Taylor & Francis
Taylor & Francis Group

Journal of Interprofessional Care

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/ijic20

Proximity and information sharing in hospitals and nursing homes: Development of an instrument assessing health personnel's perceptions of proximity and information sharing with kitchen personnel

Kjersti Berge Evensen & Elisabeth Lind Melbye

To cite this article: Kjersti Berge Evensen & Elisabeth Lind Melbye (2023): Proximity and information sharing in hospitals and nursing homes: Development of an instrument assessing health personnel's perceptions of proximity and information sharing with kitchen personnel, Journal of Interprofessional Care, DOI: 10.1080/13561820.2023.2202187

To link to this article: https://doi.org/10.1080/13561820.2023.2202187

Published online: 10 May 2023.

JOURNAL OF INTERPROFESSIONAL CARE
https://doi.org/10.1080/13561820.2023.2202187

Taylor & Francis
Taylor & Francis Group

Proximity and information sharing in hospitals and nursing homes: Development of an instrument assessing health personnel's perceptions of proximity and information sharing with kitchen personnel

Kjersti Berge Evensen[a,b] and Elisabeth Lind Melbye[a,b]

[a]UiS Business School, University of Stavanger, Stavanger, Norway; [b]Research Department, Oral Health Centre of Expertise, Rogaland, Stavanger, Norway

ABSTRACT

Healthcare services are becoming increasingly specialized, potentially hampering interprofessional care. To provide holistic treatment and care, different professions and departments need to share information. Healthcare services also include support services, such as institutional food services, and health personnel and kitchen personnel need to share information about food and patients to serve food adapted to the patients' nutritional needs. Healthcare institutions mainly use formal information-sharing systems, but informal communication is considered more suitable for exchanging complex information. Physical and social proximity may facilitate informal information sharing across different professions and units. We aimed to develop and test an instrument for assessing health personnel's perceptions of physical and social proximity to, and information-sharing practices with, kitchen personnel and to describe associations between physical and social proximity and information-sharing practices. A survey questionnaire measuring proximity and information-sharing practices was developed and distributed to 368 health personnel. Scale analyses were performed to test the psychometric properties of the measures included in the questionnaire. MANOVA and regression analyses were run to assess associations between proximity and information-sharing practices. The results indicated reasonable validity of the measures, and both physical and social proximity were associated with increased informal information sharing.

ARTICLE HISTORY
Received 3 June 2022
Revised 28 March 2023
Accepted 29 March 2023

KEYWORDS
Healthcare service; information sharing; institutional food service; integration; interprofessional cooperation; proximity

Introduction

Patient care is complex and often provided by professionals with different backgrounds and from different departments, each specialized within their own profession (Axelsson & Axelsson, 2006; Øvretveit, 2000). This specialization can be beneficial for patients, as a specialized healthcare provider has in-depth knowledge about specific diseases and treatments (Chowdhury et al., 2007). The shortcoming of this specialization is that it may hinder integrated care and interprofessional cooperation (Currie et al., 2008; Kroezen et al., 2014; Pham et al., 2008). The importance of interprofessional cooperation is especially noticeable when patient treatment requires input from several different professions (Lega & DePietro, 2005; Liberati et al., 2016; Meijboom et al., 2011).

Healthcare is generally provided by health personnel or traditional healthcare departments; however, other personnel and support services are also important in the treatment and care of patients. For in-patients in hospitals and nursing homes, institutional food is one such support service. Providing food that satisfies patients' nutritional requirements is an essential part of patient treatment and care in hospitals and nursing homes (Adler-Nissen, 2013; Johns et al., 2013). Unfortunately, undernutrition remains an underestimated challenge in both hospitals and nursing homes (Cereda et al., 2016; Johns et al., 2013; Tangvik et al., 2015). One factor that may contribute to the high prevalence of undernutrition in healthcare institutions is the organization of institutional food services.

Background

In Norway and several other countries, some smaller kitchens located close to patients have been replaced with larger kitchens located outside institutions (Adler-Nissen et al., 2013; Beck et al., 2001; Ministry of Health and Care Services, 2018). As a consequence, food production and meal service are separated, requiring cooperation and integration across the different professions and departments involved (Beck et al., 2001; Engelund et al., 2007; Ministry of Health and Care Services, 2018). Supporters of this trend argue that this way of organizing institutional food services is cost-effective and that new food production techniques can be used to make food with the same quality as that produced in smaller kitchens (Adler-Nissen, 2007; Engelund et al., 2007, 2008; Wright et al., 2006). Critics of this trend, however, claim that the separation of point-of-production and point-of-service can negatively impact the quality of food (Adler-Nissen et al., 2013; Post et al., 2008). Critics also point to another obstacle when more centralized kitchens replace smaller kitchens located closer to the patients: it is more difficult for both patients and health

CONTACT Kjersti Berge Evensen kjersti.berge.evensen@throg.no UiS Business School, University of Stavanger, Stavanger N-4036, Norway

personnel to provide feedback directly to the kitchen, which may impede the kitchen's ability to adapt the food to the patients' nutritional requirements (Engelund et al., 2007; Hartwell et al., 2006; Johns et al., 2013; Lassen et al., 2006). The Council of Europe highlighted a lack of patient input, poor knowledge about the patients and a lack of cooperation between different professions involved in food and food production as critical barriers to optimal institutional food services (Beck et al., 2001; Sivonen, 2002).

The shift from smaller, local institutional kitchens to more distant, large-scale kitchens may therefore make interprofessional cooperation difficult. According to Structural Contingency Theory (SCT; Lawrence & Lorsch, 1967), for an organization to perform successfully, it must adapt its information strategies to the environment in which they operate. Healthcare organizations, including their support services, operate in an environment with a high level of work-related uncertainty (Axelsson & Axelsson, 2006): the various tasks regarding patient care change rapidly in line with patients' shifting needs, patients being admitted and discharged and personnel's differing shifts (Evensen & Hansen, 2016; Gittell, 2002; Paulsen et al., 2013). Work-related uncertainty increases the information requirements (Gittell, 2002; Tushman, 1979) and calls for more complex and flexible information-sharing practices, that is, informal information sharing (Daft & Lengel, 1986; Lawrence & Lorsch, 1967). Informal information sharing is information shared face-to-face, and is considered to be more suitable for exchanging information that is complex and easy to misinterpret (Daft et al., 1987).

Healthcare services make extensive use of formal information, that is, information shared through electronic information systems (Daft & Lengel, 1986). Electronic information systems have the potential to improve coordination across different professions and departments involved in patient care by making information electronically available and allowing for the exchange of patient-related information (Gittell & Weiss, 2004). However, these systems have a limited capacity to capture non-medical aspects of patient care and treatment, such as social aspects or personal needs (Suter et al., 2009). Because information in a healthcare setting is often ill-defined and changes rapidly, the lack of appropriate, more flexible and urgent systems for informal information sharing is considered one of the main barriers to effective integration of various tasks and services within healthcare services, including food service (Coiera & Tombs, 1998; Gittell, 2002; Meijboom et al., 2011). To enable the sharing of complex information and rapid adaptation of food to patients' nutritional requirements, informal information-sharing practices should be used alongside formal ones in institutional food services (Donaldson, 2001; Gittell, 2002; Lawrence & Lorsch, 1967; Meijboom et al., 2011).

The literature on information sharing within organizations shows that physical closeness is beneficial for communication (Farris, 1979; Kiesler & Cummings, 2002; O'Malley et al., 2009). Close physical proximity enables *informal* information sharing, which optimizes communication, thereby facilitating interprofessional cooperation. However, the positive effects of physical proximity on communication seem to be reduced when the physical distance exceeds 30 meters (Kiesler & Cummings, 2002). Social proximity may compensate for the long distance. Research has indicated that complex information is more easily exchanged if there is a social relationship between the sender and the receiver of the information (Anchona & Caldwell, 1992; Cott, 1997; Farris, 1979; Gittell & Weiss, 2004; Kiesler & Cummings, 2002).

Therefore, given the impact of food and nutrition on patients' health and the importance of interprofessional care, it seems important to gain more insight into cooperation across professions in institutional food services. Much research has been done on integration and information sharing in general, and some on integration and information sharing in healthcare services, but very little on integration through information sharing in institutional food services. This is despite the importance of information sharing and integration for successful patient care in general (Drupsteen et al., 2011; Hall, 2005; La Rocca & Hoholm, 2017; Suter et al., 2009). Several researchers have called attention to the knowledge gap in information sharing in institutional food services (Beck et al., 2001; Diez-Garcia et al., 2012; Engelund et al., 2007; Lassen et al., 2006).

A barrier to the research has been a lack of validated instruments for measuring information sharing and proximity (Knoben & Oerlemans, 2006; Schultz et al., 2013). As a consequence, it has been difficult to measure the impact of different forms of proximity on information sharing in organizations, including healthcare institutions. Findings from a qualitative study by Evensen and Hansen (2016) indicated that proximity influenced informal information sharing across different professions in institutional food services. However, the findings of this study should be tested quantitatively, and there is a need for validated measures. Following from this, the objective of the present study was to develop and test an instrument (survey questionnaire) for assessing health personnel's perceptions of physical and social proximity to, and information-sharing practices with, kitchen personnel.

Method

Participants and procedures

We recruited nurses, auxiliary nurses, and healthcare assistants from 11 nursing homes and 2 university hospitals in Norway. These professions were chosen because they are "front-line workers," responsible for many aspects of patient care, including serving food to patients under their care (Evensen & Hansen, 2016).

Undernutrition is prevalent among patients in nursing homes and hospitals; therefore, both types of institutions were included in the study. It is often difficult to obtain a high response rate in surveys among health personnel (Bjertnaes et al., 2008). To account for this, and because an adequate sample size is essential for some of the statistical techniques used in the study (Pedhazur & Schmelkin, 1991), we invited>1,200 nursing staff to participate.

To gain access to the population of interest, we contacted the heads of the institutions to inform them about the study and ask for permission to invite their staff to respond to

a survey about proximity to, and information sharing with, kitchen personnel. Managers of the institutions/wards were asked to distribute the survey to their staff. Of the 1,202 personnel invited to take part in the survey, 368 (30.60%) agreed to participate: 233 nurses (46.60%), 102 auxiliary nurses (20.40%), and 33 healthcare assistants (6.60%).

The study was discussed with the Norwegian Centre for Research Data (NSD). NSD concluded that the project did not need approval as it did not collect any sensitive data.

Development of the survey questionnaire

The process of developing items for the survey questionnaire was guided by Frankfurt-Nachimas et al.'s (2015) recommendations and was deductively driven. It was built upon an overview of relevant literature, different theoretical approaches and knowledge derived from a recent qualitative study (Evensen & Hansen, 2016). The findings from the qualitative study indicated that the size and location of the kitchen seemed to influence the information-sharing practices across professions involved in food service. According to Frankfurt-Nachimas et al. (2015), developing a measurement instrument starts with describing the empirical world by using *concepts* followed by *operationalization* of these concepts to create measurable variables (e.g., *questionnaire items)*.

Proximity Items

The conceptual definitions of the proximity dimensions used in this study were offered by Farris (1979) and were used as a starting point for the operationalization of the proximity items. The operationalization of *physical proximity* (i.e., the categorization of kitchens in terms of size and location) was guided by findings from the qualitative study by Evensen and Hansen (2016) and included three categories: (a) small-scale local kitchen (producing food for one institution only, approximately 50 residents or in-patients), (b) large-scale kitchen located at the institution (producing food for>1000 residents or in-patients), or (c) large-scale central kitchen located outside the institution (producing food for>1000 residents or in-patients). The operationalization of *social proximity* was derived from Cott (1997), and three items were adapted to the specific setting of institutional food service (e.g. by changing the word *team-member* in the original items to *kitchen personnel)*. These items aimed to elicit health personnel's degree of social interaction with kitchen personnel, measuring the degree of social interaction, social behavior and knowledge of other employees. Response alternatives were given on a Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores indicated a higher level of perceived social proximity.

Information-sharing items

The conceptual definition of different ways of sharing information offered by Media Richness Theory (MRT; Daft et al., 1987) was used as a starting point for operationalization of items aiming at measuring different information-sharing practices across health personnel and kitchen personnel involved in institutional food services. Knowledge of institutional food services obtained in the qualitative study by Evensen and Hansen (2016) served as a backdrop to ensure all items were adapted to the present study setting. The operationalization resulted in 13 items assessing formal and informal information sharing with kitchen personnel. Also here, response alternatives were given on a Likert scale ranging from 1 (*never)* to 5 (*always)*. Higher scores indicated a higher rate of a given behavior (i.e., type of information sharing).

Pretesting

Item development resulted in a draft survey questionnaire, including two proximity scales (i.e., items measuring physical and social proximity, respectively) and two information-sharing scales (i.e., items measuring formal and informal information sharing, respectively) s The questionnaire was pretested in three steps, following the guidelines by Frankfurt-Nachimas et al. (2015), to ensure face and content validity. In the first step, nine organizational researchers examined the questionnaire's flow and salience and considered whether the items captured relevant elements of the phenomena proximity and information sharing. They also identified irrelevant or poorly worded items. We revised the questionnaire based on their feedback. In the second step, we distributed the revised questionnaire to 28 informants from the study's population of interest. We asked the respondents to fill out the questionnaire and consider its relevance to their setting in terms of expressions, words, and items. We subsequently changed some wordings to increase its comprehensibility. In the third step, 10 nurses working as heads of different wards in nursing homes and hospitals evaluated the questionnaire items. They did not have suggestions for further changes, and the survey was then considered ready for distribution.

Statistical testing

All analyses were conducted using IBM SPSS Statistics for Windows, Version 26.0 (IBM SPSS Statistics, Armonk, NY).

Evaluation of the physical proximity scale

Although the social proximity and information-sharing items have interval-level response alternatives and therefore can be tested using factor analytic techniques, the nominal nature of the physical proximity categories leaves these techniques irrelevant. Thus, the statistical testing of this measure's validity was limited to criterion-related validity assessing associations between the location of the kitchen and the various information-sharing practices. MANOVA was used with location of the kitchen as the independent variable and information-sharing practices to and from the kitchen as dependent variables. To further determine which of these categories (i.e., kitchen locations) differed from each other, the Tukey post hoc test was applied. Before running MANOVA, the following assumptions described by Pallant (2013) were tested and considered: sample size, normality, outliers, linearity, multicollinearity, singularity, and homogeneity of variance.

Evaluation of the social proximity and information-sharing scales

First, exploratory factor analysis was applied to assess the dimensionality (i.e., the convergent and discriminant validity) of the social proximity and information-sharing scales, respectively. Tabachnick and Fidell (2013) recommended correlation matrices with several coefficients greater than .30, KMO values of .60 or greater, and a significant Bartlett's test ($p < .05$) for factor analysis to be considered appropriate. Factor loadings of .40 or higher on the assigned scale were used as a criterion for convergent validity; cross-loadings of less than .40 on any other scale were used as a criterion for divergent validity (Hair et al., 2010). The Kaiser criterion (i.e., eigenvalue>1; Kaiser, 1960) was used to determine the number of factors to retain.

Internal consistency reliability for the scales resulting from factor analysis was tested using Cronbach's alpha, with alphas above .70 considered good. However, alpha is affected by the number of items, and since the number of items on these scales was relatively low, alpha values below .70 were also accepted (Cortina, 1993; Pedhazur & Schmelkin, 1991). Following factor analysis, scores for each of the exposed factors (here referred to as scales) were calculated, and the condensed measures were used in further analyses. Bivariate correlations were used as an extended test of divergent validity using coefficients <.85 as a cutoff point (Brown, 2005). The distribution of scores on each scale was assessed by calculating mean and standard deviation. Finally, a series of regression analyses with social proximity as an independent variable and information-sharing practices as dependent variables were run to evaluate associations between social proximity and the various information-sharing practices as a test of the scales' criterion-related validity.

Results

Evaluation of the physical proximity scale

All assumptions for MANOVA were met (Pallant, 2013), except the assumption of homogeneity of variance. The violation of this assumption may be due to the three different categories constituting the independent variable having unequal sample sizes. This is usually not considered a problem in MANOVA, and there is no good rule of thumb for the point at which unequal sample sizes make heterogeneity of variance a problem (Pallant, 2013; Pedhazur & Schmelkin, 1991). According to Tabachnick and Fidell (2013), a sample size of at least 20 in each cell should ensure robustness, and this criterion was met. However, to increase the chances of obtaining a valid measure of whether there were statistically significant differences between the categories, Pillai's Trace (which is considered a more robust test statistic in cases of departures from assumptions) was used instead of Wilks' Lambda (Pedhazur & Schmelkin, 1991).

We ran MANOVA to test whether the location of the institutional kitchen was associated with various information-sharing practices, and we found a statistically significant difference in information sharing based on the location of the kitchen. When the results for the dependent variables were considered separately, formal information sharing *to* the kitchen, informal information sharing *to* the kitchen, and informal information sharing *from* the kitchen – showed statistical significance. The partial eta squared, representing the proportion of the variance in the dependent variable that can be explained by the independent variable, ranged from .14 to .37. According to generally accepted criteria (Pedhazur & Schmelkin, 1991), these values are considered moderate to strong. Post hoc comparisons using the Tukey HSD test indicated that health personnel working in institutions with local small-scale kitchens reported significantly higher levels of both formal and informal information sharing *to* the kitchen and informal information sharing *from* the kitchen than health personnel working in institutions with large-scale kitchens either in the institution or outside it (see Table 4). These results indicate that health personnel working in institutions with small-scale kitchens located in the institution share more information, both formally and informally, with kitchen personnel. They also receive more information informally from kitchen personnel.

Evaluation of the social proximity scale

Our data on social proximity fulfilled the prerequisites for factor analysis described under *statistical testing* in the Methods section. Inspection of the scales' correlation matrices showed consistently significant positive correlations, most of them larger than .30. The KMO value for the scale was .77, and Bartlett's Test of Sphericity reached statistical significance ($p < .001$). Exploratory factor analysis on the *social proximity items* revealed the presence of one factor with eigenvalue exceeding 1, explaining 23% of the variance in our data. Thus, the social proximity factor (scale) included all three items describing health personnel's perceived social proximity to personnel in the institutional kitchen (Table 1). The internal consistency coefficient (Cronbach's alpha) was .76.

The mean score for the social proximity variable was 1.50, indicating that the health personnel in our sample perceived a low level of social proximity to personnel in the institutional kitchen (Table 4).

Evaluation of the information-sharing scales

The data on information sharing also fulfilled the prerequisites for factor analysis (see *Statistical Testing* in the Methods section). Because information sharing *to* and *from* the institutional kitchen represents *sending* and *receiving* information, factor analyses were performed separately for items measuring each of these perspectives. Inspection of the scales' correlation matrices showed consistently significant positive correlations,

Table 1. Results from factor analysis on the social proximity items including factor loadings, variance explained and Cronbach's alpha.

Social proximity items	Social Proximity
Item 1: know the people	.88
Item 2: talk casually	.82
Item 3: coffee and lunch	.77
R^2	.23
α	.76

Table 2. Factor structure of the items assessing information sharing to the institutional kitchen including factor loadings, variance explained and Cronbach's alpha for each factor.

Information-sharing items	Informal information sharing	Formal information sharing
Informal information sharing (item 5: regular meetings)	.81	
Informal information sharing (item 6: coincidental meetings)	.75	
Informal information sharing (item 7: during lunch)	.91	
Formal information sharing (item 3: call at set times)		.68
Formal information sharing (item 2: e-mail)		.68
Formal information sharing (item 1: electronic information sharing)		.64
Formal information sharing (item 4: call if important)		.76
R^2	.40	.19
α	.77	.60

Table 3. Factor structure of the measure assessing information sharing from the institutional kitchen including factor loadings, variance explained and Cronbach's alpha for each factor.

Information-sharing items	Informal information sharing	Formal information sharing
Informal information sharing (item 4: regular meetings)	.67	
Informal information sharing (item 6: during lunch)	.87	
Informal information sharing (item 5: coincidental meetings)	.86	
Formal information sharing (item 1: electronic information sharing)		.80
Formal information sharing (item 2: e-mail)		.78
Formal information sharing (item 3: call if important)		.60
R^2	.44	.20
α	.75	.55

most of them larger than .30. The KMO values for the were .75 and .81, and Bartlett's Test of Sphericity reached statistical significance ($p < .001$) for both scales, supporting the factorability of the correlation matrices.

As hypothesized when developing items for these scales, exploratory factor analysis on the scale measuring information sharing *to* the institutional kitchen *from* health personnel revealed a two-factor (two subscales) solution, and the items loaded onto different factors according to whether they represented formal or informal information sharing (Table 2).

Similarly, exploratory factor analysis on the scale measuring how health personnel received information *from* the institutional kitchen also showed a two-factor (two subscales) solution. The items also loaded onto different factors according to whether they represented formal or informal information sharing (Table 3).

Even though Cronbach's alpha values for two of these subscales were below .70, the factor solutions made both theoretical and intuitive sense. It was thus decided to retain the resulting four subscales measuring different forms of information sharing across health personnel and personnel in the institutional kitchen.

As an extended test of divergent validity, bivariate correlations were run separately for the information-sharing subscales related to giving and receiving information, respectively. Divergent validity was supported with correlation coefficients well below the chosen threshold of .85.

Mean scores for information sharing *to* and *from* the institutional kitchen varied between 1.20 and 1.62, indicating that the level of perceived information sharing across health and kitchen personnel was relatively low (Table 4).

As a test of criterion-related validity, four bivariate regression models were run to describe associations between social proximity and the four information-sharing variables that

Table 5. Results from a regression on information sharing to institutional kitchen including beta values (SD) and variance explained.

	B	SD
Formal information sharing		
Social proximity of institutional kitchen	**.17***	0.06
R^2	.06	
Informal information sharing		
Social proximity of institutional kitchen	**.43***	0.04
R^2	.19	

*$p < 0.05$.

Table 4. Means and SDs for various information-sharing practices depending on the physical location of the kitchen.

Dependent variable	Independent variable	M	SD
Formal information sharing to institutional kitchen	Kitchen at institution	1.73	0.11
	Kitchen outside institution	1.54	0.06
	Local small-scale kitchen	**2.02***	0.14
Informal information sharing to institutional kitchen	Kitchen at institution	1.10	0.08
	Kitchen outside institution	1.18	0.04
	Local small-scale kitchen	**1.91***	0.10
Formal information sharing from institutional kitchen	Kitchen at institution	1.56	0.11
	Kitchen outside institution	1.50	0.06
	Local small-scale kitchen	**1.96***	0.14
Informal information sharing from institutional kitchen	Kitchen at institution	1.12	0.07
	Kitchen outside institution	1.18	0.06
	Local small-scale kitchen	1.60	0.09

*$p < 0.05$.

Table 6. Results from a regression on information sharing from institutional kitchen including beta values (SD) and variance explained.

	B	SD
Formal information sharing		
Social proximity of institutional kitchen	.19*	0.06
R^2	.10	
Informal information sharing		
Social proximity of institutional kitchen	.30*	0.04
R^2	.13	

*$p < 0.05$.

resulted from factor analyses (i.e., informal and formal information sharing to and from the institutional kitchen). Different information-sharing practices served as dependent variables, while social proximity served as the independent variable in all models. Positive and statistically significant associations were found between perceived social proximity and informal and formal information sharing to and from the institutional kitchen. This indicated that health personnel who perceived greater social proximity to kitchen personnel shared more information with, and received more information from, the kitchen. Beta coefficients, R-squared and significance levels are presented in Tables 5 and 6.

Discussion

The present study is among the first to develop and test an instrument measuring proximity and information sharing in institutional food services and to assess the relationships between these variables. Our results suggest reasonable validity of both the proximity and the information-sharing scales developed, and provide support for theoretically expected associations between physical and social proximity and various information-sharing practices.

Our analyses included assessment of dimensionality (i.e., convergent and divergent validity), internal consistency reliability, and criterion-related validity for the scales developed. Both information-sharing scales showed a two-factor solution, corresponding well with the assumptions of MRT about different levels of information sharing ranging from formal to informal. However, the suboptimal alpha values (below .70) found in two of the information-sharing subscales may be questioned. Pedhazur and Schmelkin (1991) claim that when dealing with constructs with high conceptual ambiguity, values below .70 can be expected. From the literature on information sharing, it is well known that measuring these concepts is difficult due to the high level of conceptual ambiguity (Johnson et al., 1994). The low number of items may also have affected the alpha (Cortina, 1993). Furthermore, theoretical and practical considerations concerning a specific research study are essential for a decision regarding the choice of reliability estimates. In research that takes place in more realistic settings, that is, within socio-behavioral sciences, there should be less restrictive assumptions regarding reliability than in more controlled studies (Pedhazur & Schmelkin, 1991).

Bivariate correlation analyses were used as an extended test of divergent validity. Moderate correlations were revealed. However, none of these correlations were large enough to compromise the divergent validity of the scales. Correlations between informal information-sharing subscales and formal information-sharing subscales could be expected, as the scales represent conceptually close constructs. According to Johnson et al. (1994), an organization's information-sharing structure consists of both formal and informal elements and is often not reducible to either.

The results from MANOVA suggested that a small-scale local institutional kitchen has favorable effects on both formal and informal information sharing *to* the institutional kitchen, and on health personnel's perception of informal information sharing *from* the institutional kitchen. These findings are supported by former studies on physical proximity, indicating that people who are physically proximate to each other share more information informally (Kiesler & Cummings, 2002). The results did not show any effect of a larger institutional kitchen located at the institution on any of the information-sharing practices. Some scholars (e.g. Kiesler & Cummings, 2002) suggest that temporal physical proximity may compensate for the absence of a permanent, close physical proximity. This implies that health personnel and kitchen personnel do not need to be in constant physical proximity to share information informally, but that meetings, short visits, and temporary co-location might be sufficient for them to build other forms of proximity (Knoben & Oerlemans, 2006). Findings from the present study support this assumption, indicating that social proximity facilitate informal information sharing as well. Our results show significant positive associations between social proximity and information sharing both *to* and *from* the institutional kitchen, supporting theoretically expected relationships between these variables (Cott, 1997; Kiesler & Cummings, 2002; Knoben & Oerlemans, 2006).

Strengths and limitations

Among the strengths of the present study is that it provides an extension of previous research by developing and testing measures of proximity and information-sharing practices in a healthcare setting. Furthermore, the present study links these two theoretically associated concepts, contributing to an increased understanding of the mechanisms underlying information sharing in healthcare organizations.

The present research also has some limitations. Communication is a two-way process, and only having one of the groups' perspectives on communication in institutional food services is a weakness. Also, the developed instrument included scales with relatively few items. Nevertheless, few, if any, previous studies on this phenomenon in this particular context exist. Consequently, this study could not build on any preexisting scales. The small number of items may have affected the analysis and results (Cortina, 1993), and future studies should aim to increase the number of items to capture more aspects of the concepts measured and to make analyses and results more reliable. However, these limitations should be seen against the background of the current state of knowledge. Given that this study has provided some knowledge on this underexplored topic in the present study context, there is ample scope for further research.

Nevertheless, the small item pool was, to some extent, justified by the well-known difficulties in obtaining a high

response rate in surveys among health personnel (Bjertnaes et al., 2008). Despite the relatively brief measurement instrument, there was a lower response rate than expected. This is an obvious limitation of the present work. There may be several plausible explanations for the low response rate. For instance, the lack of direct information from the researcher(s) to the respondents (the surveys were distributed through institution/ward managers) may have hindered a higher response rate.

As described in the introduction section, the lack of validated instruments and lack of knowledge on information sharing in institutional food service implied an exploratory approach for present research. Exploratory studies are usually conducted when the field is yet unclear, and it allows the researcher to be familiar with the concept to be studied and to draw preliminary conclusions about designs, ideas and methods. Findings from this study must therefore be considered preliminary and in need for further exploration in various samples and settings. However, the present work has prepared the ground for further development of a measurement instrument adapted to a health care/food services setting.

Conclusion

The present study extends the literature on factors possibly influencing institutional food services by suggesting that proximity may increase information sharing across personnel involved in food services. In particular, physical proximity seems to be important for informal information sharing. However, social proximity also seems to increase informal information sharing, suggesting that social meetings and personal knowledge of each other may, to some extent, compensate for physical distance.

Acknowledgments

We thank the institutions and health personnel who participated in this study. We are also grateful to the University of Stavanger and Måltidets Hus for funding this project.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

Funded by the University of Stavanger and Måltidets hus, Stavanger, Norway.

Notes on contributors

Kjersti Berge Evensen is a PhD/clinical psychologist.

Elisabeth Lind Melbye is a PhD/RD.

Author contributions

KBE designed the study, collected and analyzed the data and drafted the manuscript. ELM contributed to the analyses and writing of the article. Both authors read and approved the final manuscript.

Consent for publication

Consent was obtained from both authors.

Ethics approval and consent to participate

The study was discussed with the Norwegian Centre for Research Data (NSD). Because no sensitive or personal information was collected, the NSD decided that the project did not need approval. Informed consent was obtained from all participants before data collection.

Data availability statemenet

The data and measurement instrument used in this study are available from the corresponding author upon request.

References

Adler-Nissen, J. (2007). Continuous wok-frying of vegetables: Process parameters influencing scale up and product quality. *Journal of Food Engineering*, *83*(1), 54–60. https://doi.org/10.1016/j.jfoodeng.2006.11.002

Adler-Nissen, J., Akkerman, R., Frosch, S., Grunow, M., Løje, H., Risum, J., Wang, Y., & Ørnholt-Johansson, G. (2013). Improving the supply chain and food quality of professionally prepared meals. *Trends in Food Science & Technology*, *29*(1), 74–79. https://doi.org/10.1016/j.tifs.2012.08.007

Anchona, D. G., & Caldwell, D. (1992). Bridging the boundary: External activity and performance in organizational teams. *Administrative Science Quarterly*, *37*(4), 634–665. https://doi.org/10.2307/2393475

Axelsson, R., & Axelsson, S. B. (2006). Integration and collaboration in public health—A conceptual framework. *The International Journal of Health Planning and Management*, *21*(1), 75–88. https://doi.org/10.1002/hpm.826

Beck, A. M., Balkn, U. N., Fürst, P., Hasunen, K., Jones, L., Keller, U., Melchior, J. C., Mikkelsen, B. E., Schauder, P., Sivonen, L., Zinck, O., Øien, H., & Ovesen, L. (2001). Food and nutritional care in hospitals: How to prevent undernutrition– Report and guidelines from the Council of Europe. *Clinical Nutrition*, *20*(5), 455–460. https://doi.org/10.1054/clnu.2001.0494

Bjertnaes, O. A., Garrat, A., & Botten, G. (2008). Nonresponse bias and cost-effectiveness in a Norwegian survey of family physicians. *Evaluation and Health Professions*, *31*(1), 65–80. https://doi.org/10.1177/0163278707311874

Brown, T. A. (2005). *Confirmatory factor analysis for applied research* (2nd ed.). Guilford Publications.

Cereda, E., Pedrolli, C., Klersy, C., Bonardi, C., Quarleri, L., Cappello, S., Turri, A., Rondanelli, M., & Caccialanza, R. (2016). Nutritional status in older persons according to healthcare setting: A systematic review and meta-analysis of prevalence data using MNA®. *Clinical Nutrition*, *35*(6), 1282–1290. https://doi.org/10.1016/j.clnu.2016.03.008

Chowdhury, M. M., Dagash, H., & Pierro, A. (2007). A systematic review of the impact of volume of surgery and specialization on patient outcome. *British Journal of Surgery Society*, *94*(2), 145–161. https://doi.org/10.1002/bjs.5714

Coiera, E., & Tombs, V. (1998). Communication behaviors in a hospital setting: An observational study. *BMJ*, *316*(7132), 673–676. https://doi.org/10.1136/bmj.316.7132.673

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *The Journal of Applied Psychology*, *78*(1), 98–104. https://doi.org/10.1037/0021-9010.78.1.98

Cott, C. (1997). "We decide, you carry it out": A social network analysis of multidisciplinary long-term care teams. *Social Science and Medicine*, *45*(9), 1411–1421. https://doi.org/10.1016/s0277-9536(97)00066-x

Currie, G., Finn, R., & Martin, G. (2008). Accounting for the "dark side" of new organizational forms: The case of health care professionals. *Human Relations*, *61*(4), 539–564. https://doi.org/10.1177/0018726708091018

Daft, R. L., & Lengel, R. H. (1986). Organisational information requirements, media richness and structural design. *Management Science*, *32* (5), 554–571. https://doi.org/10.1287/mnsc.32.5.554

Daft, R. L., Lengel, R. H., & Trevino, L. K. (1987). Message equivocality, media selection, and manager performance: Implications for information systems. *MIS Quarterly*, *11*(3), 354–366. https://doi.org/10.2307/248682

Diez-Garcia, R. W., de Sousa, A. A., da Costa Proença, R. P., Leandro-Merhi, V. A., & Martinez, E. Z. (2012). Gauging food and nutritional care quality in hospitals. *Nutrition journal*, *11*(66), 66–75. https://doi.org/10.1186/1475-2891-11-66

Donaldson, L. (2001). *The contingency theory of organizations*. Sage Publications.

Drupsteen, J., van der Vaart, T., van Donk, D. P., & Singh Srai, J. (2011). Integrative practices in hospitals and their impact on patient flow. *International Journal of Operations & Production Management*, *33*(7), 912–933. https://doi.org/10.1108/IJOPM-12-2011-0487

Engelund, E. H., Breum, G., & Friis, A. (2008). Optimisation of large-scale food production using lean manufacturing principles. *Journal of Foodservice*, *20*(1), 4–14. https://doi.org/10.1111/j.1748-0159.2008.00109.x

Engelund, E. H., Lassen, A., & Mikkelsen, B. E. (2007). The modernisation of hospital food service- Findings from a longitudinal study of technology trends in Danish hospitals. *Nutrition and Food Science*, *37*(2), 90–99. https://doi.org/10.1108/00346650710736354

Evensen, K. B., & Hansen, H. (2016). Cooperation and information sharing in institutional food chains. *British Food Journal*, *118*, 2388–2403. https://doi.org/10.1108/BFJ-01-2016-0011

Farris, G. (1979). The informal organisation in strategic decision-making. *International Studies of Management and Organization*, *9*(4), 37–62. https://doi.org/10.1080/00208825.1979.11656277

Frankfurt-Nachimas, C., Nachimas, D., & DeWaard, J. (2015). *Research methods in social sciences* (8th ed.). Worth Publishers.

Gittell, J. H. (2002). Coordinating mechanisms in care provider groups: Relational coordination as a mediator and input uncertainty as a moderator of performance effects. *Management Science*, *48*(11), 1408–1426. https://doi.org/10.1287/mnsc.48.11.1408.268

Gittell, J. H., & Weiss, L. (2004). Coordination networks within and across organizations: A multi-level framework. *Journal of Management Studies*, *41*(1), 127–153. https://doi.org/10.1111/j.1467-6486.2004.00424.x

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis. A global perspective*. Pearson Education.

Hall, P. (2005). Interprofessional teamwork: Professional cultures as barriers. *Journal of Interprofessional Care*, *19*(Suppl 1), 188–196. https://doi.org/10.1080/13561820500081745

Hartwell, H. J., Edwards, J. S., & Symonds, C. (2006). Foodservice in hospital: Development of a theoretical model for patient experience and satisfaction using one hospital in the UK National health service as a case study. *Journal of Foodservice*, *17*(5-6), 226–238. https://doi.org/10.1111/j.1745-4506.2006.00040.x

Johns, N., Edwards, J. S. A., & Hartwell, H. J. (2013). Hungry in hospital, well-fed in prison? A comparative analysis of food service systems. *Appetite*, *68*, 45–50. https://doi.org/10.1016/j.appet.2013.04.006

Johnson, J. D., Donohue, W. A., Atkin, C. K., & Johnson, S. (1994). Differences between formal and informal communication channels. *Journal of Business Communication*, *31*(2), 111–122. https://doi.org/10.1177/002194369403100202

Kaiser, H. (1960). The application of electronic computers to factor analysis. *Educational Psychological Measures*, *20*(1), 141–151. https://doi.org/10.1177/001316446002000116

Kiesler, S., & Cummings, J. N. (2002). What do we know about proximity and distance in work groups? A legacy of research. In P. K. Hinds & S. Kiesler (Eds.), *Distributed work* (pp. 57–80). MIT Press.

Knoben, J., & Oerlemans, L. A. G. (2006). Proximity and inter-organisational collaboration: A literature review. *International Journal of Management Reviews*, *8*(2), 71–89. https://doi.org/10.1111/j.1468-2370.2006.00121.x

Kroezen, M., Mistiaen, P., vanDijk, L., Groenwegen, P. P., & Franke, A. L. (2014). Negotiating jurisdiction in the workplace: A multiple-case study of nurse prescribing in hospital settings. *Social Science and Medicine*, *117*, 107–115. https://doi.org/10.1016/j.socscimed.2014.07.042

La Rocca, A., & Hoholm, T. (2017). Coordination between primary and secondary care: The role of electronic messages and economic incentives. *BMC Health Services Research*, *17*(1), 107–115. https://doi.org/10.1186/s12913-017-2096-4

Lassen, K. O., Olsen, J., Grinderslev, E., Kruse, F., & Bjerrum, M. (2006). Nutritional care of medical inpatients: A health technology assessment. *BMC Health Service Research*, *6*, 7. https://doi.org/10.1186/1472-6963-6-7

Lawrence, P. R., & Lorsch, J. W. (1967). *Organization and environment: Managing differentiation and integration*. Harvard University Press.

Lega, F., & DePietro, C. (2005). Converging patterns in hospital organization: Beyond the professional bureaucracy. *Health Policy*, *74*(3), 261–281. https://doi.org/10.1016/j.healthpol.2005.01.010

Liberati, E. G., Gorli, M., & Scaratti, G. (2016). Invisible walls within multidisciplinary teams: Disciplinary boundaries and their effects on integrated care. *Social Science and Medicine*, *150*, 31–39. https://doi.org/10.1016/j.socscimed.2015.12.002

Meijboom, B., Schmidt-Bakx, S., Westert, G., & de Vries, J. (2011). Supply chain management practices for improving patient-oriented care. *Supply Chain Management*, *16*(3), 166–175. https://doi.org/10.1108/13598541111127155

Ministry of Health and Care Services. (2018). A full life - All your life. A quality reform for older persons. Report to the parliament (15). Ministry of Health and Care Services. https://www.helsedirektoratet.no/tema/leve-hele-livet-kvalitetsreformen-for-eldre/St%20Meld%2015%20-%20engelsk.pdf/_/attachment/inline/8561e891-57dd-447b-a184-895b739d74ce:c3c28dd80df596a4c8a05ffe6e5cf2e291198ba0/St%20Meld%2015%20-%20engelsk.pdf

O'Malley, A. S., Grossman, J. M., Cohen, G. R., Kemper, N. M., & Pham, H. H. (2009). Are electronic medical records helpful for care coordination? Experiences of physician practices. *Journal of General Internal Medicine*, *25*(3), 177–185. https://doi.org/10.1007/s11606-009-1195-2

Øvretveit, J. (2000). Total quality management in European healthcare. *International Journal of Health Care Quality Assurance*, *13*(2), 74–79. https://doi.org/10.1108/09526860010319523

Pallant, J. (2013). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS* (4th ed.). Allen and Unwin.

Paulsen, B., Romøren, T. I., & Grimsmo, A. (2013). A collaborative chain out of phase. *International Journal of Integrated Care*, *13*(1), e008. https://doi.org/10.5334/ijic.858

Pedhazur, E. J., & Schmelkin, L. P. (1991). *Measurement, design, and analysis: An integrated approach*. Psychology Press, Taylor and Francis Group.

Pham, H. H., Grossman, J. M., Cohen, G., & Bodenheimer, T. (2008). Hospitalist and care transitions: The divorce of inpatient and outpatient care. *Health Affairs*, *27*(5), 1315–1327. https://doi.org/10.1377/hlthaff.27.5.1315

Post, A., Shanahan, H., & Jonsson, L. (2008). Food processing: Barriers to, or opportunities for, organic foods in the catering sector? *British Food Journal*, *110*(2), 160–173. https://doi.org/10.1108/00070700810849880

Schultz, E. M., Pineda, N., Lonhart, J., Davies, S. M., & McDonald, K. M. (2013). A systematic review of the care coordination measurement landscape. *BMC Health Service Research*, *13*(1), 119. https://doi.org/10.1186/1472-6963-13-119

Sivonen, L. (2002). Managin undernutrition at European level: A council of Europe initiative. *Clinical Nutrition*, *21*(1), 128–130. https://doi.org/10.1016/S0261-5614(02)80025-5

Suter, E., Oelke, N. D., Adair, C. E., & Armitage, G. D. (2009). Ten Key principles for successful health systems integration. *Health Quarterly*, *13*(Special Issue), 16–23. https://doi.org/10.12927/hcq.2009.21092

Tabachnick, B. G., & Fidell, L. (2013). *Using multivariate statistics*. Pearson Education.

Tangvik, R. J., Tell, G. S., & Guttormsen, A. B. (2015). Nutritional risk profile in a university hospital population. *Clinical Nutrition*, *34*(4), 705–711. https://doi.org/10.1016/j.clnu.2014.08.001

Tushman, M. L. (1979). Work characteristics and subunit communication structure: A contingency analysis. *Administrative Science Quarterly*, *24* (1), 82–98. https://doi.org/10.2307/2989877

Wright, R. L. O., Connelly, L. B., & Capra, S. (2006). Consumer evaluation of hospital food service quality: An empirical investigation. *International Journal of Health Care Quality Assurance*, *19*(2), 181–194. https://doi.org/10.1108/09526860610651708