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# Person-Oriented Profiles Can Clarify Variable-Oriented Associations: The Example of Communication with Parents and Adolescents' Mental Health Problems

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**Abstract: Background:** Variable-oriented analyses of time trends in the ease of communicating with mothers and fathers in the Swedish HBSC (Health and Behavior in School-aged Children) dataset show that communication problems with fathers, but not with mothers, positively predict mental health problems among adolescents. This similarity across years is likely to lead to high structural stability in person-oriented analyses across survey years, providing opportunities to uncover typical communication patterns in a robust way. A person-oriented method, cluster analysis, was used in this study to clarify these variable-oriented findings on the prediction of mental health problems. **Methods:** The Swedish HBSC dataset of 15-year-olds for 2002, 2006, 2010, 2014, and 2018, with a total of 9255 participants, was used for variable- and person-oriented analyses. **Results:** Person-oriented analyses of ease of communication with the mother and ease of communication with the father show that poor communication with both parents is associated with the worst mental health problems. They also show that when there is poor communication with mothers, in most cases, adolescents also have poor communication with fathers. The variable-oriented analyses do not show that mental health problems are highest when adolescents find it difficult to communicate with both parents. **Conclusions:** Person-oriented analyses offer the possibility of drawing more specific conclusions about family conditions that affect adolescents' mental health. More generally, person-oriented analyses are likely to clarify the results of variable-oriented analyses in many other areas also.

**Keywords:** communication with parents; mental health problems; person-oriented analyses; variable-oriented analyses; gender differences



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## 1. Introduction

In the present study, we examine variable-oriented analyses of the association between adolescent–parent communication and adolescent mental health problems, where results are highly stable across multiple survey years. This is likely to result in high structural stability of the person-oriented analyses and provides an opportunity to more robustly uncover typical patterns that may not be observed in the variable-oriented analyses. We use a dataset, the Swedish HSBC study, that includes measures of 15-year-olds' communication with their parents and measurements of their mental health across five survey years from 2002 to 2018. Because of the similarity in results when applying regression analyses in each survey year, this was a starting point for combining variable-oriented and person-oriented analyses to understand how the ease or lack of ease of communicating with the father and the mother is related to adolescents' mental health. Can person-oriented analyses (which allow for both linear and non-linear relationships between variables) provide more insight into the results of variable-oriented analyses (which only require linear relationships between variables)? If so, perhaps future studies can use the combined strengths of person-

and variable-oriented techniques to gain a deeper understanding of adolescent mental health problems and other areas.

All major socialization theories in developmental psychology converge in emphasizing the need for harmonious parent–adolescent relationships if parental socialization attempts are to be successful [1]. An important marker of such harmonious relationships is open communication between parents and adolescents. Feeling comfortable talking to parents indicates that adolescents' views are valued and respected and that they are open to parents' socialization attempts. Depressed mood, low self-esteem, expectations of failure, and various internal and external indicators of adolescent maladjustment characterize families in which the adolescent discloses little about his or her daily life [2]. If the family functions as a protective resource for health and well-being, easy communication between parents and adolescents may be an important explanation [3].

A recent review of the association between adolescents' ratings of the quality of parent–adolescent communication and various mental health constructs in clinical and community samples found small to moderate negative associations, with moderate associations more common in the domains of general health and depression [4]. A meta-analysis found that among 15 common psychosocial risk factors for adolescent depression, poor parent–child communication produced the strongest association [5]. Studies using HBSC data have examined the relationship between the ease of family communication and gender, age, socioeconomic status, family structure, and spirituality (e.g., [3,6,7]. These studies suggest that adolescents find it easier to communicate with their mothers than with their fathers. Consistent with easy communication with parents as an important marker of harmonious parent–adolescent relationships is the finding that this communication is significantly related to time spent together and parental care [8]. Good parent–adolescent communication in the HBSC studies is also associated with adolescents' perceptions of life satisfaction [9], low levels of psychosomatic symptoms [10], and low levels of emotional and behavioral problems [11]. The HSBC studies also report an increase in ease of communication with parents over time since early 2002 in several European countries [3,12].

We did not have specific hypotheses about the role of the quality of communication with mothers versus fathers for adolescent mental health, as some studies showed that adolescents' communication and relationship with their mothers had stronger effects on adolescents' mental health than the communication and relationship with their fathers [9,13,14], while other studies showed that adolescents' communication and relationships with their fathers had stronger effects on the adolescents' mental health than the communication and relationships with their mothers [15–18]. Our results from the Swedish HBSC dataset showed that the ease of communication with fathers had stronger effects on the adolescents' mental health than the ease of communication with mothers in all survey years between 2002 and 2018. This consistency across the years was the starting point for comparing whether similar findings from common variable-oriented analyses would also appear when person-oriented analyses are applied to the same data.

If the results of variable-based analyses are the same as the results of person-based analyses, there should be no need to complement variable-based analyses with person-based analyses. They will produce approximately the same results. However, if the results do not converge, there may be a good argument for complementing linear variable-oriented methods with non-linear person-oriented methods.

In this study, we will approach the question of how the ease of communication with parents is related to adolescents' mental health in two steps. First, a variable-oriented approach, regression analyses, will be used to understand the role of the ease of communication with mothers and fathers on adolescents' perceptions of their unhealthiness and psychosomatic symptoms. These analyses will show that adolescents with poor communication with their fathers have poorer mental health than adolescents with good communication with their fathers. These results were obtained in all survey years from 2002 to 2018. With this similarity in beta weights using a variable-oriented method, regression analysis, in a second step, we used a person-oriented method, cluster analysis,

to try to clarify the variable-oriented findings in more detail. We expected to find a high structural stability of the clusters across the survey years. Roughly the same type of cluster would be found at all ages, and the cluster sizes would be similar across the survey years. Variable-oriented and person-oriented approaches can, to some extent, be complementary methods [19]. Variable-oriented approaches examine an individual's relative position on specific variables and draw conclusions about the sample as a whole. A regression analysis assumes that the independent variables are linearly related to the dependent variable at the individual level. The relationships between the independent variables are the same for all individuals. Each variable has the same weight for each person and reflects what is characteristic of the average person [20].

Person-oriented methods do not have the limitations of linearity. Person-oriented approaches examine both the linear and non-linear relationships between the independent variables as a holistic configuration. It is the individual's configuration or profile, rather than the individual variables, that becomes the organizing principle. The key question is as follows: how do people with a particular profile differ from people with other profiles? The aim of the present study is to examine groups of individuals who are homogeneous in terms of their profiles of communication with their parents and study the characteristics of the participants in these communication profiles over the years of the survey and relate them to indicators of mental health problems. In these analyses, we examine gender differences because many previous studies have documented greater mental health problems among adolescent girls than boys [10,21–24].

## 2. Materials and Methods

### *2.1. Participants*

Health and Behavior in School-aged Children (HBSC) is a multinational study across Europe and North America, with a total of 48 countries, conducted in collaboration with the World Health Organization (WHO) Regional Office for Europe, and one of the focus domains is adolescents' mental health [25,26]. The study was initiated in 1983/84, with each country selecting a nationally randomized representative sample of boys and girls aged 11, 13, and 15 years. Here, we use the Swedish HBSC dataset of 15-year-olds for the survey years 2002 (N = 1218), 2006 (1526), 2010 (2090), 2014 (2766), and 2018 (1655). The full sample (9255) is used for the variable-oriented analyses (regression analysis). For the person-oriented analyses (cluster analysis) across the survey years, we decided to have the same number of persons in each year. Therefore, we selected all 1218 15-year-olds in 2002 and randomly sampled 1218 15-year-olds in each of the following years. The reduced sample for the person-based analyses contains 6090 persons (66% of the full sample).

### *2.2. Measures*

In this study, we measure indicators of problematic mental health. We do not include specific measures of psychopathology and psychiatric diagnoses (such as depression, anxiety, suicidal ideation, psychosis, etc.).

**The HBSC Symptom Checklist**, also referred to as a measure of psychosomatic symptoms, has been used in all HBSC surveys since 1986 [27]. The scale is a non-clinical measure of subjective health complaints. It consists of the stem question "In the last 6 months, how often have you had the following. . .?" followed by eight items: "headache", "stomachache", "backache", "feeling low", "irritability or bad temper", "feeling nervous", "difficulty falling asleep", and "feeling dizzy". The response categories are as follows: (1) *rarely or never*, (2) *approximately every month*, (3) *approximately every week*, (4) *more than once a week*, and (5) *approximately every day*. The alpha reliability was 0.84.

**Perceived overall unhealth** is a measure that captures adolescents' overall perception of their health status; it is measured by the single item "Would you say your health is . . .?". Participants were asked to rate their overall health by selecting one of the response categories (1) *poor*, (2) *fair*, (3) *good*, and (4) *excellent*, which were coded inversely [27]. Multiple-item measures are preferred to single-item measures, primarily for reasons of

reliability. However, this item is an attempt to understand how adolescents perceive their own health status without asking for specificity. It should be added that the correlation between perceived overall unhealth and psychosomatic problems ranged between 0.38 and 0.43 ($p < 0.001$) over the years of the survey.

**Ease of communication with mothers and fathers** was measured by asking adolescents how easy it was for them to talk to their father and mother, respectively, about things that really bothered them [27]. The five response options were (1) *very easy*, (2) *easy*, (3) *difficult*, (4) *very difficult*, and (5) *don't have or see that person*. Adolescents who answered that they had no contact with the specific parent were assigned a missing value (4.1% for communication with fathers and 1.4% for communication with mothers). The two scales were reverse-coded to measure the ease of communication with fathers and with mothers. The correlation between the perceived ease of communicating with fathers and mothers ranged from 0.45 to 0.63 ($p < 0.001$) across the survey years. Sex was coded 0 for girls and 1 for boys.

### *2.3. Analyses*

Regression analyses were used for the variable-oriented analyses. The two communication measures, ease of communicating with the father and ease of communicating with the mother, were predictors of perceived overall unhealth and psychosomatic symptoms. For the person-oriented analyses, we used a cluster analysis of the two standardized measures of the ease of communication with parents. First, hierarchical cluster analyses (Ward's method) were used to determine the number of clusters, and the lower bound was set at 67% explanation of the total error sums of squares for the number of clusters selected [20]. Once the number of clusters was known, a non-hierarchical cluster analysis, K-means clustering, was used to arrive at the final cluster solution, as recommended by Kinder, Curtiss, and Kalichman [28]. When comparing boys and girls for parental communication profiles with cross-tabulations, we used the program EXACON, which examines single cell frequencies in contingency tables [29]. A Bonferroni-adjusted $p$-value of 0.05 was used to determine which specific cells in the contingency table occurred more often (a type) and less often (an antitype) than expected by chance.

## 3. Results

Arnarsson and colleagues [12] looked at time trends in the ease of communicating with fathers and mothers in the HBSC in the Nordic countries between 2002 and 2014. They found small increases over time; these trends were not always linear, and the effect sizes were very small. The addition of the survey year 2018 for the Swedish data does not add any more information. The effect size, Cohen's d, when comparing 2002 to 2018 was around 0.02 for the two communication measures. In all survey years, the results showed that it was easier for adolescents to communicate with their mothers than with their fathers.

### *3.1. A Variable Approach*

As shown in Table 1, the regression analyses indicate that the ease of communication with the father is generally a stronger predictor of adolescents' mental health than the ease of communication with the mother. The results in Table 1 hold for all survey years from 2002 to 2018. We tested for differences in regression weights using Cumming's [30] method and found that in predicting perceived overall unhealth, the regression coefficient for communication with the father was significantly different from the regression coefficient for communication with the mother for the 2002, 2010, and 2018 survey years. Clearly, communication with the father is a critical factor in understanding adolescents' mental health. Thus, overall, the linear regression analyses indicate that communication with the father, in particular, is a key factor in understanding adolescents' mental health in the survey years 2002 to 2018. It should be added that a regression analysis for the combined sample that included an interaction between ease of communication with the mother and ease of communication with the father showed that this interaction term was not significant

($p$ = 0.449). The $p$-values for each of the five survey years for perceived overall unhealth were 0.17, 0.06, 0.22, 0.69, and 0.39. The same $p$-values for psychosomatic symptoms were 0.82, 0.85, 0.45, 0.39, and 0.03. We conclude that there is little evidence of an interaction between the ease of communication with mothers and fathers in predicting the two mental health outcomes.

**Table 1.** Prediction of perceived overall unhealth and psychosomatic symptoms from the ease of communicating with fathers and mothers among 15-year-olds at the five survey years. Beta weights for ease of talking to fathers and ease of talking to mothers.

| | **2002** | **2006** | **2010** | **2014** | **2018** |
|---|---|---|---|---|---|
| Perceived unhealth: | | | | | |
| Easy to talk with father | −0.21 <0.001 | −0.17 <0.001 | −0.26 <0.001 | −0.19 <0.001 | −0.27 <0.001 |
| Easy to talk with mother | −0.08 0.003 | −0.13 <0.001 | −0.10 <0.001 | −0.12 <0.001 | −0.11 <0.001 |
| $R^2$ | 0.26 | 0.26 | 0.33 | 0.27 | 0.34 |
| Psychosomatic symptoms: | | | | | |
| Easy to talk with father | −0.29 <0.001 | −0.31 <0.001 | −0.28 <0.001 | −0.29 <0.001 | −0.28 <0.001 |
| Easy to talk with mother | −0.08 0.009 | −0.02 0.458 | −0.11 <0.001 | −0.07 0.002 | −0.14 <0.001 |
| $R^2$ | 0.34 | 0.32 | 0.36 | 0.34 | 0.38 |

That communication with the father is key to understanding adolescents' mental health is the conclusion that can be drawn from the regression analyses for this period. What exactly does it mean that the ease of communicating with the father, rather than the mother, is particularly important for understanding mental unhealthiness among 15-year-olds? This conclusion is the basis for the second step, which is to extend the variable-oriented analyses to person-oriented methods that allow analyses of the heterogeneous population.

### *3.2. A Person-Oriented Approach*

The K-means clusters for all survey years combined are shown in Table 2. As a guide for the response pattern, we have used a low cluster value of <−0.70, an average value between −0.70 and 0.70, and a high value of > 0.70. Four clusters explained 77% of the total error sums of squares. We call these clusters "adequate communication", "poor mother communication", "poor father communication", and "poor father and mother communication". With the criterion of +/−0.70, about 60% of all adolescents were characterized by adequate communication with both parents. Poor communication with the mother was the case for 4%, and poor communication with the father characterized 20% of the adolescents. Finally, 15% of the adolescents had poor communication with both mother and father.

**Table 2.** A cluster analysis of 15-year-olds' communication with their fathers and mothers from 2002 to 2018. Data are aggregated over all five survey years from 2002 to 2018.

| | **Adequate Communication** | **Poor Mother Communication** | **Poor Father Communication** | **Poor Father and Mother Communication** |
|---|---|---|---|---|
| Easy to talk with father | 0.64 | 0.47 | −1.09 | −1.3 |
| Easy to talk with mother | 0.47 | −1.6 | 0.16 | −1.7 |
| $n$ | 3397 | 227 | 1114 | 801 |
| % | 61.3 | 4.1 | 20.1 | 14.5 |

*Note.* The low value is <−0.70, the average value is between −0.70 and 0.70, and the high value is >0.70.

We looked at each of the survey years to examine structural stability over time for the communication clusters, i.e., changes in response patterns (see Table 3). Four clusters were extracted for each individual survey year. They accounted for between 77.2 and 80.1 percent of the total error sums of squares. For the 2002 survey year, we only had to extract three clusters (the low-frequency cluster communicating with the mother did not appear when using the 67% selection rule); however, for comparison purposes, we also selected four clusters for that year. The cluster solutions for each of these years were very

similar to the cluster solutions for the survey years combined. In summary, we conclude that very similar cluster profiles emerged over the five survey years. This indicates a high structural stability of the cluster profiles.

**Table 3.** Cluster analyses of 15-year-olds' communication with their fathers and mothers at each survey year.

| | Adequate Communication | Poor Mother Communication | Poor Father Communication | Poor Father and Mother Communication |
|---|---|---|---|---|
| 2002: | | | | |
| Easy to talk with father | 0.57 | 0.48 | −1.1 | −1.35 |
| Easy to talk with mother | 0.42 | −1.56 | 0.18 | −1.71 |
| *n* | 611 | 53 | 301 | 145 |
| % | 55 | 4.8 | 27.1 | 13.2 |
| 2006: | | | | |
| Easy to talk with father | 0.68 | 0.6 | −0.99 | −1.25 |
| Easy to talk with mother | 0.54 | −1.39 | 0.22 | −1.57 |
| *n* | 626 | 62 | 228 | 183 |
| % | 57 | 5.6 | 20.7 | 16.7 |
| 2010: | | | | |
| Easy to talk with father | 0.7 | 0.51 | −1.03 | −1.18 |
| Easy to talk with mother | 0.53 | −1.58 | 0.23 | −1.53 |
| *n* | 646 | 46 | 237 | 193 |
| % | 57.6 | 4.1 | 21.1 | 17.2 |
| 2014: | | | | |
| Easy to talk with father | 0.59 | 0.33 | −1.13 | −1.36 |
| Easy to talk with mother | 0.44 | −1.56 | 0.19 | −1.69 |
| *n* | 708 | 37 | 175 | 169 |
| % | 65 | 3.4 | 16.1 | 15.1 |
| 2018: | | | | |
| Easy to talk with father | 0.49 | 0.27 | −1.39 | −1.53 |
| Easy to talk with mother | 0.36 | −2.02 | −0.07 | −2.02 |
| *n* | 806 | 29 | 173 | 110 |
| % | 72.1 | 2.6 | 15.5 | 9.8 |

*Note.* The low value is <−0.70, the average value is between −0.70 and 0.70, and the high value is >0.70.

### *3.3. Communication Profiles and Mental Health*

It remains to be understood how the differences in the profiles of communication with fathers and mothers between the four cluster groups are related to mental unhealth. We, therefore, examined the level of perceived overall unhealth and psychosomatic symptoms between the four clusters for all survey years combined and for each survey year using one-way ANOVAs. The results are reported in Table 4. For the samples combined, adequate communication with both parents was associated with good mental health. Participants in the two clusters of communication problems with the father alone and with the mother alone had significantly poorer mental health. Finally, participants with poor communication with both parents had generally worse mental health than those in the other three clusters. The results varied somewhat between survey years, but for all years, the order in which the four cluster profiles were associated with mental health problems was as follows: adequate communication < poor communication with father or poor communication with mother < poor communication with both parents. Thus, the cluster group with poor communication with both fathers and mothers was characterized by the highest level of perceived overall unhealth and psychosomatic symptoms.

**Table 4.** Differences in perceived overall unhealth and psychosomatic symptoms between the four cluster groups at each survey year. The measures, perceived overall unhealth and psychosomatic symptoms, are transformed to Z-scores with higher values indicating a worse mental health outcome.

| | Adequate Communication | Poor Mother Communication | Poor Father Communication | Poor Father and Mother Communication | F | *p* | $eta^2$ |
|---|---|---|---|---|---|---|---|
| All years: | | | | | | | |
| Perceived unhealth | −0.21 [a] | 0.23 [b] | 0.22 [b] | 0.41 [c] | 190.66 | <0.001 | 0.06 |
| Psychosomatic symptoms | −0.24 [a] | 0.23 [b] | 0.29 [b] | 0.41 [c] | 258.45 | <0.001 | 0.09 |
| 2002: | | | | | | | |
| Perceived unhealth | −0.22 [a] | 0.23 [b] | 0.21 [b] | 0.34 [b] | 22.29 | <0.001 | 0.06 |
| Psychosomatic symptoms | −0.27 [a] | 0.13 [b] | 0.24 [b c] | 0.41 [c] | 32.14 | <0.001 | 0.08 |
| 2006: | | | | | | | |
| Perceived unhealth | −0.19 [a] | 0.14 [b] | 0.16 [b] | 0.33 [b] | 16.76 | <0.001 | 0.04 |
| Psychosomatic symptoms | −0.26 [a] | 0.07 [b] | 0.24 [b c] | 0.44 [c] | 32.60 | <0.001 | 0.08 |
| 2010: | | | | | | | |
| Perceived unhealth | −0.29 [a] | 0.24 [b] | 0.24 [b] | 0.45 [b] | 40.19 | <0.001 | 0.10 |
| Psychosomatic symptoms | −0.33 [a] | 0.26 [b] | 0.33 [b] | 0.50 [b] | 57.66 | <0.001 | 0.13 |
| 2014: | | | | | | | |
| Perceived unhealth | −0.20 [a] | 0.32 [b] | 0.12 [b] | 0.43 [b] | 23.53 | <0.001 | 0.06 |
| Psychosomatic symptoms | −0.26 [a] | 0.33 [b] | 0.33 [b] | 0.52 [b] | 43.69 | <0.001 | 0.11 |
| 2018: | | | | | | | |
| Perceived unhealth | −0.19 [a] | 0.28 [b] | 0.39 [b] | 0.59 [b] | 34.94 | <0.001 | 0.09 |
| Psychosomatic symptoms | −0.22 [a] | 0.61 [b] | 0.50 [b] | 0.65 [b] | 53.24 | <0.001 | 0.13 |

Different superscripts [a, b, c] represent significant differences ($p < 0.05$) between the four cluster groups employing SNK post-hoc tests.

For a more formal test of whether the four cluster groups predicted the two indicators of mental unhealth, the four clusters were dummy coded into three measures, each of which was coded 1 if the individual belonged to the cluster and 0 otherwise. The three measures were entered into regression analyses with poor perceived health and psychosomatic symptoms as the two dependent variables. The results combining all survey years are shown in Table 5. As can be seen in this table, communication with the mother had the smallest effect on adolescents' mental health, communication with the father had a larger effect, and the strongest effect was found in poor communication with both the mother and the father.

**Table 5.** Predictions of perceived overall unhealth and psychosomatic symptoms from dummy coded communication profiles.

| | Perceived Unhealth | | | | Psychosomatic Symptoms | | | |
|---|---|---|---|---|---|---|---|---|
| | Beta | SE | t | *p* | Beta | SE | t | *p* |
| Poor communication with mother | 0.07 | 0.01 | 6.73 | <0.001 | 0.07 | 0.01 | 7.16 | <0.001 |
| Poor communication with father | 0.14 | 0.01 | 13.54 | <0.001 | 0.18 | 0.01 | 16.93 | <0.001 |
| Poor communication with both | 0.19 | 0.01 | 16.22 | <0.001 | 0.22 | 0.01 | 20.83 | <0.001 |
| $R^2$ | 0.22 | | | | 0.25 | | | |

The $R^2$ in these analyses was 0.22 for perceived overall unhealth and 0.25 for psychosomatic symptoms. These $R^2$ values should be compared with the $R^2$ values when the two dependent variables were predicted from the two original measures of ease of communication with fathers and mothers, respectively, for the survey years combined: 0.30 and 0.33. These comparisons show that the predictions of the two indicators of mental health were better for the variable-oriented method than for the person-oriented method. Note, however, that these predictions were for linear rather than non-linear relationships.

Overall, the person-oriented results in Tables 4 and 5 show the following:

- Adequate communication with both parents is associated with good mental health. If adolescents experience poor communication with their mother or father or both, their mental health is significantly worse.

- Young people who do not communicate well with either parent have the highest levels of mental health problems.
- Poor communication with mothers alone is rare among adolescents. Where poor communication with mothers appeared in the clusters, only 22% were reports of poor communication with mothers alone. Poor communication with mothers most often occurs in a generally negative family context that also involves the father.

These findings are very different from the variable-oriented findings that poor communication with fathers seems to be more important for adolescents' mental unhealth than poor communication with mothers.

### *3.4. Gender Differences*

We compared boys and girls for all study measures. These are shown in Table 6. Not unexpectedly, girls scored higher on perceived overall unhealth and psychosomatic symptoms for aggregated measures across the survey years. Girls also had worse communication with their fathers than boys. Effect sizes were moderate. With a small effect size, girls also had slightly worse communication with their mothers. It should be added that both boys and girls found it more difficult to talk to their fathers than to their mothers (boys: t (df = 4364) = 16.69, $p < 0.001$, Cohen's d = 0.25; girls: t (df = 4503) = 37.68, $p < 0.001$, Cohen's d = 0.56).

**Table 6.** Sex differences in mental unhealth indicators and problematic parent communication.

| | Boys | | Girls | | | | |
|---|---|---|---|---|---|---|---|
| | **M** | **SD** | **M** | **SD** | **t** | ***p*** | **Cohen's d** |
| Perceived overall unhealth | 1.67 | 0.69 | 1.94 | 0.69 | 18.76 | <0.001 | 0.39 |
| Psychosomatic symptoms | 2.07 | 0.75 | 2.62 | 0.83 | 32.50 | <0.001 | 0.68 |
| Poor father communication | 2.09 | 1.04 | 2.53 | 1.08 | 19.99 | <0.001 | 0.42 |
| Poor mother communication | 1.85 | 0.89 | 1.92 | 1.04 | 4.09 | <0.001 | 0.10 |

Table 7 shows the gender differences for each of the communication profiles. EXACON was used to test for these differences. For data aggregated across all survey years, girls were overrepresented in the clusters of poor communication with fathers and poor communication with both parents. They were underrepresented in the adequate communication cluster than would be expected by chance. Looking at individual survey years, girls were overrepresented in the poor communication with fathers cluster and underrepresented in the adequate communication cluster in all survey years. They were also overrepresented in the poor communication with both parents cluster in two of the five survey years (2006 and 2010). Girls and boys did not differ significantly for the poor communication with mothers cluster. Overall, these analyses show that girls are less likely than boys to have adequate communication with both parents, more likely to have problematic communication with fathers, and, to some extent, more likely to have problematic communication with both parents. These are more specific conclusions compared to having gender as another significant predictor variable in the original regression analysis.

**Table 7.** Gender differences in the four cluster groups. Percentages.

| **Survey Year and Sex** | **Adequate Communication** | **Poor Mother Communication** | **Poor Father Communication** | **Poor Father and Mother Communication** | $\chi^2$ | ***p*** | **Cramer's V** |
|---|---|---|---|---|---|---|---|
| All years: | | | | | | | |
| Boys | 70.7 [t] | 4.1 | 13.2 [a] | 12.0 [a] | 234.13 | <0.001 | 0.21 |
| Girls | 51.9 [a] | 4.2 | 27.0 [t] | 16.9 [t] | | | |

**Table 7.** *Cont.*

| Survey Year and Sex | Adequate Communication | Poor Mother Communication | Poor Father Communication | Poor Father and Mother Communication | $\chi^2$ | *p* | Cramer's V |
|---|---|---|---|---|---|---|---|
| 2002: | | | | | | | |
| Boys | 63.5 [t] | 4.4 | 20.3 [a] | 11.7 | 36.43 | <0.001 | 0.18 |
| Girls | 46.3 [a] | 5.1 | 34.1 [t] | 14.6 | | | |
| 2006: | | | | | | | |
| Boys | 68.7 [t] | 6.2 | 11.4 [a] | 13.7 [a] | 78.49 | <0.001 | 0.27 |
| Girls | 45.4 [a] | 5.1 | 30.0 [t] | 19.5 [t] | | | |
| 2010: | | | | | | | |
| Boys | 70.2 [t] | 4.3 | 11.8 [a] | 13.6 [a] | 83.90 | <0.001 | 0.27 |
| Girls | 45.1 [a] | 3.9 | 30.3 [t] | 20.7 [t] | | | |
| 2014: | | | | | | | |
| Boys | 71.2 t | 3.0 | 12.5 [a] | 15.3 | 18.39 | <0.001 | 0.13 |
| Girls | 59.0 [a] | 3.8 | 19.5 [t] | 17.7 | | | |
| 2018: | | | | | | | |
| Boys | 80.6 [t] | 2.4 | 9.5 [a] | 7.5 | 40.20 | <0.001 | 0.19 |
| Girls | 63.9 [a] | 2.9 | 21.3 [t] | 11.8 | | | |

t = type (where the cell frequency is higher than expected by chance; $p < 0.05$), a = antitype (where the cell frequency is lower than expected by chance; $p < 0.05$).

### *3.5. Clustering Mental Health Problems*

So far, we have treated perceived unhealth and psychosomatic problems separately. However, they can be integrated as two indicators of mental health problems in general [31]. This makes it possible to distinguish between patterns of mental health ranging from adolescents who perceive themselves as healthy and have low levels of psychosomatic problems to adolescents who both perceive themselves as unhealthy overall and are also burdened with high levels of psychosomatic problems. Here, using the same technique as before, we clustered the measures of perceived overall unhealth and psychosomatic problems. Four clusters emerged, accounting for 73 percent of the total variance. They were labeled 'no problems', 'perceived health problems', 'psychosomatic symptoms', and 'both perceived unhealth and psychosomatic symptoms'. The clusters are shown in Table 8.

**Table 8.** Cluster analysis of perceived overall unhealth and psychosomatic symptoms.

| | Clusters: | | | |
|---|---|---|---|---|
| | No Problems | Perceived Unhealth | Psychosomatic Symptoms | Both Perceived Unhealth and Psychosom. Symptoms |
| Perceived unhealth | −0.50 | 1.82 | 0.04 | 1.84 |
| Psychosomatic symptoms | −0.70 | −0.10 | 0.83 | 1.76 |
| *n* (%) | 4880 (53.9) | 658 (7.3) | 2905 (32.1) | 616 (6.8) |
| % females [1] | 37.8 | 55.6 | 66.8 | 75.4 |

*Note.* The low value is <−0.70, the average value is between −0.70 and 0.70, and the high value is >0.70. The values in the first two rows are the centroids for perceived unhealth and psychosomatic symptoms in the four clusters. [1] $\chi^2(N = 9011, df = 3) = 776.60$, $p < 0.001$, contingency coefficient = 0.29.

The four mental health patterns are the same as the health patterns of Swedish adolescents reported by Eriksson and Stattin [31]. There are significant gender differences, with boys overrepresented in the 'no problems' cluster and girls overrepresented in the 'psychosomatic problems' and 'both perceived unhealth and psychosomatic problems' clusters according to the EXACON analysis.

Finally, we cross-tabulated the ease of communication with parents cluster with the mental health clusters. Again, the EXACON program was used to determine which specific cells in the contingency table occurred more or less frequently than expected by chance. The contingency table is presented in Table 9.

**Table 9.** Crosstabulation of two cluster groups: Communications with parents and mental health problems.

| Communications with Parents | No Problems | Mental Health Problems: Perceived Unhealth | Psychosomatic Symptoms | Both Perceived Unhealth and Psychosom. Symptoms |
|---|---|---|---|---|
| Adequate communication | 3392 [t] | 272 [a] | 1372 [a] | 162 [a] |
| Poor mother communication | 136 [a] | 26 | 115 | 29 |
| Poor father communication | 698 [a] | 152 [t] | 657 [t] | 149 [t] |
| Poor communication with both | 397 [a] | 134 [t] | 468 [t] | 195 [t] |

$\chi^2$ ($N$ = 8264, $df$ = 9) = 773.07, $p < 0.001$, contingency coefficient = 0.29. t = type where the cell frequency is higher than expected by chance ($p < 0.05$), a = antitype where the cell frequency is lower than expected by chance ($p < 0.05$).

As can be seen in Table 9, the majority of adolescents who reported easy communication with both their father and mother were overrepresented in the no problem cluster and underrepresented in the other problem clusters. Adolescents who reported problems communicating with their mothers were underrepresented in the no problem cluster but not in the other three problem clusters. Finally, both adolescents who reported problems communicating with their fathers and both fathers and mothers were underrepresented in the no problem cluster and overrepresented in all three problem clusters. We carried out these analyses separately for boys and girls, and the results were very similar. The strong conclusion is that adolescents who had problems communicating with their fathers, as well as those who had problems with both fathers and mothers, suffer from higher levels of mental health problems than other adolescents.

## 4. Discussion

This study shows how cluster analysis can be combined with regression analysis to improve inferences about family conditions that affect adolescent mental health. When regression analyses were used to predict mental unhealth indicators from 15-year-olds' ease of communicating with their parents, these analyses over the period 2002 to 2018 showed that lack of ease of communicating with the father was more predictive of mental unhealth than lack of ease of communicating with the mother. As the relationships between the independent variables and the dependent variable are the same for all individuals in a regression analysis, this rules out the possibility that there are subgroups in the sample with different profiles for these independent variables beyond the linear relationships. Rather than focusing on what is characteristic of the average person, person-oriented approaches attempt to identify different subgroups.

In this study, we chose to investigate a case where regression analyses across several survey years tended to show roughly the same results. We reasoned that a person-oriented approach, cluster analysis, would also show high structural stability across these survey years, allowing us to examine whether person-oriented approaches can provide more specific information about what is happening over time than what variable-oriented approaches can provide (because they allow for both linear and non-linear relationships between variables).

We were correct in our hypothesis that a cluster analysis would find distinct, meaningful subgroups of communication profiles that showed high structural stability over time, just as the regression results showed very similar regression weights in predicting mental health over time. The communication profiles generated by cluster analysis were more informative about what was happening over time than the regression analyses revealed. In addition to the regression findings that communication with fathers is more important for understanding adolescent mental health than communication with mothers, the cluster analyses showed that (a) poor communication with both parents was associated with the worst mental health problems, and (b) when there was poor communication with mothers,

in most cases the adolescents also had poor communication with their father. Cluster analysis is a statistical technique for examining the co-occurrence of a set of variables and grouping them into typical patterns that allow non-linear effects to emerge beyond the requirements of linearity. In this case, poor communication with both parents emerged as a typical pattern across the different samples. This is a 'profile effect' that was not found in the original regression analyses.

If we had included gender as a third independent variable, significant gender differences would appear in all survey years, with girls scoring higher than boys on both mental health indicators (beta weights for poor perceived overall unhealth range from 0.11 to 0.19 and for psychosomatic symptoms from 0.25 to 0.30). Similar gender differences are often found in the mental health literature [21–23,32]. Gender differences in communication profiles were more specific. For the survey years combined, they show that girls scored higher than boys in two clusters: they were overrepresented in the poor communication with fathers cluster and overrepresented in the poor communication with both parents cluster. Overall, the cluster analyses seem to provide more specific information than the regression analyses. The regression analyses do not reflect all the subgroup characteristics in the data.

The technique used here is likely to be particularly relevant in longitudinal studies of change [19,33]. For example, variable-oriented analyses can reveal gradual or more sudden shifts in the effects of certain independent variables over time. With data collected over time for the same individuals, these can be followed as individuals move from one cluster to another. We hope that the results reported in this study will stimulate further research on how to clarify changes over time in variable-oriented analyses with person-based approaches.

When we examine both clusters representing different types of communication problems with parents and clusters representing mental health problems, it seems that cluster analysis improves the ability to draw more specific conclusions about family conditions that affect adolescents' mental health. The adolescents with both perceived overall unhealth and high levels of psychosomatic problems have either problems communicating with their fathers or problems communicating with both their fathers and their mothers. This is a more specific conclusion than reporting in regression analyses that adolescents with poor communication with their fathers have poorer mental health than adolescents with good communication with their fathers.

The results suggest that the practical implications may differ depending on whether analyses are based on variable- or person-oriented methods. This is a conclusion that, to our knowledge, has not been widely discussed. For example, one policy implication of the variable-oriented results is that it is important to involve fathers in parental support activities, as mothers tend to make up the majority of participants. A more rigorous policy implication of the person-oriented analyses is that it should be standard practice to include both fathers and mothers in such support activities, as it is when young people have problems communicating with both parents that they experience the greatest mental health problems [34]. Future studies are needed to cross-validate the reported findings in mental health and other domains. They will provide the basis for more general discussions about practical applications. To us, an advantage of person-oriented methods is that results can be interpreted more directly at the individual level than in variable-oriented analyses [19]. Person-oriented approaches tell us something about people. Are people with a particular response pattern different from people with a different configuration?

Finally, we need to pay attention to the particular relationship between adolescents' mental health and their communication problems with their fathers. It is one thing to show that poor communication with fathers is associated with poor adolescent mental health, but it is another to show that communication with fathers may be more important for adolescent mental health than communication with mothers. One explanation for this study's findings may lie in the different roles that mothers and fathers play in their relationships with their adolescents. The mother typically has the role of caregiver in the

family. Looking back on their upbringing, samples of Swedish young adults living in a suburb of Stockholm in 1958, 1981, and 2011 were asked "Who did you turn to most for support?" and given three alternatives: only mother, only father, or both. The majority of young adults answered only the mother (61, 71, and 58%, respectively) [35]. Consistent with the finding that the mother is the primary provider of emotional support, both boys and girls in the present study perceived that they had an easier time communicating with their mothers than with their fathers. One explanation for the study findings from the variable-oriented analyses is that particularly poor communication with the father is associated with perceived low paternal emotional support and low-quality interactions, which negatively affect adolescents' mental health [17,18,36]; In the present study, adolescents' perceptions of poor communication with fathers were associated with more mental health problems (perceived overall unhealth and psychosomatic symptoms) than poor communication with mothers across all survey years and for both sexes in variable-oriented analyses. Good communication with *both* parents is considered crucial for adolescents' mental health [1]. Not surprisingly, person-oriented analyses showed that the cluster group that had problems communicating with both their fathers and their mothers generally reported more overall poor unhealth and psychosomatic symptoms than other cluster groups.

## 5. Strengths and Limitations

The main strength is that we have attempted to clarify the findings predicting adolescent mental health from a common variable-oriented method by addressing the heterogeneous population. To our knowledge, this type of follow-up with person-oriented analyses has not been done before.

There are limitations that need to be acknowledged. The first is causality. We have assumed that problematic communication with parents affects the mental health of adolescents. It is possible that the directions of influence run the other way. Poor mental health may affect communication between fathers and adolescents more than between mothers and adolescents. Longitudinal studies have documented that parents' communication, especially their control attempts, can be predicted by adolescents' internalizing problems [37]. This is a different conclusion from the assumption that it is poor adolescent–parent communication that affects adolescents' mental health over time.

Another limitation is the use of single items. Ease of communication with fathers and mothers were two items. Perceived overall unhealth was also a single item. The lack of robustness in these independent and dependent variables would be expected to produce results that would shift over the years of the surveys. In this study, we have not seen much shift over time. In fact, the opposite seems to be the case.

Finally, the results reported here for Swedish adolescents should be cross-validated, and the possibilities for this are high, as this information is available in many national HBSC databases.

## 6. Conclusions

Person-oriented analyses, which can examine both linear and non-linear relationships between variables, can clarify results based on conventional variable-oriented methods, which are limited to examining linear relationships. They can highlight patterns or profiles that emerge from studies of the heterogeneous population. The results reported in this study seem intuitively clear when the variable-oriented and person-oriented results are considered side by side. Both approaches show results that are highly stable over time. However, the juxtaposed results would not have been predicted at the outset. Specifically, in addition to the finding in both approaches that adolescents' mental health problems are more related to poor communication with fathers than with mothers, the person-oriented analysis also showed that the highest mental health problems were among adolescents with poor communication with both parents and that of all the cases of poor communication with mothers, in most cases, the adolescents also had poor communication with the father. It appears that person-oriented analyses can, under certain conditions, provide important

new and complementary information about what happens over time compared to variable-oriented approaches. More generally, person-oriented analyses are likely to clarify the results of variable-oriented analyses in many areas other than adolescent mental health.

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