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Feasibility and impact of data-driven learning within the suicide prevention action network of thirteen specialist mental healthcare institutions (SUPRANET Care) in the Netherlands: A study protocol

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Feasibility and impact of data-driven learning within the suicide prevention action network of thirteen specialist mental healthcare institutions (SUPRANET Care) in the Netherlands: A study protocol

Authors: Kim Setkowski [1,*], Jan Mokkenstorm [1,2], Anton J.L.M. van Balkom [2], Gerdien Franx [1], Inge Verbeek- van Noord [1], Dave. A. Dongelmans [3,4], Merijn Eikelenboom [2] and Renske Gilissen [1]

[1] 113 Suicide Prevention, Amsterdam, The Netherlands; j.mokkenstorm@113.nl (J.M.); g.franx@113.nl (G.F.); i.verbeek@113.nl (I.V.); r.gilissen@113.nl (R.G.)

[2] Department of Psychiatry, Amsterdam Public Health research institute, VU University Medical Center and GGZinGeest, Amsterdam, The Netherlands; t.balkom@ggzingeest.nl (T.v.B.); m.eikelenboom@ggzingeest.nl (M.E.)

[3] Department of Intensive Care Medicine, Academic Medical Center, University of Amsterdam, The Netherlands; d.a.dongelmans@amc.uva.nl (D.D.)

[4] National Intensive Care Evaluation (NICE) foundation, Amsterdam, The Netherlands

* Correspondence: k.setkowski@113.nl

Abstract

Introduction: Improvement of the quality and safety of care is associated with lower suicide rates among mental health care patients. In the Netherlands about 40% of all people that die by suicide is in specialist mental health care. Unfortunately, the degree of implementation of suicide prevention policies and best practices within mental health care services in the Netherlands is variable. Sharing and comparing outcome and performance data in confidential networks of professionals working in different organizations can be effective in reducing practice variability within and across organizations and improving the quality of care. Suicide is a relatively rare event compared to the prevalence of its known risk factors. Learning to prevent this outcome requires a database large enough to allow for

reliable and meaningful analyses that can be studied and discussed in an atmosphere of mutual trust and confidentiality.

Methods and Analysis: Using formats of professional networks to improve surgical care (DICA) and somatic intensive care (NICE), 113 Suicide Prevention has taken the lead in the formation of a Suicide Prevention Action Network (SUPRANET Care) in mental health care. At present, thirteen large specialist mental health institutions in the Netherlands govern and participate in this network. Implementation and data collection take place after consensus rounds in which key professionals participate to define what data are relevant to collect, how they are operationalized, retrieved and will be analyzed. This paper describes the planned activities of SUPRANET Care and the evaluation of its feasibility, possible relevance and impact for the field of suicide prevention.

Ethics and dissemination: This study has been approved by the Central Committee on Research Involving Human Subjects, the Netherlands. This study does not fall under the scope of the Medical Research Involving Human Subjects Act (WMO).

Study registration number: 537001006 and funded by the Ministry of Health Funding-program for Health Care Efficiency Research (ZonMw).

Strengths and limitations of this study:

* Possible gains that could be achieved with optimal implementation of suicide prevention recommendations are currently not reached. SUPRANET Care is a project actively improving the quality of care to prevent suicide. The SUPRANET network started January 2016 as a long-term project. Innovative activities of SUPRANET Care for mental health care organizations are:

- o a unique collaboration of mental health organizations based on a strong mutual ambition to achieve better compliance to suicide prevention guidelines, increased patient safety and lower suicide rates;
- o sharing of data on a core set of quality indicators derived from the Dutch multidisciplinary guideline which are jointly chosen, operationalized, defined, and registered;

- national registry with pooled data on suicide (attempts) and their determinants, and on service quality indicators to provide meaningful data on successful approaches to prevent suicide in mental health care.

- standardized suicide (attempt/mortality) rates, allowing for benchmark comparisons between and within organizations; and for monitoring changes in service provision.

- direct relevance to practice. Biannual feedback to the institutions using feedback reports, along with guided improvement in the participating institutions in response to the feedback reports makes that mental health organizations and practitioners can immediately use the results in their practice.

- long-term effects. SUPRANET Care launched with thirteen mental health institutions across the country. Other mental health institutions have also indicated their intention to join. Aim of SUPRANET Care is an enduring national suicide registry.

* Due to the aggregation of the collected patient and treatment data to protect the privacy of patients, it is not possible to decrypt personal patient information to follow patients in time.

Keywords: suicide; suicide attempt; implementation study; guideline; quality of care; mental health care

Introduction

Mental health problems are important risk factors for suicide and suicidal behavior [1-3]. Many patients with psychiatric disorders, like mood-, anxiety-, and personality disorders also suffer from suicidal ideation that may lead to self-harming behaviors or to suicide [4 5]. This makes suicide prevention a core component and responsibility of health care services, in particular of those working in the field of behavioral and specialist mental health [6]. In the Netherlands about 40% of all people that die by suicide is in specialist mental health care [7].

The implementation of guideline best practices appears to be of paramount importance in preventing suicide among patients in health care. A recent large-scale UK study showed that the

implementation of service guideline recommendations significantly reduced the suicide rate with more than two suicides per 10.000 patient contacts [8]. Kapur et al [9] demonstrated a 20-30% reduction of suicide rates in mental health services in England associated with sixteen specific service improvements and implementation of guideline recommendations. In 2012, the Dutch multidisciplinary guideline for the diagnosis and treatment of suicidal behavior was published [10], but its uptake by the field is problematic with marked degrees of variation of suicide prevention policies and practices in mental health care institutions across the country [11]. To promote its implementation a one-day training program was developed and tested with significant positive effects on professionals' competences and attitude towards guideline best practices [12]. To date, the majority of specialist mental health workers have not partaken in this training. These observations illustrate that guideline implementation and quality improvement can be difficult [13][14].

Although suicide is a relatively common cause of death in the high-risk population of patients in specialist mental health [7][15], its population base rate is too low to assess the preventative impact of specific practices or routines within a single health care organization. Suicide attempts that have a much higher incidence rate are considered a valuable proxy outcome measure to evaluate the effectiveness of prevention and intervention [16]. Unfortunately, most mental health organizations in the Netherlands do not systematically register and analyze suicide attempts in their patient populations. To date, annual suicide numbers are collected on institutional and national levels for reporting purposes only [15]. Due to confounders and lack of standardized registration, these absolute numbers are not useful to drive learning and improvement. As a result, it is unclear to what extent the (lack of) implementation of guideline recommendations affect suicide and suicide attempt rates among patients in Dutch specialist mental health care.

Given growing concerns and waning acceptance of suicide as an outcome of mental health treatment among health care professionals and in Dutch society, guideline implementation has become a focal point of the national suicide prevention strategy [17]. Commissioned by the Ministry of Welfare, Health and Sports, 113 Suicide Prevention change agents monitored the degree of implementation of guideline-based policies in the largest 25 Dutch specialist mental health care organizations [11]. This resulted in growing awareness of their responsibility and potential to enhance suicide prevention

efforts. Bringing together leaders and key health care professionals within interested specialist mental health organizations, 113 proposed to form a Suicide Prevention Action Network in health care (SUPRANET Care). The SUPRANET Care program is modeled after successful examples in Dutch somatic health care: the Netherlands Intensive Care Evaluation (NICE) project and the Dutch Initiative for Clinical Auditing (DICA) network that showed improved quality of care as a result of benchmark feedback based on joint registration of standardized process- and outcome data. Within the NICE network [18], more than 90 participant Intensive Care Units of general hospitals across the Netherlands share, evaluate and use registered data to improve the quality of care [19]. The DICA was founded with the objective to organize and support clinical audits by facilitating on legal, technical, methodological and logistic issues [20]. This has led to improved quality of care with reduced practice variance in the field of colorectal, pancreatic and cardiovascular surgery. Also, SUPRANET Care takes example after the successful implementation of treatment guidelines for anxiety disorders in the Netherlands. Van Dijk et al showed that a multilevel, multifaceted and systematical implementation strategy resulted in higher quality of care leading to earlier patient recovery compared to a treatment setting in which guidelines were passively disseminated [21].

SUPRANET Care aims at improving quality and safety of care to enhance suicide prevention by: 1) collecting standardized process, practice and suicide (attempt) outcome data, 2) providing benchmark feedback reports to participant organizations, 3) identifying trends and promising preventative practices, and 4) systematically implement these practices across the network. After due settlement of legal and logistic issues specifically pertaining to privacy and safety of the sharing of data, the SUPRANET Care Foundation was founded. The program's first data collection took place in 2017. This paper describes the activities of SUPRANET Care and the evaluation of its feasibility and impact.

Suicide prevention action network (SUPRANET Care)

SUPRANET Care is the confidential learning network of at present thirteen specialist mental health institutions in the Netherlands that share the ambition to optimize suicide prevention. Legally it is a non-profit foundation governed by a board that includes four senior psychiatrists (working as chief medical officers in participating organizations); a patient and family advocate; and two PhD level

quality improvement / implementation researchers and experts (the SUPRANET Care project leader and the chairman of the National Intensive Care Evaluation). Each participant organization has signed a contract pertaining to the confidential exchange and analysis of the data and pays an annual 10,000 euro participation fee to the SUPRANET Care foundation. The board of the SUPRANET Care Foundation established two workgroups, the Quality of Care Group and the Registration Group, in which professionals recruited from the participant organizations participate. The first group is consulted on the quality of care indicators relevant and feasible to use in daily practice. The second group determines what data are relevant and feasible to collect, and how the data variables are operationalized and retrieved.

Multifaceted improvement program

A multifaceted benchmark and quality improvement program is offered to each participant containing the following three elements: (1) Biannual feedback reports with benchmark information based on data collected from all participating organizations. The feedback reports are generated by an analysis and support team of 113 Suicide Prevention and sent to and discussed with local suicide prevention teams within the organizations. (2) Improvement modules supported and initiated by the SUPRANET Care board. The aim is to develop strong multidisciplinary teams that continuously promote and monitor suicide prevention activities within the organizations. Ultimate goal is to create useful quality indicators that guide these teams. The third element (3) concerns exchange meetings, leadership development, educational sessions and outreach visits by the national support team of 113 Suicide Prevention to help the institutions interpreting their feedback reports and to formulate and execute action plans for improvement.

Recruitment of SUPRANET Care participants

Participants were recruited by 113 Suicide Prevention using invitational conferences to inform candidates about the nature of the SUPRANET program and the possibility (and necessity) of co-creating this program. Participants can partake within the SUPRANET Care program annually. At this moment, thirteen Dutch mental health care institutions participate within the network. In order to be eligible, participants have to provide specialist care involving acute inpatient clinics, residential care,

outpatient clinics, crisis resolution/home treatment care, partial hospitalization for adults and elderly

(18 and older). Next to specialist care, most (N = 10) provide general basic behavioral health care

(BGGZ) to patients with mild or non-complex mental health problems. From January to June 2017,

the thirteen Dutch mental health care institutions participating in the SUPRANET program provided

care to more than 300.000 patients.

Data collection of SUPRANET Care

SUPRANET Care collects data on suicide, suicide attempts and their determinants in a national

registry, as well as consumer care policies and practices to provide meaningful feedback on successful

approaches to prevent suicide in mental health care. Consensus rounds with key professionals

recruited from the participant organizations resulted in the definition of a minimal dataset consisting of

data pertaining to all patients in treatment with respect to gender, age, DSM – IV/V diagnosis, GAF

score, type of care, marital status, safety plan, waiting-list duration, registration of a contact person,

treatment duration, suicides, and suicide attempts. Furthermore, organizational characteristics of

participating institutions are collected including the number of psychiatric beds, total number of

psychiatric admission days and absenteeism of staff. Each SUPRANET participant agreed to deliver

the data on an aggregated level to the SUPRANET Care data-analyst, who combines them in a

national registry. Data is collected every six months.

Privacy

To protect the privacy of patients, data managers of participating mental health institutions

aggregate the patient and treatment data. Using aggregated data, neither SUPRANET Care nor the

data-analyst is able to decrypt personal patient information. Aggregated data and the results of

statistical analyses will be reviewed by researchers of SUPRANET Care to ensure the anonymity of

both patients and mental health institutions before publication. The SUPRANET Care data-analyst

works in a secure network environment and uses a central database to pool the data. On request, data

will be made available for other research after approval of the SUPRANET Care board.

Evaluation of the feasibility and impact of SUPRANET Care

The purpose of the evaluation is to investigate the activities of SUPRANET Care by examining its feasibility and impact on suicide and suicide attempts.

This study aims to answer:

(1) Is SUPRANET Care implemented as intended, in terms of:

    (a) Is the multifaceted performance feedback provided and used as intended?

    (b) Does SUPRANET Care facilitate the implementation of key guideline recommendations?

    (c) Is it feasible to register reliable, unambiguous data on completed suicide and on suicide attempts, and on this basis, to generate meaningful feedback?

(2) Does the implementation strategy of SUPRANET Care lead to:

    (a) Reduced suicide rates in time compared to baseline?

    (b) Increased registration of suicide attempts in time compared to baseline?

    (c) Improved mutually shared professional knowledge, attitude and adherence to suicide prevention guidelines in time compared to baseline?

Materials and methods

Design

The outcomes to evaluate the feasibility and impact of SUPRANET Care are studied using an uncontrolled longitudinal prospective design. To determine whether the SUPRANET Care implementation approach affects the three outcome variables (standardized suicide mortality, registration of suicide attempts, and professional knowledge), an implementation study will be performed using an interrupted time series analysis at three levels. Level one is a process evaluation: Is the multifaceted feedback performed as intended. Level two is the measurement of the extent of implementation of the quality indicators. Finally, the third level is the effect over time of the intervention on the three outcome variables (standardized suicide mortality, registration of suicide attempts, and professional knowledge).

Evaluation procedure of the feasibility bmd impact of SUPRANET Care

1. Is SUPRANET Care implemented as intended, in terms of:

a. Is the multifaceted performance feedback provided and used as intended?

In order to answer the first research questions, we will evaluate the multifaceted performance feedback. Annual interview rounds will be held with the local team members and at least three professionals per institution to determine (1) the extent to which the multifaceted feedback is performed as intended, (2) whether feedback reports provide meaningful information to professionals, (3) how feedback reports are used in practice for improvement actions and (4) which best practices arise. Data derived from the interviews on the process evaluation will be described and will contribute to the knowledge of successes and barriers of the implementation approach.

b. Does SUPRANET Care facilitate the implementation of key guideline recommendations and better quality of suicide prevention in mental health care?

To answer this research question, we will validate and examine the implementation process of a core set of relevant and action-oriented quality indicators. In order to do this, standardization of definitions and terminology is needed. By using a standard terminology and a data dictionary, all institutions know exactly what is meant and results are comparable and can be used for benchmarking. To achieve this, first, project leads select quality indicators for suicide prevention in mental health based on a literature search and the Dutch multidisciplinary guideline. Next, the selected quality indicators are discussed in a small group of mental health care professionals and suicide experts (the SUPRANET Care Quality of Care group). This discussion results in a basic set of relevant and action oriented quality indicators. Finally the Delphi method will be used to further achieve convergence of opinion among suicide experts, members of clients' advisory boards, experts with experiences in suicidal behavior and health care professionals to create common definitions and nomenclature.

After standardization of language, at least five quality indicators for implementation are jointly chosen. Criteria for selection of quality indicators are relevance (it affects the number of suicides in the institution), action orientation (it can be influenced by the mental health institutions or professionals themselves) and feasibility (it is feasible to implement and monitor). At least 50 experts in the field of suicide prevention and staff members of each mental health institution will receive an

online questionnaire for expert opinion. After the Delphi round, the prioritized indicators and definitions are proposed to the SUPRANET Care Quality of Care group and the SUPRANET Care board. After this, the selected quality indicators will be implemented with the feedback procedure as described above.

During the study period, the implementation process on each quality indicator will be measured and evaluated with the SUPRANET Care database. Prioritized quality indicators (e.g. safety-plan; waiting-list) will be operationalized and included in the minimal dataset. Results from the SUPRANET Care database will be used to transfer knowledge among mental health care institutions.

c. Is it feasible to register reliable, unambiguous data on completed suicide and on suicide attempts, and on this basis, to generate meaningful feedback?

To examine the feasibility of registering completed suicide and suicide attempt data, the extent of registration will be monitored biannually on 5-point rating scale (0 = mental health care institution does not register suicide (attempts); 5 = mental health care institutions registers all suicide (attempts) of their patients). In addition, suicide and suicide attempt data will be monitored biannually in the SUPRANET Care database whereby changes can be investigated. To this end, standardization of definitions and terminology of suicide and suicide attempt is of great importance. The SUPRANET Care registration group determines the definitions of suicide (attempt) for adoption by all SUPRANET Care mental health institutions.

2. Does the implementation strategy of SUPRANET Care lead to suicide safer mental health care institutions in terms of three outcome variables:

a. Reduced suicide rates in time compared to baseline

Standardized suicide rates will be the primary outcome variable of this study. In order to analyze the effect of the SUPRANET Care program on reducing suicide rates in mental health care institutions, all suicide cases will be defined and measured. A recent pilot across four SUPRANET Care institutions showed the feasibility of extracting these data from existing data-registration systems and the ability to compute suicide rates adjusted for relevant confounding factors to make comparisons

over time plausible.

In order to identify differences between institutions and within institutions over time, standardized suicide rates will be calculated biannually. Differences between and changes in the number of suicides could be attributed to differences in the patient population of institutions. To compare mortality data, absolute numbers of suicide have to be adjusted for confounders (e.g. demographic, psychiatric severity factors) in order to be able to attribute differences in patient suicide rates to policy, service or staff related factors of the institutions. Therefore, for each SUPRANET Care institution, suicide rates will be adjusted for confounding factors in the client population of each institution using indirect standardization. This method is preferred when one or more confounding – specific mortality rates are based on small numbers [22]. Adjustment for risk factors like gender, age and DSM-IV/V diagnosis will make comparison within and between institutions more reasonable, and thereby learning possible.

b. Increased registration of suicide attempts in time compared to baseline

The second outcome variable in this study, is the extent to which suicide attempts are being registered. Currently, suicide attempts are hardly registered in Dutch mental health institutions. Monitoring and registration of suicide attempts may be one of the quality indicators improving the quality of care for suicidal patients as a suicide attempt is an important risk factor for completed suicide [23]. SUPRANET Care will encourage the registration of suicide attempts of patients in care. Changes in the extent to which suicide attempts of patients are registered, will be analyzed with the suicide attempt data that are monitored biannually in the national SUPRANET database. We hypothesize that SUPRANET Care will lead to increased registration of suicide attempts.

c. Improved mutually shared knowledge, attitude and adherence to suicide prevention guidelines in time compared to baseline

The third outcome variable is improved mutually shared professional knowledge, attitude and adherence to suicide prevention guidelines compared to baseline. In order to measure the outcome, an extended version of the PITSTOP suicide survey (Professionals In Training to STOP suicide) among crisis teams and ambulatory care teams in each participating mental health institution will be held to

test (1) the shared knowledge of suicidal behavior and suicide prevention, (2) the attitude of healthcare professionals towards suicidal patients and (3) adherence to the clinical practice guidelines [24]. This questionnaire will be conducted in crisis teams and ambulatory care teams at baseline (before the SUPRANET Care implementation approach) with annual repeated measurements after one, two and three years. An improvement in shared knowledge and attitude of professionals and adherence to guidelines is expected [24].

Statistical analysis

First, the implementation progress will be analyzed. The first data collection is for the purpose of having the baseline measurement. Outcomes on progress in implementation are assessed biannually at the organizational, professional, and patient level using data from the national registry of SUPRANET Care. Generalized Linear Model (GLM) repeated measures will be used to analyze if institutions change over time on each quality indicator including registration of a contact person, waiting-list duration and safety-plan.

To test the effect of the SUPRANET Care implementation approach on the outcome variables, Interrupted Time-Series Analysis Procedure (ITSACORR) will be conducted, designed to analyse short time series that likely have auto correlated errors [25]. ITSACORR is the preferred method above Autoregressive Integrated Moving Average (ARIMA) in relatively short time-series data [26]. The result is a "repeated time series" that, unlike pre- and post-intervention means or percentage difference tests, enables investigation of the pattern of change over time and include its mean level (the average of all time points) and changes in its slope [25]. To strengthen this uncontrolled study design, health care organizations' level of implementation is added to the study. If organizations with better, or greater number of, implemented quality indicators show greater change in the outcomes, it strengthens the argument that the SUPRANET Care approach led to the changes.

Patient and public involvement

A member of the clients' advisory board participates in the board of the SUPRANET Care Foundation. Experts with experiences in suicidal behavior are involved in the development of SUPRANET GGZ: in the Delphi study to create useful quality indicators for implementation.

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Furthermore, they actively participate in the workgroups: the Quality of Care Group and the

Registration Group, in which professionals recruited from the participant organizations participate.

Results of the study will be disseminated to the study participants, through feedback reports,

presentations and messages on our website (www.supranetggz.nl).

Discussion

This paper describes the study protocol of a longitudinal study investigating the activities of

SUPRANET Care by examining its feasibility and impact in a network formed by thirteen specialist

mental health care institutions. It will be the first study worldwide to report on the results of a

confidential learning network approach in suicide prevention. We expect that SUPRANET Care will

improve shared knowledge of professionals, increase the registration of suicide attempts and decrease

suicide rates in Dutch mental health care.

Suicide is the worst outcome of mental illness. Recent evidence shows that suicide prevention

in mental health care can be enhanced considerably by creating a culture that puts patient and staff

safety first; and by systematically improving the quality and organization of care [8][9]. This involves the

implementation of guideline best practices addressing contextual barriers and facilitators at different

levels; continually addressing targeted quality and safety issues using plan-do-check-act cycles. Given

the low base rate of suicides and suicide attempts, large and longitudinal databases are needed to

assess the impact of quality improvement and guideline best practice implementation. The

SUPRANET Care program contains these elements and may prove to be a successful new approach to

enhance suicide prevention in mental health care.

Strength of the study is that SUPRANET Care is a bottom-up initiative covering almost half of

the large mental health care organizations in the Netherlands, with a clear ambition to work together to

improve guideline implementation, suicide prevention and quality of care in Dutch mental health

settings. Also, experts with experiences in suicidal behavior are involved in the organization of

SUPRANET Care.

A limitation of our study is the aggregation of the collected patient and treatment data to

protect the privacy of patients and SUPRANET Care nor the data-analyst is thus able to decrypt

personal patient information to follow patients in time. However, for feedback reports and our

implementation and study goals, the aggregated data appear sufficient.

SUPRANET Care is a unique project worldwide. When successful, all Dutch mental health settings will be invited to join SUPRANET and to include the quality indicators into their policy for suicide prevention. As the results will be of high relevance for countries in and outside of Europe, the implementation approach of SUPRANET Care, and the gained knowledge of the evaluation study will be shared with an international audience.

Ethics and dissemination: This study protocol has been approved by the Central Committee on Research Involving Human Subjects, the Netherlands. This study does not fall under the scope of the Medical Research Involving Human Subjects Act (WMO).

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4 **Authors:** Kim Setkowski [1,*], Jan Mokkenstorm [1,2], Anton J.L.M. van Balkom [2], Gerdien Franx [1],

5 Inge Verbeek- van Noord [1], Dave. A. Dongelmans [3,4], Merijn Eikelenboom [2] and Renske Gilissen [1]

6

7 [1] 113 Suicide Prevention, Amsterdam, The Netherlands; j.mokkenstorm@113.nl (J.M.);

8 g.franx@113.nl (G.F.); i.verbeek@113.nl (I.V.); r.gilissen@113.nl (R.G.)

9 [2] Department of Psychiatry, Amsterdam Public Health research institute, VU University Medical

10 Center and GGZinGeest, Amsterdam, The Netherlands; t.balkom@ggzingeest.nl (T.v.B.);

11 m.eikelenboom@ggzingeest.nl (M.E.)

12 [3] Department of Intensive Care Medicine, Academic Medical Center, University of Amsterdam, The

13 Netherlands; d.a.dongelmans@amc.uva.nl (D.D.)

14 [4] National Intensive Care Evaluation (NICE) foundation, Amsterdam, The Netherlands

15

16 * Correspondence: k.setkowski@113.nl

17 **Abstract**

18 **Introduction:** Improvement of the quality and safety of care is associated with lower suicide rates

19 among mental health care patients. In the Netherlands about 40% of all people that die by suicide is in

20 specialist mental health care. Unfortunately, the degree of implementation of suicide prevention

21 policies and best practices within Dutch mental health care services is variable. Sharing and comparing

22 outcome and performance data in confidential networks of professionals working in different

23 organizations can be effective in reducing practice variability within and across organizations and

24 improving quality of care.

25 **Methods and Analysis:** Using formats of professional networks to improve surgical care (DICA) and

26 somatic intensive care (NICE), 113 Suicide Prevention has taken the lead in the formation of a Suicide

27 Prevention Action Network (SUPRANET Care), with at present thirteen large Dutch specialist mental

28   health institutions. Data on suicide, suicide attempts and their determinants as well as consumer care

29   policies and practices is collected biannually, after consensus rounds in which key professionals define

30   what data is relevant to collect, how it is operationalized, retrieved and will be analyzed. To evaluate

31   the impact of SUPRANET Care, standardized suicide rates will be calculated adjusted for confounding

32   factors. Second, the extent to which suicide attempts are being registered will be analyzed with the

33   suicide attempt data. Finally, professionals' knowledge, attitude and adherence to suicide prevention

34   guidelines will be measured with an extended version of the Professionals In Training to STOP suicide

35   survey.

36   **Ethics and dissemination:** This study has been approved by the Central Committee on Research

37   Involving Human Subjects, the Netherlands. This study does not fall under the scope of the Medical

38   Research Involving Human Subjects Act (WMO) or the General Data Protection Regulation (GDPR)

39   as stated by the Dutch Data Protection Authority (Dutch DPA), because data is collected on an

40   aggregated level.

41

42   **Strengths and limitations of this study:**

43   o   Sharing of data which are jointly chosen, operationalized, defined, and registered.

44   o   Analyses of standardized suicide rates, allowing for benchmark comparisons between and

45   within organizations; and for monitoring changes in service provision.

46   o   Biannual feedback to the institutions using feedback reports, along with guided improvement

47   makes that mental health organizations and practitioners can immediately use the results in

48   their practice.

49   o   Due to the aggregation of the collected patient and treatment data to protect the privacy of

50   patients, it is not possible to decrypt personal patient information to follow patients in time.

51   **Keywords:** suicide; suicide attempt; implementation study; guideline; quality of care; mental

52   health care

53

54   **Introduction**

55   Mental health problems are important risk factors for suicide and suicidal behavior [1-3]. Many

56   patients with psychiatric disorders, like mood-, anxiety-, and personality disorders also suffer from

57   suicidal ideation that may lead to self-harming behaviors or to suicide [4 5]. This makes suicide

58   prevention a core component and responsibility of health care services, in particular of those working

59   in the field of behavioral and specialist mental health [6]. In the Netherlands about 40% of all people that

60   die by suicide is in specialist mental health care [7].

61   The implementation of guideline best practices appears to be of paramount importance in

62   preventing suicide among patients in health care. A recent large-scale UK study showed that the

63   implementation of service guideline recommendations significantly reduced the suicide rate with more

64   than two suicides per 10.000 patient contacts [8]. Kapur et al [9] demonstrated a 20-30% reduction of

65   suicide rates in mental health services in England associated with sixteen specific service

66   improvements and implementation of guideline recommendations. In 2012, the Dutch

67   multidisciplinary guideline for the diagnosis and treatment of suicidal behavior was published [10], but

68   its uptake by the field is problematic with marked degrees of variation of suicide prevention policies

69   and practices in mental health care institutions across the country [11]. To promote its implementation a

70   one-day training program was developed and tested with significant positive effects on professionals'

71   competences and attitude towards guideline best practices [12]. To date, the majority of specialist mental

72   health workers have not partaken in this training. These observations illustrate that guideline

73   implementation and quality improvement can be difficult [13 14].

74   Although suicide is a relatively common cause of death in the high-risk population of patients

75   in specialist mental health [7 15], its population base rate is too low to assess the preventative impact of

76   specific practices or routines within a single health care organization. Suicide attempts that have a

77   much higher incidence rate are considered a valuable proxy outcome measure to evaluate the

78   effectiveness of prevention and intervention [16]. Unfortunately, most mental health organizations in the

79   Netherlands do not systematically register and analyze suicide attempts in their patient populations. To

80   date, annual suicide numbers are collected on institutional and national levels for reporting purposes

81   only [15]. Due to confounders and lack of standardized registration, these absolute numbers are not

82   useful to drive learning and improvement. As a result, it is unclear to what extent the (lack of)

83   implementation of guideline recommendations affect suicide and suicide attempt rates among patients

84   in Dutch specialist mental health care.

85   Given growing concerns and waning acceptance of suicide as an outcome of mental health

86   treatment among health care professionals and in Dutch society, guideline implementation has become

87   a focal point of the national suicide prevention strategy [17]. Commissioned by the Ministry of Welfare,

88   Health and Sports, 113 Suicide Prevention change agents monitored the degree of implementation of

89   guideline-based policies in the largest 25 Dutch specialist mental health care organizations [11]. This

90   resulted in growing awareness of their responsibility and potential to enhance suicide prevention

91   efforts. Bringing together leaders and key health care professionals within interested specialist mental

92   health organizations, 113 proposed to form a Suicide Prevention Action Network in health care

93   (SUPRANET Care). The SUPRANET Care program is modeled after successful examples in Dutch

94   somatic health care: the Netherlands Intensive Care Evaluation (NICE) project and the Dutch Initiative

95   for Clinical Auditing (DICA) network that showed improved quality of care as a result of benchmark

96   feedback based on joint registration of standardized process- and outcome data. Within the NICE

97   network [18], more than 90 participant Intensive Care Units of general hospitals across the Netherlands

98   share, evaluate and use registered data to improve the quality of care [19]. The DICA was founded with

99   the objective to organize and support clinical audits by facilitating on legal, technical, methodological

100   and logistic issues [20]. This has led to improved quality of care with reduced practice variance in the

101   field of colorectal, pancreatic and cardiovascular surgery. Also, SUPRANET Care takes example after

102   the successful implementation of treatment guidelines for anxiety disorders in the Netherlands. Van

103   Dijk et al showed that a multilevel, multifaceted and systematical implementation strategy resulted in

104   higher quality of care leading to earlier patient recovery compared to a treatment setting in which

105   guidelines were passively disseminated [21].

106   SUPRANET Care aims at improving quality and safety of care to enhance suicide prevention

107   by: 1) collecting standardized process, practice and suicide (attempt) outcome data, 2) providing

108   benchmark feedback reports to participant organizations, 3) identifying trends and promising

109   preventative practices, and 4) systematically implement these practices across the network. After due

110   settlement of legal and logistic issues specifically pertaining to privacy and safety of the sharing of

111   data, the SUPRANET Care Foundation was founded. The program's first data collection took place in

112   2017. This paper describes the activities of SUPRANET Care and the evaluation of its feasibility and

113   impact.

Suicide prevention action network (SUPRANET Care)

115   SUPRANET Care is the confidential learning network of at present thirteen specialist mental

116   health institutions in the Netherlands that share the ambition to optimize suicide prevention. Legally it

117   is a non-profit foundation governed by a board that includes four senior psychiatrists (working as chief

118   medical officers in participating organizations); a patient and family advocate; and two PhD level

119   quality improvement / implementation researchers and experts (the SUPRANET Care project leader

120   and the chairman of the National Intensive Care Evaluation). Each participant organization has signed

121   a contract pertaining to the confidential exchange and analysis of the data and pays an annual 10,000

122   euro participation fee to the SUPRANET Care foundation. The board of the SUPRANET Care

123   Foundation established two workgroups, the Quality of Care Group and the Registration Group, in

124   which professionals recruited from the participant organizations participate. The first group is

125   consulted on the quality of care indicators relevant and feasible to use in daily practice. The second

126   group determines what data are relevant and feasible to collect, and how the data variables are

127   operationalized and retrieved.

Multifaceted improvement program

129   A multifaceted benchmark and quality improvement program is offered to each participant

130   containing the following three elements: (1) Biannual feedback reports with benchmark information

131   based on data collected from all participating organizations. The feedback reports are generated by an

132   analysis and support team of 113 Suicide Prevention and sent to and discussed with local suicide

133   prevention teams within the organizations. (2) Improvement modules supported and initiated by the

134   SUPRANET Care board. The aim is to develop strong multidisciplinary teams that continuously

135   promote and monitor suicide prevention activities within the organizations. Ultimate goal is to create

136   useful quality indicators that guide these teams. The third element (3) concerns exchange meetings,

137   leadership development, educational sessions and outreach visits by the national support team of 113

138 Suicide Prevention to help the institutions interpreting their feedback reports and to formulate and

139 execute action plans for improvement.

Recruitment of SUPRANET Care participants

141 Participants were recruited by 113 Suicide Prevention using invitational conferences to inform

142 candidates about the nature of the SUPRANET program and the possibility (and necessity) of co-

143 creating this program. Participants can partake within the SUPRANET Care program annually. At this

144 moment, thirteen Dutch mental health care institutions participate within the network. In order to be

145 eligible, participants have to provide specialist care involving acute inpatient clinics, residential care,

146 outpatient clinics, crisis resolution/home treatment care, partial hospitalization for adults and elderly

147 (18 and older). Next to specialist care, most (N = 10) provide general basic behavioral health care

148 (BGGZ) to patients with mild or non-complex mental health problems. From January to June 2017,

149 the thirteen Dutch mental health care institutions participating in the SUPRANET program provided

150 care to more than 300.000 patients.

Data collection of SUPRANET Care

152 SUPRANET Care collects data on suicide, suicide attempts and their determinants in a national

153 registry, as well as consumer care policies and practices to provide meaningful feedback on successful

154 approaches to prevent suicide in mental health care. Consensus rounds with key professionals

155 recruited from the participant organizations resulted in the definition of a minimal dataset consisting of

156 data pertaining to all patients in treatment with respect to gender, age, DSM – IV/V diagnosis, GAF

157 score, type of care, marital status, safety plan, waiting-list duration, registration of a contact person,

158 treatment duration, suicides, and suicide attempts. Furthermore, organizational characteristics of

159 participating institutions are collected including the number of psychiatric beds, total number of

160 psychiatric admission days and absenteeism of staff. Each SUPRANET participant agreed to deliver

161 the data on an aggregated level to the SUPRANET Care data-analyst, who combines them in a

162 national registry. Data is collected every six months.

Privacy

164   To protect the privacy of patients, data managers of participating mental health institutions

165   aggregate the patient and treatment data. Using aggregated data, neither SUPRANET Care nor the

166   data-analyst is able to decrypt personal patient information. Hereby it does not fall within the scope of

167   the General Data Protection Regulation (GDPR). Aggregated data and the results of statistical analyses

168   will be reviewed by researchers of SUPRANET Care to ensure the anonymity of both patients and

169   mental health institutions before publication. The SUPRANET Care data-analyst works in a secure

170   network environment and uses a central database to pool the data. On request, data will be made

171   available for other research after approval of the SUPRANET Care board.

172   **Evaluation of the feasibility and impact of SUPRANET Care**

173   The purpose of the evaluation is to investigate the activities of SUPRANET Care by examining its

174   feasibility and impact on suicide and suicide attempts.

175   This study aims to answer:

176   (1) Is SUPRANET Care implemented as intended, in terms of:

177   (a) Is the multifaceted performance feedback provided and used as intended?

178   (b) Does SUPRANET Care facilitate the implementation of key guideline

179   recommendations?

180   (c) Is it feasible to register reliable, unambiguous data on completed suicide and on

181   suicide attempts, and on this basis, to generate meaningful feedback?

182   (2) Does the implementation strategy of SUPRANET Care lead to:

183   (a) Reduced suicide rates in time compared to baseline?

184   (b) Increased registration of suicide attempts in time compared to baseline?

185   (c) Improved mutually shared professional knowledge, attitude and adherence to suicide

186   prevention guidelines in time compared to baseline?

187   **Materials and methods**

188   **Design**

189   The outcomes to evaluate the feasibility and impact of SUPRANET Care are studied using an

190   uncontrolled longitudinal prospective design. To determine whether the SUPRANET Care

191   implementation approach affects the three outcome variables (standardized suicide mortality,

192   registration of suicide attempts, and professional knowledge), an implementation study will be

193   performed using an interrupted time series analysis at three levels. Level one is a process evaluation: Is

194   the multifaceted feedback performed as intended. Level two is the measurement of the extent of

195   implementation of the quality indicators. Finally, the third level is the effect over time of the

196   intervention on the three outcome variables (standardized suicide mortality, registration of suicide

197   attempts, and professional knowledge).

198   **Evaluation procedure of the feasibility and impact of SUPRANET Care**

199   **1.   Is SUPRANET Care implemented as intended, in terms of:**

200   **a.   Is the multifaceted performance feedback provided and used as intended?**

201   In order to answer the first research questions, we will evaluate the multifaceted performance

202   feedback. Annual interview rounds will be held with the local team members and at least three

203   professionals per institution to determine (1) the extent to which the multifaceted feedback is

204   performed as intended, (2) whether feedback reports provide meaningful information to professionals,

205   (3) how feedback reports are used in practice for improvement actions and (4) which best practices

206   arise. Data derived from the interviews on the process evaluation will be described and will contribute

207   to the knowledge of successes and barriers of the implementation approach.

208   **b.   Does SUPRANET Care facilitate the implementation of key guideline recommendations**

209   **and better quality of suicide prevention in mental health care?**

210   To answer this research question, we will validate and examine the implementation process of a

211   core set of relevant and action-oriented quality indicators. In order to do this, standardization of

212   definitions and terminology is needed. By using a standard terminology and a data dictionary, all

213   institutions know exactly what is meant and results are comparable and can be used for benchmarking.

214   To achieve this, first, project leads select quality indicators for suicide prevention in mental health

215 based on a literature search and the Dutch multidisciplinary guideline. Next, the selected quality

216 indicators are discussed in a small group of mental health care professionals and suicide experts (the

217 SUPRANET Care Quality of Care group). This discussion results in a basic set of relevant and action

218 oriented quality indicators. Finally the Delphi method will be used to further achieve convergence of

219 opinion among suicide experts, members of clients' advisory boards, experts with experiences in

220 suicidal behavior and health care professionals to create common definitions and nomenclature.

221 After standardization of language, at least five quality indicators for implementation are jointly

222 chosen. Criteria for selection of quality indicators are relevance (it affects the number of suicides in

223 the institution), action orientation (it can be influenced by the mental health institutions or

224 professionals themselves) and feasibility (it is feasible to implement and monitor). At least 50 experts

225 in the field of suicide prevention and staff members of each mental health institution will receive an

226 online questionnaire for expert opinion. After the Delphi round, the prioritized indicators and

227 definitions are proposed to the SUPRANET Care Quality of Care group and the SUPRANET Care

228 board. After this, the selected quality indicators will be implemented with the feedback procedure as

229 described above.

230 During the study period, the implementation process on each quality indicator will be

231 measured and evaluated with the SUPRANET Care database. Prioritized quality indicators (e.g.

232 safety-plan; waiting-list) will be operationalized and included in the minimal dataset. Results from the

233 SUPRANET Care database will be used to transfer knowledge among mental health care institutions.

234 **c. Is it feasible to register reliable, unambiguous data on completed suicide and on suicide**

235 **attempts, and on this basis, to generate meaningful feedback?**

236 To examine the feasibility of registering completed suicide and suicide attempt data, the extent of

237 registration will be monitored biannually on 5-point rating scale (0 = mental health care institution

238 does not register suicide (attempts); 5 = mental health care institutions registers all suicide (attempts)

239 of their patients). In addition, suicide and suicide attempt data will be monitored biannually in the

240 SUPRANET Care database whereby changes can be investigated. To this end, standardization of

241 definitions and terminology of suicide and suicide attempt is of great importance. The SUPRANET

242 Care registration group determines the definitions of suicide (attempt) for adoption by all SUPRANET

243 Care mental health institutions.

244   **2. Does the implementation strategy of SUPRANET Care lead to suicide safer mental**

245   **health care institutions in terms of three outcome variables:**

246   **a. Reduced suicide rates in time compared to baseline**

247   Standardized suicide rates will be the primary outcome variable of this study. In order to analyze

248 the effect of the SUPRANET Care program on reducing suicide rates in mental health care

249 institutions, all suicide cases will be defined and measured. A recent pilot across four SUPRANET

250 Care institutions showed the feasibility of extracting these data from existing data-registration systems

251 and the ability to compute suicide rates adjusted for relevant confounding factors to make comparisons

252 over time plausible.

253   In order to identify differences between institutions and within institutions over time,

254 standardized suicide rates will be calculated biannually. Differences between and changes in the

255 number of suicides could be attributed to differences in the patient population of institutions. To

256 compare mortality data, absolute numbers of suicide have to be adjusted for confounders (e.g.

257 demographic, psychiatric severity factors) in order to be able to attribute differences in patient suicide

258 rates to policy, service or staff related factors of the institutions. Therefore, for each SUPRANET Care

259 institution, suicide rates will be adjusted for confounding factors in the client population of each

260 institution using indirect standardization. This method is preferred when one or more confounding –

261 specific mortality rates are based on small numbers [22]. Adjustment for risk factors like gender, age and

262 DSM-IV/V diagnosis will make comparison within and between institutions more reasonable, and

263 thereby learning possible.

264   **b. Increased registration of suicide attempts in time compared to baseline**

265   The second outcome variable in this study, is the extent to which suicide attempts are being

266 registered. Currently, suicide attempts are hardly registered in Dutch mental health institutions.

267 Monitoring and registration of suicide attempts may be one of the quality indicators improving the

268 quality of care for suicidal patients as a suicide attempt is an important risk factor for completed

269   suicide [23]. SUPRANET Care will encourage the registration of suicide attempts of patients in care.

270   Changes in the extent to which suicide attempts of patients are registered, will be analyzed with the

271   suicide attempt data that is monitored biannually in the national SUPRANET database. We

272   hypothesize that SUPRANET Care will lead to increased registration of suicide attempts.

273   **c.   Improved mutually shared knowledge, attitude and adherence to suicide prevention**

274   **guidelines in time compared to baseline**

275   The third outcome variable is improved mutually shared professional knowledge, attitude and

276   adherence to suicide prevention guidelines compared to baseline. In order to measure the outcome, an

277   extended version of the PITSTOP suicide survey (Professionals In Training to STOP suicide) among

278   crisis teams and ambulatory care teams in each participating mental health institution will be held to

279   test (1) the shared knowledge of suicidal behavior and suicide prevention, (2) the attitude of healthcare

280   professionals towards suicidal patients and (3) adherence to the clinical practice guidelines [24]. This

281   questionnaire will be conducted in crisis teams and ambulatory care teams at baseline (before the

282   SUPRANET Care implementation approach) with annual repeated measurements after one, two and

283   three years. An improvement in shared knowledge and attitude of professionals and adherence to

284   guidelines is expected [24].

285   **Statistical analysis**

286   First, the implementation progress will be analyzed. The first data collection is for the purpose of

287   having the baseline measurement. Outcomes on progress in implementation are assessed biannually at

288   the organizational, professional, and patient level using data from the national registry of SUPRANET

289   Care. Generalized Linear Model (GLM) repeated measures will be used to analyze if institutions

290   change over time on each quality indicator including registration of a contact person, waiting-list

291   duration and safety-plan.

292   To test the effect of the SUPRANET Care implementation approach on the outcome variables,

293   Interrupted Time-Series Analysis Procedure (ITSACORR) will be conducted, designed to analyse

294   short time series that likely have auto correlated errors [25]. ITSACORR is the preferred method above

295   Autoregressive Integrated Moving Average (ARIMA) in relatively short time-series data [26]. The result

296   is a "repeated time series" that, unlike pre- and post-intervention means or percentage difference tests,

297   enables investigation of the pattern of change over time and include its mean level (the average of all

298   time points) and changes in its slope [25]. To strengthen this uncontrolled study design, health care

299   organizations' level of implementation is added to the study. If organizations with better, or greater

300   number of, implemented quality indicators show greater change in the outcomes, it strengthens the

301   argument that the SUPRANET Care approach led to the changes.

302   **Patient and public involvement**

303   A member of the clients' advisory board participates in the board of the SUPRANET Care

304   Foundation. Experts with experiences in suicidal behavior are involved in the development of

305   SUPRANET GGZ: in the Delphi study to create useful quality indicators for implementation.

306   Furthermore, they actively participate in the workgroups: the Quality of Care Group and the

307   Registration Group, in which professionals recruited from the participant organizations participate.

308   Results of the study will be disseminated to the study participants, through feedback reports,

309   presentations and messages on our website (www.supranetggz.nl).

310   **Discussion**

311   This paper describes the study protocol of a longitudinal study investigating the activities of

312   SUPRANET Care by examining its feasibility and impact in a network formed by thirteen specialist

313   mental health care institutions. It will be the first study worldwide to report on the results of a

314   confidential learning network approach in suicide prevention. We expect that SUPRANET Care will

315   improve shared knowledge of professionals, increase the registration of suicide attempts and decrease

316   suicide rates in Dutch mental health care.

317   Suicide is the worst outcome of mental illness. Recent evidence shows that suicide prevention

318   in mental health care can be enhanced considerably by creating a culture that puts patient and staff

319   safety first; and by systematically improving the quality and organization of care [8][9]. This involves the

320   implementation of guideline best practices addressing contextual barriers and facilitators at different

321   levels; continually addressing targeted quality and safety issues using plan-do-check-act cycles. Given

322   the low base rate of suicides and suicide attempts, large and longitudinal databases are needed to

323   assess the impact of quality improvement and guideline best practice implementation. The

324   SUPRANET Care program contains these elements and may prove to be a successful new approach to

325   enhance suicide prevention in mental health care.

326   Strength of the study is that SUPRANET Care is a bottom-up initiative covering almost half of

327   the large mental health care organizations in the Netherlands, with a clear ambition to work together to

328   improve guideline implementation, suicide prevention and quality of care in Dutch mental health

329   settings. Also, experts with experiences in suicidal behavior are involved in the organization of

330   SUPRANET Care.

331   A limitation of our study is the aggregation of the collected patient and treatment data to

332   protect the privacy of patients and SUPRANET Care nor the data-analyst is thus able to decrypt

333   personal patient information to follow patients in time. However, for feedback reports and our

334   implementation and study goals, the aggregated data appear sufficient.

335   SUPRANET Care is a unique project worldwide. When successful, all Dutch mental health

336   settings will be invited to join SUPRANET and to include the quality indicators into their policy for

337   suicide prevention. As the results will be of high relevance for countries in and outside of Europe, the

338   implementation approach of SUPRANET Care, and the gained knowledge of the evaluation study will

339   be shared with an international audience.

344   **Author Contributions:** All authors contributed to the design of the study. KS drafted the manuscript.

345   JK, AB, GF, IV, DD, ME and RG made critical revisions to and edited the manuscript. All authors

346   contributed to and approved the final manuscript.

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