1)
3) … are there duplicate and overlapping activities with other professionals?	142 (8.1)		27 (1.5)
4) … does it happen that clients do not have all or the right medications?	183 (10.9)		100[a] (5.6)
5) … does it happen that no or no current prescription/medication lists are available?	302 (17.9)		98[a] (5.5)
6) … does it happen that no one from the homecare team is involved at the discharge from an inpatient stay?	341 (22.5)		270[a] (15.1)
7) … does it happen that that you are not sufficiently informed about a client's condition? (e.g., information is not available, only partially documented)	362 (20.9)		50[a] (2.8)
8) … does it happen that you receive important information about the client too late?	253 (14.5)		41[a] (2.3)
Employee-perceived coordination (scale from 0 to 4)		2.5 (0.6)	7 (0.4)
Mean employee-perceived coordination aggregated at agency level (scale from 0 to 4)		2.6 (0.3)	–
Outcome variable employees			
Quality of care rating			7 (0.4)
Very good	795 (44.7)		
Rather good	953 (53.6)		
Rather bad	28 (1.6)		
Very bad	1 (0.1)		
Clients	1466		
Age			34 (2.3)
60–64	62 (4.4)		
65–74	218 (15.2)		
75–84	497 (34.7)		
85–94	599 (41.8)		
≥95	56 (3.9)		
Gender			44 (3.0)
Female	895 (62.9)		
Male	527 (37.1)		
Non-binary	0		
Living situation			82 (5.6)
Alone	817 (59.0)		
Not alone	567 (41.0)		
Type of services used			
Only nursing care	730 (49.8)		
Nursing care & other services	433 (29.5)		
Other services (e.g., domestic services, meals on wheels)	303 (20.7)		

(continued on next page)

Table 1 (*continued*)

Variable	n (%)	Mean (SD)	Missing n (%)
Health status (rating of own health)		2.3 (0.8)	31 (2.1)
Excellent	8 (0.6)		
Very good	55 (3.8)		
Good	464 (32.3)		
Fair	732 (51.0)		
Poor	176 (12.3)		
Language region			0
German	1052 (71.8)		
French	298 (20.3)		
Italian	116 (7.9)		
Coordination variables, clients			
Clients were asked (responses of sometimes/often/very often)			
1) Were there times when the different health care professionals told you different things (that didn't make sense together) about your health?	171 (12.0)		41 (2.8)
2) Were there times when the different health care professionals did not seem to work well together?	167 (11.8)		51 (3.5)
3) Were there times when the different health care professionals did not seem to know who should be doing what?	142 (10.0)		48 (3.3)
Client-perceived coordination problems (scale from 0 to 3)		0.3 (0.7)	70 (4.8)
Outcome variables clients			
Overall rating of care (0–10)		8.9 (1.3)	41 (2.8)
Rating of 9 or 10	925 (64.9)		
Rating below 9	500 (35.1)		
Number of unscheduled urgent medical visits in 2020		0.7 (1.6)	196 (13.4)
No unscheduled urgent medical visit	792 (62.4)		
At least one unscheduled urgent medical visit	478 (37.6)		
Number of emergency department (ED) visits in 2020		1.7 (4.7)	137 (9.3)
No ED visit	766 (57.9)		
At least one ED visit	556 (42.1)		
Number of hospitalizations in 2020		0.7 (1.4)	144 (9.8)
No hospitalization	718 (54.0)		
At least one hospitalization	611 (46.0)		

Note. RN = registered nurse, SD = standard deviation.
[a] Answer option "not in my field of responsibility" treated as missing.
[b] Items were translated into English for the purpose of this article, original language is German/French/Italian.

questionnaires, we removed all clients younger than 60 years of age, yielding a final sample size of 1466 client questionnaires, with a median of 16.0 (IQR 11.0–20.0) clients per agency.

3.1. Description of the sample and variables

Participating homecare employees were mostly female (91.9%); they had a mean age of 44.6 years and a mean employment percentage of 70% (corresponding to 3.5 working days (~29.5 h) per week). Most participating homecare clients (76.5%) were between 75 and 94 years of age; most (62.9%) were female; and most (79.5%) were receiving nursing services. Details of the homecare agency, employee and client characteristics can be found in Table 1.

The mean score of the employee-perceived coordination scale was 2.5 (SD 0.6). Concerning their responses, slightly over two-thirds (67.6%) of employees reported that relevant information is often or very often reported in a timely manner, and that client care is often or very often well-aligned among professionals (66.9%). On the other hand, 20.9% of employees did not feel sufficiently informed about their clients' conditions. The client-perceived coordination problem scale showed a mean score of 0.3 (SD 0.7). Of the clients, 12% reported that sometimes, often or very often different health care professionals gave them conflicting information, while 21.1% reported at least one indication of a coordination problem. Detailed descriptions of the independent and outcome variables can also be found in Table 1. For full information on the coordination variables, see Appendix A.

The outcome variable's ICCs yielded values of 0.09 (95% confidence interval (CI): 0.05–0.13) for *employees' ratings of care quality*, 0.03 [CI: 0.00–0.06] for *client ratings of care quality*, 0.07 [CI: 0.04–0.10] for *unscheduled urgent medical visits*, 0.04 [CI: 0.02–0.06] for *ED visits*, and 0.12 [CI: 0.08–0.16] for *hospitalization*, all of which are low. However, to remain conservative in the calculation of confidence intervals, we still added random intercepts.

3.2. Association between coordination and quality of care in homecare

3.2.1. Hypothesis 1: higher employee-reported coordination is associated with higher employee-rated quality of care

Employee-perceived coordination ratings were significantly associated with their quality-of-care ratings. For every unit increase in the employee-perceived coordination, the odds of a higher rating for quality of care (i.e., bad/rather good vs. rather good/very good) increase by 2.78 times ($p < .001$) (holding constant all other variables). There were no substantial changes in the estimates after controlling for covariates. The coordination scale alone explains 8.8% of the variability in the quality-of-care rating. See Table 2 for details of the analysis.

Considering the strength of the relationship indicated, we conducted an additional analysis to examine which of the employee-perceived coordination scale's eight items show the strongest correlation with the quality-of-care rating. For details, see Appendix B. In descending order, the coordination variables "possess relevant information from other professionals", "care activities well aligned with other professionals", and "duplicate and overlapping activities with other professionals" showed the strongest associations with employees' quality of care ratings.

3.2.2. Hypothesis 2: higher client- and employee-reported coordination is associated with higher client-rated quality of care

Client-perceived coordination problems were strongly associated with the clients' quality-of-care ratings. For every unit increase in coordination problems, clients' quality-of-care ratings decreased by 0.55 ($p < .001$) (holding constant all other variables). On the other hand, employee-perceived coordination showed no significant associations with clients' quality-of-care ratings. These estimates showed no substantial changes with or without covariates. The model not controlled for covariates explained roughly 11% of the clients' quality-of-care rating variability. For details of the analysis and model fit, see Table 3.

Table 2
Ordinal logistic multilevel regression output: Employees' quality-of-care ratings.

	Quality-of-care rating from employees (independent variables only) (n = 1662)	Quality-of-care rating from employees incl. covariates (n = 1662)
	OR [95% CI]	aOR [95% CI]
Independent variable		
Employee-perceived coordination	2.69*** [2.23; 3.24]	2.78*** [2.28; 3.38]
Intercept 0|1[a]	0.13*** [0.07; 0.23]	0.17*** [0.08; 0.37]
Intercept 1|2[b]	14.07*** [8.37; 23.64]	18.37*** [8.85; 38.13]
Covariables		
Employment percentage		1.00 [1.00; 1.01]
Years of experience in current homecare agency		0.99 [0.98; 1.01]
Nurses with university/college degrees and RNs[c]		1.19 [0.94; 1.49]
Language region French[d]		0.77 [0.49; 1.22]
Language region Italian[d]		2.08 [0.96; 4.49]
Second level variable		
Homecare agencies (variance [SD])	0.46 [0.68]	0.40 [0.63]
Effect size		
AIC	2358.15	2358.71
Marginal R^2	0.088	0.105
Conditional R^2	0.200	0.203

Note. AIC = Akaike information criterion, aOR = adjusted odds ratio, CI = confidence interval, OR = odds ratio, RN = registered nurse, SD = standard deviation, α levels of significance = *p < .05, **p < .01, ***p < .001.
[a] OR for the intercept between answer category bad vs. rather good.
[b] OR for the intercept between answer category rather good vs. very good.
[c] Nursing and care staff with a lower level of training in the nursing field as the reference category.
[d] Language region German as the reference category.

3.2.3. Hypothesis 3: lower client- and employee-reported coordination is associated with higher unplanned health care use by the client (i.e., ED visits, unscheduled urgent medical visits, hospitalization)

Client-perceived coordination was significantly associated with the number of unscheduled urgent medical visits and hospital visits but not with ED visits. Employee-perceived coordination, on the other hand, showed no significant associations with health care use (see Table 4). We found an 18% increase in the incidence rate (IR) of unscheduled urgent medical visits for every unit increase in client-perceived coordination problems (p < .05). Similar associations were noted with hospitalization, where (holding other variables constant) a one-unit increase in client-perceived coordination problems correlated with a 20% increase in the hospitalization rate (p < .05). The clients' rating of their own health was a significant covariable in all three models. The highest association was found with urgent medical visits: for every unit increase in self-rated health, the urgent medical visit rate fell by

Table 3
General linear model output: Quality-of-care rating from clients.

	Quality-of-care rating from clients (independent variables only) (n = 1090)	Quality-of-care rating from clients incl. covariates (n = 1090)
	Beta [95% CI]	*Beta* [95% CI]
Independent variables		
Client-perceived coordination problems	−0.56*** [−0.65; −0.46]	−0.55*** [−0.64; −0.45]
Mean employee-perceived coordination at agency-level	0.15 [−0.18; 0.49]	0.16 [−0.18; 0.50]
Covariables		
Types of services used: nursing care and other services[a]		−0.05 [−0.21; 0.11]
Type of services used: other services but not nursing care[a]		0.03 [−0.23; 0.16]
Living situation: alone[b]		−0.08 [−0.21; 0.07]
Overall health status (clients' ratings of their own general health)		0.11* [0.02; 0.21]
Language region French[c]		−0.16 [−0.38; −0.06]
Language region Italian[c]		−0.09 [−0.46; 0.27]
Gender male[d]		−0.05 [−0.19; 0.09]
Second-level variable		
Homecare agencies (n = 87)		
Agency level (variance [SD])	0.06 [0.25]	0.06 [0.25]
Residuals (variance [SD])	1.29 [1.14]	1.29 [1.13]
Effect size		
AIC	3427.15	3453.54
Marginal R^2	0.109	0.118
Conditional R^2	0.151	0.160

Note. AIC = Akaike information criterion, CI = confidence interval, SD = standard deviation, α levels of significance = *p < .05, **p < .01, ***p < .001.
[a] Only nursing care as the reference category,
[b] Living situation "not alone" as the reference category.
[c] Language region German as the reference category.
[d] Female as the reference category.

Table 4
Negative binomial multilevel regression output: clients' health care use.

	Urgent medical visits ind. variables only (n = 994)	Urgent medical visits incl. covariates (n = 994)	Hospitalization ind. variables only (n = 1037)	Hospitalization incl. covariates (n = 1037)	ED visits ind. variables only (n = 1034)	ED visits incl. covariates (n = 1034)
	IRR [95% CI]	IRR [95% CI]	IRR [95% CI]	IRR [95% CI]	IRR [95% CI]	IRR [95% CI]
Independent variables						
Client-perceived coordination problems	1.20* [1.04; 1.39]	1.18* [1.02; 1.36]	1.29** [1.08; 1.52]	1.20* [1.01; 1.42]	1.10 [0.97; 1.25]	1.08 [0.95; 1.23]
Mean employee-perceived coordination at agency level	1.37 [0.84; 2.22]	1.29 [0.80; 2.08]	0.54 [0.29; 1.01]	0.63 [0.34; 1.17]	1.04 [0.66; 1.61]	0.94 [0.59; 1.52]
Covariables						
Type of services used: nursing care and other services[a]		1.04 [0.81; 1.34]		0.67** [0.50; 0.89]		0.90 [0.72; 1.13]
Type of services used: other services but not nursing care[a]		1.07 [0.78; 1.46]		0.99 [0.71; 1.38]		1.12 [0.86; 1.45]
Living situation: alone[b]		0.99 [0.78; 1.25]		0.68** [0.53; 0.88]		0.90 [0.74; 1.11]
Overall health status (clients rating of own general health)		0.63*** [0.54; 0.73]		0.83* [0.71; 0.97]		0.85* [0.75; 0.97]
Financial burden of health expenditures		1.05* [1.01; 1.09]		1.03 [0.99; 1.08]		1.03 [1.00; 1.07]
Language region French[c]		0.78 [0.57; 1.06]		0.98 [0.68; 1.41]		0.89 [0.66; 1.20]
Language region Italian[c]		0.48** [0.28; 0.84]		0.68 [0.36; 1.28]		1.04 [0.64; 1.70]
Gender male[d]		1.17 [0.94; 1.47]		1.05 [0.81; 1.35]		1.45*** [1.19; 1.76]
Second level variable						
Homecare agencies (variance [SD])	0.09 [0.29]	0.06 [0.24]	0.21 [0.45]	0.12 [0.35]	0.08 [0.28]	0.10 [0.32]
Effect size						
AIC	2336.8	2296.5	3358.2	3342.3	2390.5	2373.3
Marginal R^2	0.015	0.134	0.033	0.095	0.004	0.060
Conditional R^2	0.071	0.170	0.153	0.167	0.063	0.134

Note. AIC = Akaike information criterion, CI = confidence interval, ED = emergency department, IRR = incident rate ratio, SD = standard deviation, α levels of significance = *p < .05, **p < .01, ***p < .001.
[a] Only nursing care as the reference category.
[c] Language region German as the reference category.
[b] Living situation "not alone" as the reference category.
[d] Female as the reference category.

37% (=100%–63%). As seen by the R^2 in Table 4, explained variabilities were generally lower than for the previous hypotheses.

In almost all cases, sensitivity analyses for the different outcome variables did not change the models' conclusions. One model—the one using the number of ED visits as its outcome variable—became statistically significant after that variable was dichotomized. However, for all others, the regression coefficients after dichotomization were comparable to those before. For details, see Appendix B.

4. Discussion

This study's primary aim was to examine the relationship between care coordination and quality of care in homecare. Hypotheses 1 and 2—that higher care coordination is associated with higher quality-of-care ratings respectively from employees' and clients' perspectives—were supported. The third hypothesis, that higher coordination from the clients' perspective is negatively associated with unplanned health care use (i.e., unscheduled urgent medical visits, ED visits, hospitalization), was partly supported. We found moderate positive associations between client-reported coordination problems and urgent medical visits and hospitalization, but not with ED visits. Nor did we find any noteworthy associations between employee-perceived coordination and clients' health care service use or quality-of-care ratings.

To our knowledge, this is the first study to examine the relationship between the degree of coordination and quality of care. Moving away from measuring coordination processes as proxies for actual coordination, our findings confirm a relationship between coordination and quality-of-care outcomes based on both employee- and client-provided data. This supports our argument that coordination level should be considered an intermediate outcome between coordination processes and patient outcomes. However, based on the model fits for the three guiding questions, either 10%—for hypotheses 1 and 2—or only a negligible part of the outcome variables' variability—for hypothesis 3—could be explained by the independent variables of interest. This indicates that the outcomes measured are mostly determined by factors other than our independent variables. To name one other contributing factor, the intervention's appropriateness clearly has a greater effect than coordination: even the highest level of coordination cannot compensate for an intervention that does not fit the client's needs.

To the best of our knowledge, this is the first study to aim at measuring coordination in homecare. On a scale ranging from 0 to 4, the self-developed employee-perceived coordination scale recorded a mean rating of 2.5, indicating a rather good overall level of coordination. Nonetheless, it also shows potential for improvement, with several items exposing coordination gaps. For example, almost a third of employees (31.7%) reported that they only sometimes or rarely receive information from other professionals in a timely manner; and one in seven (14.5%) reported very often receiving important information about the client too late. For seamless coordination, a smooth flow of timely information is essential. As Jones et al. (2017) confirmed, access to information is crucial to the provision of optimal care. Unfortunately, other studies have shown that homecare workers commonly find themselves with scattered or conflicting information. This can be burdensome regarding referrals and lead to adverse medication events at home (Arbaje et al.,

2019; Masotti et al., 2010; Meyer-Massetti et al., 2018). Our data also confirmed those of previous studies: over 10% of participating homecare employees reported that they are often or very often confronted with unavailable or outdated prescriptions, medication plans or medications; and 16.2% reported (almost) never being involved in their clients' hospital discharges.

Client-perceived coordination problems showed a mean value of 0.3 (on a scale from 0 to 3) indicating rather few coordination problems. One explanation for such a low score could be that coordination problems arising between health care providers or services are generally resolved before the clients can take notice. Another possibility is that a large proportion of our homecare clients sample dealt with small numbers of service providers and consequently few interfaces of care. As the complexity of coordination increases with the number of providers involved, such cases would entail correspondingly more conflicts (Brooks, 1987; Van de Ven et al., 1976). However, coordination problems did occur; i.e., 12.0% of clients experienced times when they received conflicting information from different health care professionals, 11.8% experienced times where their health care professionals did not seem to work well together and one-tenth experienced times where the different health care professionals did not know who should be doing what. Kern et al. (2020) found similar numbers of client-perceived coordination problems in the U.S. In their study, almost 12% of respondents thought that their doctors did not communicate with each other about their care; 8.3% rated coordination of care among their health professionals as fair or poor. And a qualitative study by Chang et al. (2018) found that patients who experienced coordination problems often attributed it to poor communication between health care providers. However, whether or not clients are aware of poor coordination, it is a problem: a single incident of failed coordination can lead to unnecessary health care use or adverse events.

Overall, employee-perceived coordination was significantly related to their quality-of-care ratings but not to any client outcomes. Considering the evidence that nurses' perceived quality aligns reasonably well with objectively measured quality indicators and nurse-sensitive indicators (McHugh and Stimpfel, 2012; Stalpers et al., 2016), this positive association supports the premise that coordination is relevant to quality of care. The lack of finding a relationship with client outcomes might be a measurement issue: The employee-perceived coordination scale was aggregated at the agency level for client-level analysis, leading to only 87 individual scores for the analysis. The scale might also not be sensitive enough to capture more subtle levels of coordination regarding client outcomes. In addition, clients' and employees' perception of coordination might not match. If health care professionals are highly coordinated in virtually every aspect of client care, but fail to manage a key dependency properly (for example, a time-consuming process to gain access to client data or reports or additional efforts to obtain missing information), it can negatively impact the employee-perceived coordination rating, although clients might not notice it. Norlyk et al. (2022) highlighted the ongoing behind-the-scenes activities of homecare nurses, which conceal the complexity of their work in the homecare setting (e.g., several health professionals involved but geographically dispersed, often working at the limits of available resources).

Client-perceived coordination showed significant associations with hospitalization and urgent medical visits as well as client-rated quality of care. In line with previous studies (Sheinfeld Gorin and Haggstrom, 2018), our results accordingly indicate that coordination can impact diverse areas of care quality. However, client-perceived coordination and ED visits were not significantly associated. Other studies showed similar results, with no significant effects of care coordination on ED visits (Tricco et al., 2014; Wells et al., 2019). Wells et al. (2019) observed that most patients either reported that their ED visits were warranted or indicated that alternatives were unavailable. Indeed, in difficult care situations or where qualified personnel (e.g., general practitioners) are unavailable, ED visits are sometimes unavoidable or even included in contingency plans. However, even where a health care team is highly-coordinated, such transfers occasionally occur for reasons independent of coordination. In this sense, coordination is only one of a diverse range of factors that can impact ED visits. This issue raises the critical question of the contexts within which widely-cited quality indicators such as hospitalizations, ED visits or urgent medical visits, or even mortality or nursing home transfers are appropriate measures of care quality without also tracking and accounting for the underlying circumstances of admission or transfer. Therefore, as Haas and Swan (2014) pointed out almost a decade ago, it is vital to choose quality of care outcomes that adequately reflect the success of interventions to improve coordination: choosing outcomes that are influenced only marginally by good coordination can lead to misleading conclusions. To help navigate the development of logic models (W.K. Kellogg Foundation, 2004) for interventions to improve care coordination, we recommend the COORA framework (Möckli et al., 2023).

4.1. Strengths & limitations

This study has notable strengths and limitations. On the one hand, the application of the COORA framework creates consistency and transparency in the concept of coordination and its relationship to outcomes, which is a strength. In addition, the combination of perspectives on quality of care provides a more accurate image on how coordination is related to outcomes. On the other hand, due to the cross-sectional design and the country-specific functions of homecare services, our findings' generalizability is limited. Mainly due to the COVID pandemic, we did not enlist the targeted sample size of homecare agencies and the representativeness of the agency sample is questionable. Further, voluntary participation of agencies, employees and clients may have led to selection bias. The random selection of homecare agencies, as well as the sufficiently-large sample to increase power, and the good response rate may have reduced this problem. However, it must be noticed that the number of employee participants dropped from 3223 to 1784 for this analysis, given we only included participants involved in exchanges with other professions. Clients who answered the questionnaire may have been in above-average health. To diminish this problem, clients' relatives were actively encouraged to assist in completing the questionnaires. Furthermore, it needs to be taken into account that data were collected during the COVID pandemic, which likely impacted overall health care use during 2020 (i.e., homecare services, doctor visits, ED visits, hospitalizations) (Pellegrini et al., 2022). Due to the nature of data collection, we may have introduced biases regarding recall and social desirability, and considering that both healthcare service use and care coordination are reported by the clients, self-reporting bias is likely involved. Further, validated instruments to capture coordination are not available, our self-developed questions are not validated, and unmeasured confounding factors may impact the outcomes.

4.2. Further research

Further research should focus on developing and validating a coordination questionnaire that reliably measures the process of coordination. In addition, in terms of research design, to collect data that reflects care coordination perceptions per case/interaction between health care providers and their clients would allow a deeper understanding of the different perspectives. The COORA framework provides guidance for just such a development. In addition, it would be useful to test the COORA framework in other health care settings, such as hospitals or nursing homes. For quality indicators, we strongly recommend further research to create a selection of indicators that reliably measure diverse aspects of care quality while relating accurately to coordination.

5. Conclusion

As this study indicates, interprofessional coordination contributes crucially to high-quality health care. Coordination problems including

gaps in information flow and non-involvement of homecare workers in hospital discharge were identified, with communication (whether personal or impersonal) playing a particularly important role in ensuring the flow of information. At a time when the range of medical treatment options is greater than ever before, but must increasingly be weighed against budgetary constraints, the way health care is organized and coordinated is crucial and should be a key focus for all involved in health care delivery. However, from a research perspective, both measuring and operationalizing the process of coordination and quality of care remain challenging issues. The COORA framework can provide guidance in the development of research questions, the operationalization of coordination, and especially the development and evaluation of relevant interventions.

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Consent for publication

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CRediT authorship contribution statement

Nathalie Möckli: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Michael Simon:** Writing – review & editing, Validation, Supervision, Methodology, Conceptualization. **Kris Denhaerynck:** Writing – review & editing, Validation, Methodology, Formal analysis. **Tania Martins:** Writing – review & editing, Validation, Project administration, Data curation. **Carla Meyer-Massetti:** Writing – review & editing, Validation, Conceptualization. **Roland Fischer:** Writing – review & editing, Validation, Conceptualization. **Franziska Zúñiga:** Writing – review & editing, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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