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Received: 14 April 2023 | Revised: 2 October 2023 | Accepted: 5 November 2023

DOI: 10.1111/jgs.18695

CLINICAL INVESTIGATION

Journal of the American Geriatrics Society

The impact of the COVID-19 pandemic on Positive Health among older adults in relation to the complexity of health problems

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Funding information
ZonMw, Grant/Award Number: 10430102110005

Abstract

Background: The broad concept of health as "the ability to adapt and self-manage in the face of social, physical and emotional challenges" has been operationalized by "Positive Health," a framework increasingly used in the Netherlands. We explored to what degree the impact of the COVID-19 pandemic and preventive measures on Positive Health differed between community-dwelling older adults without, with mild and with complex health problems, as well as differences flowing from their use of preventive measures.

Methods: During the second wave in the Netherlands (November 2020–February 2021), a convenience sample of adults aged ≥65 years completed an online questionnaire. Positive Health impact was measured based on self-reported change of current health status, across six dimensions, compared to before the pandemic (decreased/unchanged/increased). The complexity of health problems (past month) was assessed using the validated ISCOPE tool, comparing subgroups without, with mild or with complex health problems. High use of preventive measures was defined as ≥9 of 13 measures and compared to low use (<9 measures).

Results: Of the 2397 participants (median age 71 years, 60% female, and 4% previous COVID-19 infection), 31% experienced no health problems, 55% mild health problems, and 15% complex health problems. Overall, participants reported a median decrease in one Positive Health dimension (IQR 1–3), most commonly in social participation (68%). With an increasing complexity of health problems, subjective Positive Health declined more often across all six dimensions, ranging from 3.3% to 57% in those without, from 22% to 72% in those with

Part of this paper was presented with a poster presentation at the 18th European Geriatric Medicine Society (EUGMS) Congress in London in September 2022.

mild, and from 47% to 75% in those with complex health problems (p-values for trend <0.001; independent of age and sex). High users of preventive measures more often experienced declined social participation (72% vs. 62%, $p < 0.001$) and a declined quality of life (36% vs. 30%, $p = 0.007$) than low users, especially those with complex health problems.

Conclusion: As the complexity of health problems increased, the adverse impact of the COVID-19 pandemic and related preventive measures was experienced more frequently across all dimensions of Positive Health. Acknowledging this heterogeneity is pivotal to the effective targeting of prevention and healthcare to those most in need.

KEYWORDS

community-dwelling, COVID-19, health impact assessment, older adults, self-rated health

INTRODUCTION

The COVID-19 pandemic affected the health of many older adults in the Netherlands. The severity of COVID-19 infections (e.g., hospital admissions) and related mortality rates were disproportionally higher in older age groups,[1–3] with a majority of fatal cases (89%) involving adults aged 70 years and older.[2] The government adopted preventive measures to lower viral transmission, avoid an overburdened healthcare system, and protect vulnerable members of society.[4] Older adults in general were considered part of this vulnerable subgroup and were strongly urged to comply with preventive measures.[4,5] Throughout the pandemic, these measures ranged from improved personal hygiene to self-isolation and stringent societal lockdowns, the wider health impact of which warrants deliberation in policymaking[6] and prioritization in research.[7]

A new and dynamic concept of health was proposed by Machteld Huber in 2011: "*Health as the ability to adapt and self-manage in the face of social, physical and emotional challenges.*"[8] This broad perception of health was subsequently operationalized by the term "*Positive Health.*"[9] Its framework incorporates six self-reported medical and non-medical dimensions of health (bodily functions, mental well-being, meaningfulness, quality of life (QoL), social participation, and daily functioning) and thus complements traditional health outcomes such as disease severity or mortality. Positive Health-derived dialogue tools are increasingly being implemented in older adult healthcare in the Netherlands as a means of providing holistic, person-centered care for the challenges they are facing.[10] To assess the wider health impact of the challenging pandemic in the Netherlands and to give voice to older adults, we initiated the PHICOP study: the "*Positive Health Impact of the COVID-19 pandemic and the associated measures on community-dwelling Older Individuals and Professionals study.*"[11] The first COVID-19 wave had a substantial impact on all dimensions of Positive Health in the overall study population, both adverse and favorable (e.g., 73% of participants experienced a decrease in social participation, whereas 37% experienced an improvement in mental well-being).[11]

Key points

- The largest adverse impact of the COVID-19 pandemic on community-dwelling older adults in the Netherlands was experienced in the dimension of social participation.
- Older adults with increasingly complex health problems experienced adverse impacts on all six dimensions of Positive Health substantially more often than older adults without health problems and increasingly experienced the largest adverse impact on dimensions other than social participation (especially in bodily functions, mental well-being, and quality of life).
- Higher use of preventive measures correlated with an adverse impact on quality of life and social participation, which was most pronounced in those with complex health problems.

Why does this paper matter?

The perceived health impact of the COVID-19 pandemic and related preventive measures on a heterogeneous older population was both broad and unequal, an issue that should be addressed in future policymaking and healthcare.

However, it is important to keep in mind the high degree of heterogeneity found in any "older population" regarding health status. The health deficits experienced by older adults vary widely across diverse domains (functional, somatic, mental, and social), and only 26% of community-dwelling older adults (75+) have so-called complex health problems (i.e., multiple deficits on ≥3 health domains).[12] As multiple deficits are, for example, associated with increased COVID-19-related concerns and perceived threats,[13] the impact of the pandemic and associated measures on health likely differs between older adults with differing complexities of health problems. To the best of our knowledge, impact studies concerning broad health outcomes such as Positive Health have either not yet compared older adults with differing complexities of health problems[11,14] or have assessed only certain dimensions of Positive Health.[15–18]

We therefore investigated to what degree the impact of the COVID-19 pandemic and related preventive measures on Positive Health differed between community-dwelling older adults without, with mild and with complex health problems, as well as differences flowing from their use of preventive measures. We hypothesized that a larger adverse impact would correlate with an increasing complexity of health problems and with higher use of preventive measures. It is important to understand heterogeneity among older populations to substantiate previous and future policymaking concerning vulnerable populations. Our work also addresses the need for inclusive COVID-19 research,[7] as well as personalized, evidence-based medicine for older adults.[19]

METHODS

Study design and participants

The present study took a cross-sectional approach, targeted at a convenience sample of community-dwelling older adults aged 65 years and over in the Netherlands with differing complexities of health problems while embedded in the abovementioned PHICOP study. Data were collected between November 16, 2020 and February 2, 2021 via an anonymous online questionnaire in a manner similar to our previous cross-sectional study during the first COVID-19 wave.[11] In short, older adults (65+) were invited to participate via email, digital newsletters, and/or social media of senior organizations, municipal health services, and libraries. Onward distribution of the invitation via professional and personal networks was encouraged (i.e., the snowball method), without regional restrictions within the Netherlands. Older adults were excluded from participation if residing in care institutions or outside the Netherlands. Furthermore, questionnaires with less than 92% of questions answered were excluded. This cutoff was chosen to obtain valid scores concerning the complexity of health problems and to minimize the inclusion of potential duplicate data entries (e.g., technical difficulties when filling out the questionnaire may have led to multiple attempts by the same individual). The study was approved by the Institutional Review Board of the Leiden University Medical Center for observational COVID-19 studies (CoCo 2020-063). All participants provided informed consent.

Setting

Data collection was carried out during a period that included the upward slope and peak of the second COVID-19 pandemic wave.[4] Existing personal hygiene and social distancing measures were nationally supplemented with a partial lockdown prior to the start of our data collection, which evolved into a full lockdown (December 15, 2020 onward) and eventually included a curfew to prevent "code black" (January 23, 2021 onward). During these months, COVID-19 vaccination strategies were debated (such as prioritization of vulnerable older adults) and the first community-dwelling older adults received vaccinations at the end of January 2021.

Questionnaire

Complexity of health problems

An older person with complex problems is someone with multiple health problems that interact.[20] The complexity of health problems was assessed using the validated Integrated Systematic Care for Older People (ISCOPE) screening questionnaire (Supplementary File 1A).[12,20] This tool was selected as it discriminates between older adults without health problems and those with increased complexity of health problems in line with primary care in the Netherlands, and as it is a simple self-reported tool.[20,21] This tool consists of 21 closed-ended questions on deficits across four health domains (functional, somatic, mental, and social health) and applies a stepwise scoring system. First, health problems per domain were defined as experiencing two or more deficits during the past month. Second, participants were divided into three subgroups based on the number of domains with health problems: those without health problems (i.e., 0 domains), those with mild health problems (1–2 domains), and those with complex health problems

(3–4 domains). These subgroups have been shown to reflect both the accumulation and the interaction of experienced deficits, and as such the complexity of experienced health problems.[20]

Application of preventive measures

Participants were asked about their use of 13 preventive measures to decrease the risk of COVID-19 infection, which were urgently advised by the government in the Netherlands at that time.[4] These measures encompassed five types of prevention: improved personal hygiene, use of protective equipment, and limiting either physical contact, indoor contact, or time spent outdoors (with 1–3 measures questioned per type). Participants were categorized as high or low users, calculated based on median number of preventive measures used. In addition, overall strictness in applying the measures (strict vs. less than strict) was also reported, as well as the underlying motivation (protection of oneself, others or both; Supplementary File 1B).

Impact on Positive Health

In the absence of a validated Positive Health measurement tool at the time of our data collection,[22,23] we based our timely, subjective health impact assessment on the dialogue tool from the Institute for Positive Health,[9,24] in line with our study of the first wave (Supplementary File 1C).[11] First, Positive Health impact was measured as self-rated change across the six dimensions of its framework: "*Compared to one year ago (before the corona crisis), how do you currently rate your [dimension]?*" Per dimension, several more specific health indicators ($n = 1$–3) were similarly assessed (e.g., memory and cheerfulness on the dimension mental well-being). Experiences were categorized as "*decreased*" (much or somewhat), "*unchanged*" or "*improved*" (much or somewhat). In case of "*no opinion*," the experience was not included in the analysis. Second, participants were asked to compare the degree of impact of the second wave relative to during the first wave (March & April 2020), to evaluate perceived differences between the subsequent COVID-19 waves. They ranked which of the six Positive Health dimensions most worsened or improved. In summary, we used two different measures of Positive Health impact: (1) rating to determine the prevalence of *any* impact in comparison to 1 year ago (before the COVID-19 pandemic) and (2) ranking to determine the prevalence of the single *largest* impact in comparison to the first wave (i.e., not to assess the magnitude of any impact since the COVID-19 pandemic).

Other measures

Socio-demographic data were gathered on age, sex, educational attainment (a lower or middle vs. a higher completed level of education according to the Dutch Verhage scale),[25] and living situation (alone vs. with others). Previous COVID-19 infections (self or a loved one) were reported, as well as experienced fear of (repeated) COVID-19 infections (for self or a loved one). Finally, participants indicated which of the six Positive Health dimensions was most important to life.

Statistical analysis

Continuous data, which were not normally distributed, were presented as medians with interquartile ranges (IQR). Categorical data were presented as proportions. Results were stratified by the complexity of experienced health problems to allow group comparisons. Trends across groups were tested by Jonckheere-Terpstra and linear by linear Chi-square tests, as appropriate. Logistic regression models were applied, both crude and adjusted for age and sex,[11,20] to assess dependency on these covariates in the risk of self-rated decrease in Positive Health for those with mild and complex health problems versus those without health problems. To explore additional differences based on use of preventive measures, those with high and low use were compared by Pearson Chi-square tests, overall and in the above subgroups based on complexity of health problems. SPSS Statistics version 25.0 was used (IBM Corp, Armonk, NY),[26] and a p-value <0.05 was considered statistically significant.

RESULTS

Participants' characteristics

Our anonymous survey was opened by 3058 older adults from our target population, of which 661 surveys (20%) had too little progress for valid scores on the complexity of health problems (i.e., ≤92% progress). Therefore, our study included 2397 participants, with summary characteristics shown in Table 1. The participants, 60% of whom were women, had a median age of 71 (IQR 68–76 years), 46% had a lower or middle-level education, and 36% lived alone. The experience of health problems during the past month ranged from 4.5% in the functional domain to 52% in the social domain. No health problems were experienced by 736 participants (31%), mild health problems by 1311 (55%), and complex health problems by 350 (15%). The prevalence of a previous COVID-19 infection was 4.0%, and participants used a median of 9 preventive measures (IQR 7–10 out of 13). Regarding Positive Health, QoL was regarded as the

TABLE 1 Characteristics of study participants overall ($N = 2397$).

Sociodemographic characteristics		
Age, median [IQR], years		71 [68, 76]
Female, %		60
Lower or middle educated, %[a]		46
Living alone, %		36
Health problems, %[b]		
Domain	Functional	4.5
	Somatic	29
	Mental	43
	Social	52
Complexity	None	31
	Mild	55
	Complex	15
COVID-19 infection, %		
Previous infection	Self	4.0
	Loved one	24
Fear of (repeated) infection	For self	28
	For loved one	41
Preventive measures		
Number of measures used, median (IQR)[c]		9 [7, 10]
Overall strict application, %[d]		25
Motivation for application, %	Personal protection	10
	Protection of others	2.5
	Protection of self and others	88
Positive Health, %		
Most important dimension to life	Bodily functions	8.3
	Mental well-being	19
	Meaningfulness	6.9
	Quality of life	45
	Social participation	6.1
	Daily functioning	14

Note: Missing data (numbers): Sex—26, education—4, living situation—2, functional domain—1, somatic domain—4, social domain—1. Otherwise excluded from analysis: previous infection "do not know"—47, fear of infection "no opinion"—28 for self and 52 for loved ones, strictness "no opinion"—10, motivation "else"—28, motivation "N/A"—22, most important dimension in life of Positive Health "no opinion"—22.
Abbreviations: IQR, interquartile range; ISCOPE, Integrated Systematic Care for Older People.
[a]Lower- or middle-level education included those whose highest level of completed education was none, primary, low- or average-level secondary or secondary vocational compared to those with high-level secondary or higher (vocational) education.
[b]Health problems were defined as experiencing ≥2 deficits out of 4–7 potential deficits per health domain of the ISCOPE tool during the past month. Complexity of health problems was defined by the number of domains with these health problems: none (0 domains), mild (1–2 domains), and complex (3–4 domains).
[c]The application of 13 preventive measures was assessed.
[d]Self-reported strictness in the overall application of the preventive measures (strict vs. less than strict).

dimension most important to life (45%), followed by mental well-being (19%), and daily functioning (14%).

As participant's health problems became more complex (Table 2), they were slightly older and more often female, with a lower educational level and more likely to be living alone (all p_{trend}-values <0.001). With an increasing complexity of health problems, participants more frequently experienced fear of infection concerning both oneself and others (ranging from 14% respectively 28% in participants without health problems to 43% respectively 57% in participants with complex health problems, p_{trend}-values <0.001). Moreover, participants more often adhered strictly to preventive measures and more often used measures solely for personal protection (ranging from 22% respectively 7.8% in participants without health problems to 30% respectively 17% in participants with complex health problems, p_{trend}-values ≤0.006). There was no difference across groups in the prevalence of "high users" (i.e., those who used ≥9 recommended preventive measures; $p_{trend} = 0.449$).

Impact on Positive Health

Overall and by complexity of health problems

The overall study population rated a median of 4 dimensions of Positive Health as unchanged (IQR 2–5), 1 dimension as decreased (IQR 1–3), and 0 dimensions as improved (IQR 0–0). The most frequently decreased dimension was social participation (68%), followed by QoL (33%) and daily functioning (30%). With an increasing complexity of health problems (Figure 1), participants more frequently reported a decreased experience across all six dimensions of Positive Health, ranging from 3.3% to 57% in those without, from 22% to 72% in those with mild, and from 47% to 75% in those with complex health problems (all p_{trend}-values <0.001), even after adjustment for age and sex (Supplementary Table 1). Similar trends were shown per dimension across the more specific health indicators (Supplementary Table 2; all p_{trend}-values <0.001). As all three subgroups reported 0 dimensions improved (IQR 0–0), favorable impacts could not be analyzed.

In line with the above ratings, a majority of the overall study population ranked the reduction in their social participation as the largest decline in their Positive Health (62%), ranging from 78% (no health problems) to 35% (complex health problems) across the three subgroups (Figure 2). However, with an increasing complexity of health problems, participants more frequently reported that they felt the largest decline in their Positive Health in other dimensions than social participation. For example, especially in bodily functions (from 5.3% to 22%; no vs. complex health problems), mental well-being (from 1.3% to 12%; no vs. complex health

TABLE 2 Characteristics of study participants, stratified by the complexity of health problems.

		Complexity of health problems[a]			
		None	Mild	Complex	*p*-value for trend
		N = 736	*N* = 1311	*N* = 350	
Sociodemographic characteristics					
Age, median (IQR), years		71 [67, 75]	71 [68, 76]	72 [68, 78]	<0.001
Female, %		53	63	65	<0.001
Lower or middle educated, %[b]		40	45	57	<0.001
Living alone, %		25	38	49	<0.001
Health problems, %[c]					
Domain	Functional	n/a	1.3	26	n/a
	Somatic	n/a	26	98	n/a
	Mental	n/a	53	98	n/a
	Social	n/a	70	96	n/a
COVID-19 infection, %					
Previous infection	Self	2.3	4.8	4.1	0.047
	Loved one	23	24	27	0.135
Fear of (repeated) infection	For self	14	32	43	<0.001
	For loved one	28	45	57	<0.001
Preventive measures, %					
High use (≥ 9 out of 13 measures)		55	57	57	0.449
Overall strict application		22	25	30	0.006
Motivation for application	Personal protection	7.8	9.2	17	<0.001
	Protection of others	2.2	2.3	3.5	
	Protection of self and others	90	88	80	
Positive Health, %					
Most important dimension in life	Bodily functions	7.0	8.0	12	<0.001
	Mental well-being	16	20	24	
	Meaningfulness	5.9	7.5	6.9	
	Quality of life	50	45	37	
	Social participation	5.5	6.3	6.6	
	Daily functioning	15	14	12	

Note: Missing data: please see notes underneath Table 1.

Abbreviations: IQR, interquartile range; ISCOPE, Integrated Systematic Care for Older People.

[a]The complexity of health problems was defined by the number of domains with experienced health problems: none (0 domains), mild (1–2 domains), and complex (3–4 domains).

[b]Lower or middle educated included those whose highest level of completed education was none, primary, low- or average-level secondary or secondary vocational compared to those with high-level secondary or higher (vocational) education.

[c]Health problems were defined as experiencing ≥2 deficits out of 4–7 potential deficits per health domain of the ISCOPE tool during the past month.

problems), and QoL (8.9% to 17%; no vs. complex health problems (p_{trend} <0.001)).

Additional stratification by use of preventive measures

Overall, high use of preventive measures correlated with experiencing decrease on more Positive Health dimensions compared to low use (median (IQR): respectively 2 (1–3) versus 1 (0–3), $p < 0.001$). This decrease was most prominent in the dimensions QoL (36% vs. 30%; $p = 0.007$) and social participation (72% vs. 62%; $p < 0.001$), and these differences increased with an increasing complexity of health problems (Figure 3). There was no association between use of measures and an experienced decrease in the other four dimensions, either overall or stratified by complexity of health problems. Ranking of the largest decrease was also

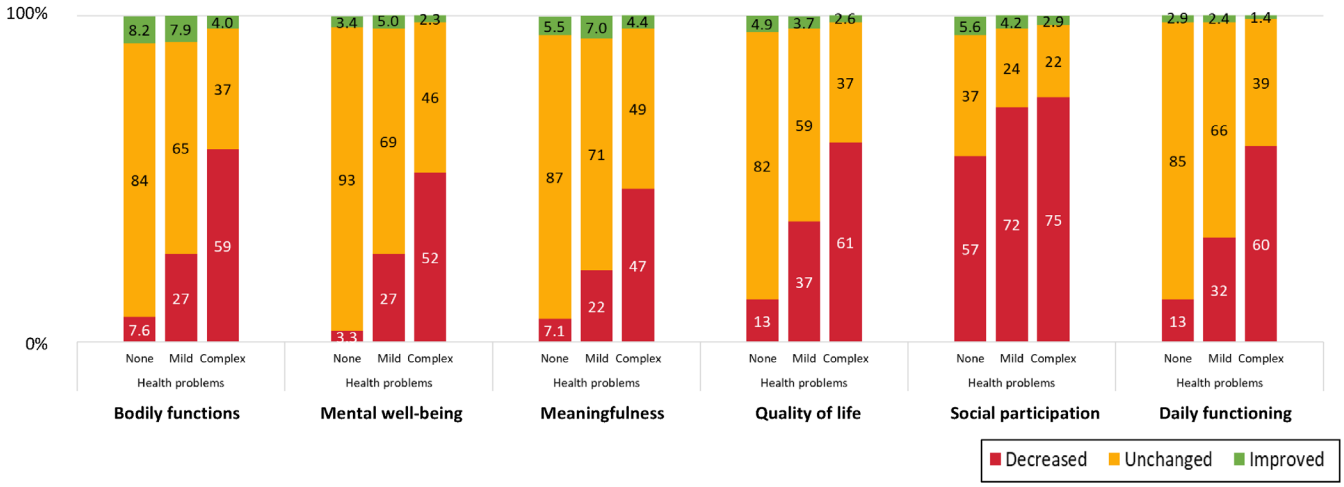

FIGURE 1 Self-rated impact on Positive Health compared to 1 year ago (%), stratified by the complexity of health problems. Results per dimension from a linear by linear Chi-square test (all p_{trend}-values <0.001). The complexity of health problems was defined by the number of domains with experienced health problems: none (0 domains), mild (1–2 domains), and complex (3–4 domains). Excluded from analysis (overall numbers "no opinion"): bodily functions—2, mental well-being—3, meaningfulness—48, QoL—8, social participation—23, daily functioning—4.

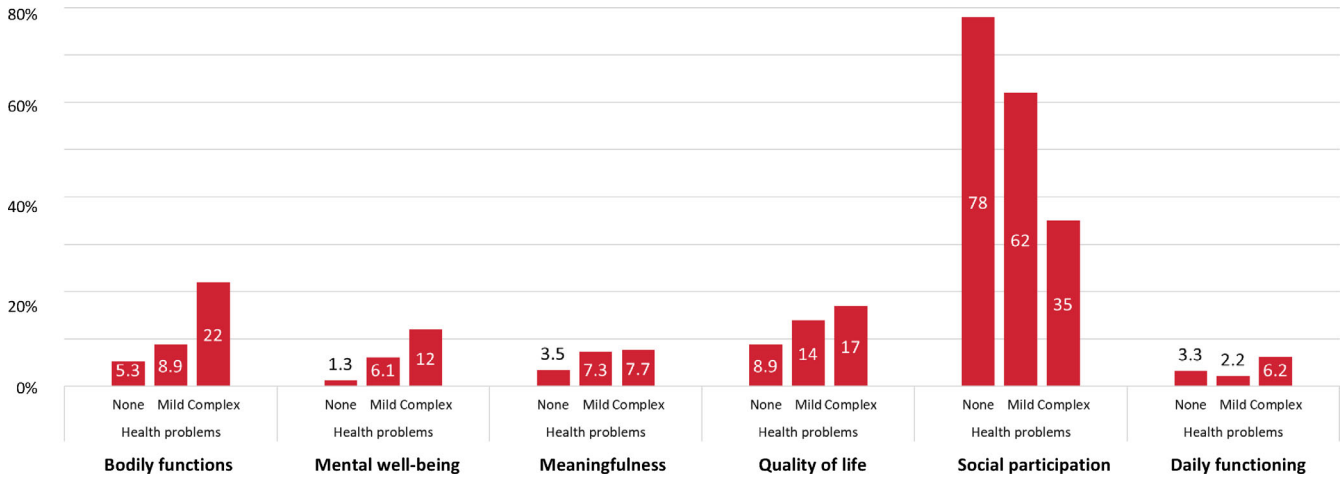

FIGURE 2 Largest decrease experienced in Positive Health compared to the first wave (%), stratified by the complexity of health problems. Results from a linear by linear Chi-square test (p_{trend} <0.001). The complexity of health problems was defined by the number of domains with experienced health problems: none (0 domains), mild (1–2 domains), and complex (3–4 domains). Excluded from analysis (overall number [% of the subgroups with increasing complexity of health problems]): "Not applicable"—311 (26%, 8.5%, and 3.1%, respectively).

independent of use of preventive measures, except in those with complex health problems, where high use of preventive measures correlated with more frequently experiencing the largest decrease in the dimensions QoL and social participation in particular ($p = 0.026$; not shown).

DISCUSSION

This study explored the relationship of increasingly complex health problems with the impact of the second wave of the COVID-19 pandemic and related preventive measures on Positive Health in community-dwelling older adults in the Netherlands. With an increasing complexity of health problems, an adverse impact was reported substantially more often across all dimensions of Positive Health, independent of age and sex, of which a decrease in social participation was the most prevalent overall. The largest adverse impact was increasingly experienced in other dimensions, especially in bodily functions, mental well-being, and QoL. Furthermore, high use of preventive measures was associated with adverse impacts in the dimensions QoL and social participation, which increased with an increase in the complexity of health problems. Favorable impacts were limited overall.

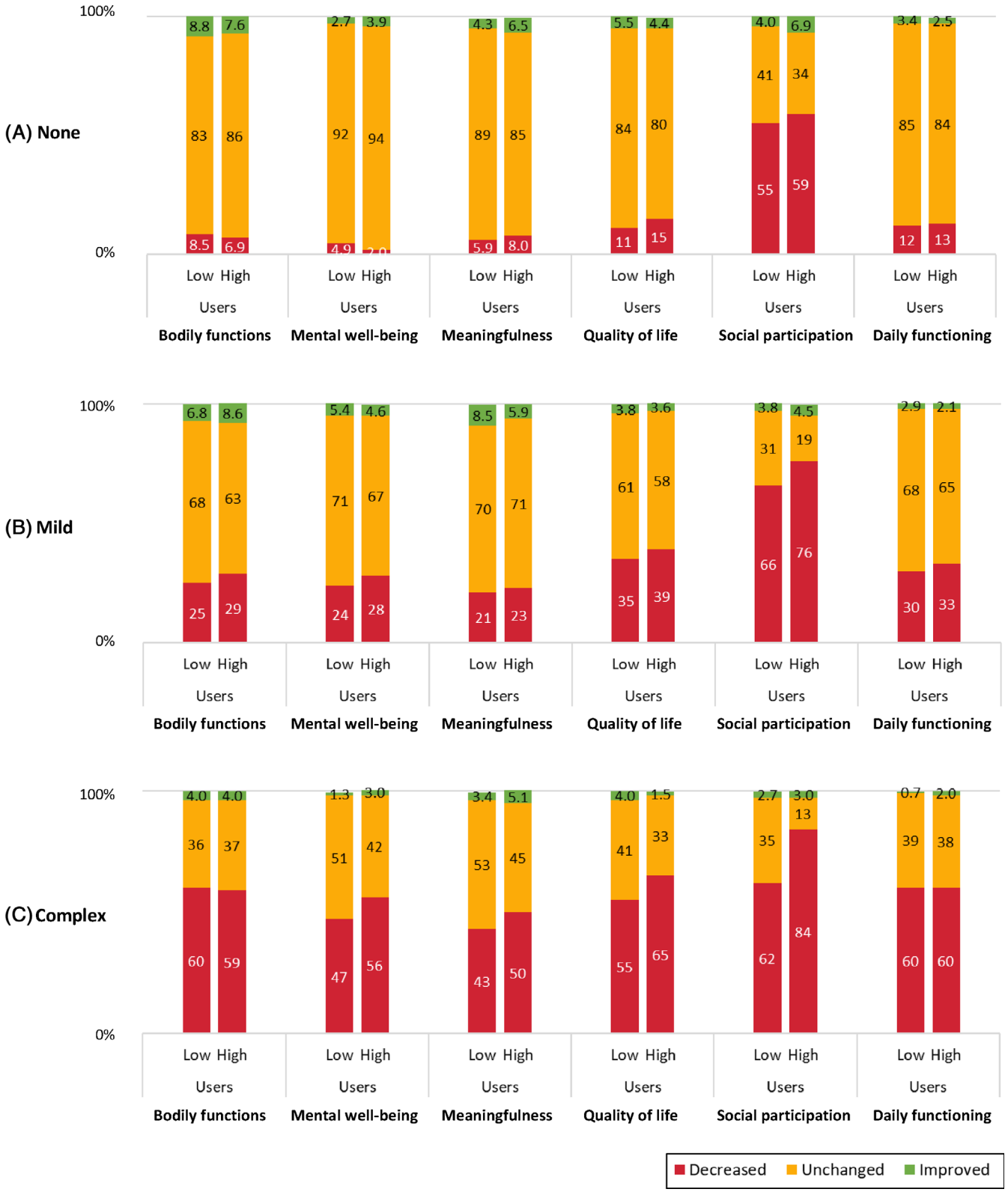

FIGURE 3 Self-rated impact on Positive Health compared to 1 year ago (%), stratified by the use of preventive measures (low vs. high use), and by complexity of health problems. Participants were divided into low versus high users by the median number of measures used out of 13 possible measures (i.e., respectively <9 vs. ≥9). The complexity of health problems was defined by the number of domains with experienced health problems: none (0 domains), mild (1–2 domains), and complex (3–4 domains).

Compared with our earlier cross-sectional study at the end of the first wave,[11] this study showed a similar-rated impact on Positive Health, with the exception of common initial improvements in areas such as mental well-being reported in our earlier study. This seems to suggest that rather than more prevalent adverse impacts across more dimensions, the second wave of the pandemic and associated increasingly strict preventive measures[4] was mainly characterized by the absence of previously experienced improvements in certain dimensions. Positive effects on daily life reported during the first wave, such as a break from routine, a simpler life and less pressure, may have faded,[14,27] followed by possible seasonal effects,[27] as well as negative expectations regarding the severity (the end of a wave vs. the rise and peak) and duration of the COVID-19 pandemic (initial crisis vs. prolongation of measures). Alternatively, some older adults reportedly adapted to the situation and felt more equipped to deal with it.[27]

Since most preventive measures directly impacted social interactions,[4] it is not surprising that social participation was the most frequently cited and most adversely affected dimension of Positive Health among the overall study population. These findings are in line with a study by Griffith et al.[18] who studied the impact of the first year of the pandemic in community-dwelling adults in Canada. In that study, the most frequently reported impact among all participants (approximately 50%) was on relationships due to family separation, with only a minor increase in prevalence with increasing pre-pandemic frailty (5% across quartiles). Similarly, Ankuda et al. showed that increased feelings of loneliness were also common (21%), but were not different when comparing older adults in the United States based on pre-pandemic homebound status as an indicator of heterogeneity in health status.[16]

There are several possible explanations why older adults with more complex health problems experienced the largest adverse impact of the pandemic and its associated measures. With increasingly complex health problems, participants were more likely to fear a COVID-19 infection during the second wave, reminiscent of COVID-19-related concerns expressed during the first wave when comparing frail versus non-frail older adults in the Netherlands.[13] Second, participants with complex health problems adhered more strictly to the preventive measures used and more often reported decreased QoL and social participation with high use, possibly as a result of this strict adherence. Restriction in life-space mobility during the first wave was shown to similarly affect QoL, especially of frail older adults.[17] Third, coping strategies differed across the older population,[27] as pre-pandemic frail older adults reported specific efforts to maintain their physical and mental health during stay-at-home periods less often compared with their more robust counterparts (e.g., less walking, fewer hobbies at home or less use of the internet).[15] Illness during the first year of the pandemic or an inability to access necessary food/supplies were also shown to be more prevalent with increasing pre-pandemic frailty.[18] Furthermore, regular healthcare for those with non-communicable diseases experienced major disruption during the pandemic.[28] Besides these explanations for a differential impact of the COVID-19 pandemic and its related measures on Positive Health, the timeframe of our assessment of complexity of health problems (past month) allowed room for the perceived course of Positive Health to be impacted by deficits that developed due to normal aging.

A strength of the current study is the large sample of community-dwelling older adults across the Netherlands, whose participation was facilitated by an anonymous and online accessible questionnaire (95% of Dutch adults aged 65+ uses a computer).[29] We addressed heterogeneity among this older population by use of the validated ISCOPE tool for complex health problems. This tool reflects the perception of the older adults and did not additionally burden healthcare professionals during the peak of the COVID-19 pandemic. We also replicated our previously applied method on Positive Health, which enhanced comparability between distinct COVID-19 waves and gave a much needed voice to the broad experience of older adults themselves.

Regarding limitations, the convenience sampling may, for instance, limit generalizability to those without digital skills or to immigrants to the Netherlands (data on country of birth were not available), and anonymity hampered the analysis of repeated measures. Second, the cross-sectional study design including the lack of a pre-pandemic heterogeneity assessment and the use of a recall-based health impact assessment impedes conclusions about causality. Even though more adverse impacts of the pandemic could have led to more complex health problems, our findings are in line with previously mentioned health impact studies using pre-pandemic heterogeneity measures.[15,16,18] Finally, the normal course of Positive Health throughout the year or with an increasing complexity of health problems is presently unknown. A better understanding of these issues would help when interpreting existing studies of self-rated change in older adults.

In conclusion, community-dwelling older adults in the Netherlands particularly experienced substantial adverse impact on social participation throughout the first year of the COVID-19 pandemic. With increasingly complex health problems, adverse impacts were substantially more common across all dimensions of Positive Health. High use of preventive measures only exacerbated this problem. Acknowledging heterogeneity in

health status among the older population is not only pivotal to prevent ageism in policymaking for COVID-19 and future pandemics,[5] but will also help target prevention strategies and healthcare to those in greatest need (e.g., public health campaigns to improve social participation and, in the case of complex health problems, more personalized medicine that covers all dimensions of Positive Health). Moreover, balanced assessment of both the positive and adverse impacts of preventive policies should encompass broader health outcomes such as Positive Health and at least include dimensions vital to older adults such as QoL. A better understanding of the impact of COVID-19 infections on Positive Health could further refine future policies.

AUTHOR CONTRIBUTIONS

Isabelle S. Moens, Yvonne M. Drewes, Wendy P.J. den Elzen, Simon P. Mooijaart, and Jacobijn Gussekloo designed the study. Data acquisition was done by Isabelle S. Moens, Yvonne M. Drewes, and Wendy P.J. den Elzen. Veerle M.G.T.H. van der Klei and Yvonne M. Drewes had full access to all of the data and took responsibility for the integrity of the data and accuracy of the data analysis. Veerle M.G.T.H. van der Klei, Yvonne M. Drewes, Stella Trompet, Twan Simons, and Jacobijn Gussekloo analyzed and/or interpreted the data. Veerle M.G.T.H. van der Klei, Yvonne M. Drewes, Stella Trompet, and Jacobijn Gussekloo drafted the manuscript. Isabelle S. Moens, Twan Simons, Wendy P.J. den Elzen, and Simon P. Mooijaart critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

ACKNOWLEDGEMENTS

The authors would like to thank all organizations that distributed the online survey: Elderly Council (RVO), BeterOud, Elderly Board South-Holland North, Leyden Academy on Vitality and Ageing, The Catholic Union of the Elderly—Protestant Christian Union of the Elderly (KBO-PCOB), Network of Organizations of Older Migrants (NOOM), Fos'ten, Branchevereniging Zorgthuisnl, Mensen met dementie Groningen, Ouderen in de Wijk, Seniorennieuws, Vereniging Ouderenbelang Voorschoten, Stichting Senioren Voorschoten, Wijkcentrum Swaenswijk, Adviesraad Sociaal Domein Leiden, Stedelijke Ouderen Commissie Den Haag, GGD Haaglanden, and the Leiden University Medical Center.

The COVID-19 Outcomes in Older People (COOP) consortium wishes to acknowledge the COOP Seniors Advisory Board (Ouderenraad) for their participation as representatives of older persons and for their helpful feedback and numerous insights throughout the project.

FUNDING INFORMATION

This study was part of the larger COVID-19 Outcomes in Older People (COOP) study (project number 10430102110005), which is supported by Zorg Onderzoek Nederland en Medische Wetenschappen (ZonMw) under the COVID-19 program. ZonMW had no role in data analysis or reporting.

CONFLICT OF INTEREST STATEMENT

The authors have no conflicts.

SPONSOR'S ROLE

The sponsors had no role in the design and conduct of the study, in the collection, analysis, and interpretation of the data, nor in the preparation of the manuscript.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Supplementary File 1. Forward translation and scoring of PHICOP questions.

Supplementary Table 1. Cross-sectional association between the complexity of health problems and self-rated decrease in Positive Health.

Supplementary Table 2. Self-rated decrease in the health indicators per dimension of Positive Health, stratified by the complexity of health problems.

How to cite this article: van der Klei VMGTH, Moens IS, Simons T, et al. The impact of the COVID-19 pandemic on Positive Health among older adults in relation to the complexity of health problems. *J Am Geriatr Soc*. 2024;72(3):718-728. doi:10.1111/jgs.18695