

# An Issue of Trust

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Exploring Different Aspects of the Municipal  
Acute Ward as an Alternative to Hospitalization

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## Abbreviations

COPD = chronic obstructive pulmonary disease

MAW = municipal acute ward

PCP = primary care physician





## Summary

Demographic changes, as well as technological and medical innovations, are the leading causes for longer life expectancy, and for more people living with chronic disorders. This increase the need for healthcare services. The pressure on hospitals is already heavy, and it is expected to increase in the coming decades. The Municipal Acute Wards were introduced in the Norwegian Coordination Reform in 2009, and implemented from 2012. The Municipal Acute Wards were meant to relieve pressure on hospitals by offering medical treatment and care in a local unit nearby patients' home. Under the premises that 1) patients were in need of hospitalization, but not specialist healthcare services, and 2) they should receive treatment as good as or better than in a hospital.

The main aim of this thesis is to provide knowledge about various aspects of the Municipal Acute Wards as an alternative to hospitalization. Specific purposes are to: 1) explore Primary Care Physicians' perspectives on the Municipal Acute Ward as an alternative to hospitalization, 2) explore characteristics of patients admitted to the Municipal Acute Wards in the period 2014-2020, and 3) assess the quality of healthcare services in Municipal Acute Wards compared to those in the hospital. Consequently, this thesis consists of a qualitative study, a registry data study, and a randomized controlled study.

The first study showed that Primary Care Physicians at the out-of-hours service were skeptical to refer patients to a Municipal Acute Ward, due to lower medical competence and less diagnostic possibilities compared to in the hospital. However, they perceived that the "diagnostic loop"<sup>1</sup> made it safer to refer patients to a Municipal Acute Ward. The second study showed that mainly older persons were admitted to the Municipal Acute Wards. Patients treated in a Municipal Acute Ward mainly needed basic medical treatment, care, and nursing. The results showed that patients were transferred to the hospital when they needed more advanced medical treatment, such as intravenous medication. The third study indicated that the patients experienced equally positive patient experiences, whether they were treated in a Municipal Acute Ward or in a hospital. The patients had slightly better scores on self-reported quality of life and health status 4-6 weeks after a stay in a Municipal Acute Ward compared to in the hospital. There were no significant differences in the number of

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<sup>1</sup> The "diagnostic loop" implies that patients may be sent to the hospital for extended diagnostics before being admitted to the Municipal Acute Ward.

readmissions, mortality, or self-perceived health status after treatment in a Municipal Acute Ward compared to in the hospital.

This thesis provides increased knowledge about the assessments performed by Primary Care Physicians at the out-of-hours service before transferring a patient to a Municipal Acute Ward. Their skepticism may have consequences for how this healthcare service is utilized. The registry data indicates that the Municipal Acute Ward fills a gap in the interface between specialist and primary healthcare. This also indicates that the Municipal Acute Ward does not represent the alternative to hospitalization as intended. The randomized controlled study indicates that patients receive services of the same quality in the Municipal Acute Ward as in the hospital. This is supported by previous research on similar alternatives to hospitalization.

Findings in this thesis indicate that despite the Primary Care Physicians' skepticism, the Municipal Acute Wards may provide proper and quality healthcare services in the interface between specialist and primary healthcare. However, the results indicate that there may be a need to adjust the intentions with the Municipal Acute Wards in order to fulfil a need in tomorrow's healthcare service.

## Sammendrag

Demografiske endringer, samt teknologiske og medikamentelle nyvinninger, gjør at flere lever lengre, og at flere lever med kroniske lidelser. Dette øker behovet for helsetjenester. Presset på sykehusene er allerede stort og antas å øke i de neste tiårene. Kommunale Akutte Døgneheter ble introdusert i Samhandlingsreformen i 2009, og implementert fra 2012. De Kommunale Akutte Døgneheterne skulle avlaste sykehusene ved å tilby medisinsk behandling og omsorg i pasientens nærmiljø. Forutsetningen var at pasienter med behov for innleggelse, men ikke for spesialisthelsetjenester, skulle kunne motta et like godt eller bedre behandlingstilbud som på sykehus.

Hovedmålet med denne avhandlingen er å tilføre kunnskap om ulike aspekter ved tilbudet ved de Kommunale Akutte Døgneheterne, som et alternativ til sykehusinnleggelse. Spesifikke formål er å: 1) utforske legevaktslegers vurderinger knyttet til de Kommunale Akutte Døgneheterne som alternativ til sykehusinnleggelse, 2) utforske kjennetegn ved pasienter som ble henvist til Kommunale Akutte Døgneheter i perioden 2014-2020, og 3) undersøke om kvaliteten på helsetjenesten er like god på Kommunal Akutt Døggenhet som på sykehuset. Denne avhandlingen består av en kvalitativ studie, en registerdatastudie og en randomisert, kontrollert studie.

Den første studien viste at legevaktslegene var skeptiske til å henvise pasienter til Kommunal Akutt Døggenhet, på grunn av lavere medisinsk kompetanse blant personalet og dårligere diagnostiske muligheter enn på sykehuset. Legene opplevde at muligheten til å sende pasientene i en «diagnostisk sløyfe»<sup>2</sup> gjorde det tryggere å henvise pasienter til Kommunal Akutt Døggenhet. Den andre studien viste at Kommunal Akutt Døggenhet hovedsakelig benyttes for eldre pasienter som har behov for enkel medisinsk behandling, stell og pleie. Resultatene tydet på at pasientene blir overført til sykehuset når de har behov for mer avansert medisinsk behandling, som intravenøs medikasjon. Den tredje studien indikerte at pasientene opplevde like positive pasienterfaringer, uavhengig av om de ble behandlet på Kommunal Akutt Døggenhet eller på sykehus. Pasientene hadde noe bedre resultater på selvrappert livskvalitet og helsestatus 4-6 uker etter opphold på den kommunale enheten sammenlignet med opphold på sykehus. Det var ingen forskjeller i antall reinnleggelser, dødelighet eller

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<sup>2</sup> «Diagnostisk sløyfe» innebærer at pasienten kan sendes til sykehuset for utvidet diagnostikk før innleggelse på Kommunal Akutt Døggenhet.

egenopplevd helsestatus etter behandling på Kommunal Akutt Døgnerhet sammenlignet med sykehus.

Avhandlingen gir økt kunnskap om de vurderinger legevaktslegene gjør før de henviser pasienter til en Kommunal Akutt Døgnerhet. Skepsisen deres kan ha konsekvenser for hvordan denne helsetjenesten benyttes. Registerdataene viser at de Kommunale Akutte Døgnerhetene fyller et behov i skjæringspunktet mellom spesialist- og kommunehelsetjenesten. Dette tyder på at tilbudet ikke fungerer som et alternativ til sykehus, slik intensjonen var. Den randomiserte kontrollerte studien indikerer at pasientene mottar tjenester av like god kvalitet ved de Kommunale Akutte Døgnerhetene som på sykehus. Dette underbygges av tidligere forskning på tilsvarende alternativer til sykehusinnleggelse.

Til tross for legevaktslegenes skepsis til tilbudet, viser denne avhandlingen at de Kommunale Akutte Døgnerhetene kan tilby sikre tjenester av god kvalitet i skjæringspunktet mellom spesialist- og kommunehelsetjeneste. Videre viser resultatene at det kan være behov for å justere intensjonene med dette tilbudet, for å fylle behovet i morgendagens helsetjeneste.

## List of Papers

Paper I: Nystrøm Vivian, Lurås Hilde, Midlöv Patrik, Leonardsen Ann-Chatrin Linqvist. What if something happens tonight? A qualitative study of primary care physicians' perspectives on an alternative to hospital admittance. *BMC Health Serv Res* **21**, 447 (2021). <https://doi.org/10.1186/s12913-021-06444-x>

Paper II: Nystrøm Vivian, Lurås Hilde, Moger Tron Anders, Leonardsen Ann-Chatrin Linqvist. Finding good alternatives to hospitalisation: a data registry study in five municipal acute wards in Norway. *BMC Health Serv Res* **22**, 715 (2022). <https://doi.org/10.1186/s12913-022-08066-3>

Paper III: Nystrøm Vivian, Lurås Hilde, Moger Tron Anders, Leonardsen Ann-Chatrin Linqvist. Patient experiences and clinical outcomes of admissions to municipal acute wards versus a hospital: A multicentre randomised controlled trial in Norway. Submitted to: *Scandinavian Journal of Primary Health Care* (2023)



## 1.0 Introduction

The Norwegian healthcare service is organized into two different administrative levels: The municipalities are responsible for primary care, while the state is responsible for specialist healthcare via four regional enterprises (1). Primary and specialist healthcare are subject to different funding systems, laws, and central legislations (1-7).

Municipal acute wards (MAWs) were introduced in primary healthcare in 2012, and became mandatory from 2016 (7-9). Initially, the MAWs were meant for eligible somatic patients, but this was expanded to include psychiatric patients from 2017 (10, 11). Statutory cooperative agreements between the municipalities and the regional hospital regulate the MAWs (1, 12). The aim of the MAWs was to reduce emergency hospital admissions for patients with eligible conditions, through referral of patients directly from primary care physicians (PCPs) (12). However, reports from the MAWs have shown varying results regarding utilization and outcomes, and there is still need for an exploration of these issues (13).

The purpose of this thesis is to add knowledge about different aspects of the MAWs in Norway. First, PCPs' perspectives about the MAW as an alternative to the hospital was explored, assuming it may impact the utilization of the MAWs. Second, the characteristics of all patients admitted to five MAWs in Østfold county during a seven-year period was studied, searching for insight into which patients PCPs assessed as suitable for being treated in a MAW. Finally, the quality of the healthcare services provided in hospital versus MAW was compared through randomizing patients to the different health service levels, examining whether the MAW represents a sound alternative to hospitalization.

Despite of significant restructuring in healthcare, more patients are treated in the hospital today (14). In 2030, it is estimated that one in five patients requiring healthcare services do not need treatment at such a high level as in hospital (8). In the future, a greater proportion of the population will be older people and people with chronic diseases (15). Medical-technical development, new effective medication, and increasingly higher levels of expertise, lead to more accessible treatment, which in turn increases survival (15, 16). Thus, more people will survive and live with a severe illness, and more will also live with complications after illness (1, 17). Having a chronic condition requires effective self-care and participation, which in turn may rise the healthcare expectations of patients and their relatives

(18-22). Consequently, the pressure on the healthcare system is estimated to increase significantly (23-25). Additionally, increasing specialization has led to coordination problems in patient pathways, resulting in fragmented treatment (8). Lack of communication between the different healthcare services lead to transition failures, and the overall experienced quality of healthcare services has decreased (8).

The World Health Organization (WHO) highlights the importance of ensuring adequate quantity and quality of public health workforce (26). In Norway, the demand of health personnel towards 2040 is estimated to increase (27, 28). A better balance between primary and specialist healthcare is expected to increase healthcare sustainability (22, 29, 30). According to the principle of best effective care level, the most sustainable healthcare is to treat patients at the right place and in right time (8). Internationally, governments have proposed different approaches of moving specialist healthcare services from hospitals to the community, with an expectation that this will increase the accessibility and responsiveness of the system, at potentially reduced costs (22, 31). Samhandlingsreformen [The Coordination reform] in Norway in 2009 pointed out a shift from hospital treatment to more treatment provided in primary care. Coordination of care was a key in the reform to achieve higher quality of healthcare services (8).



## 2.0 Alternatives to Hospitalization

In line with the shift in governmental strategies, with more outpatient care and day surgery combined with a reduction in inpatient length of stay, hospital beds have been reduced in many countries during the last 20 years (1, 22, 32, 33). Healthcare systems worldwide are now struggling with high bed occupancy rates (34, 35). This may adversely affect safe and effective hospital functions (36), which again may increase morbidity and mortality (37). Consequently, a goal in many healthcare systems is to relieve pressure on hospitals through establishing alternative organization of services (22).

### 2.1 International Alternatives to Hospitalization

Different healthcare models have been suggested and tested internationally, to meet the future challenges and to avoid hospital admissions (38-42). Literature searches have identified several approaches to organizing healthcare services as alternatives to hospitalization (37, 39, 43-49). Examples include: Community hospitals (39), Hospital at Home services (48, 49), Nurse-led units (47), Emergency department interventions (45, 46), and introduction of Community Paramedic practitioners/emergency care practitioners (50, 51). Due to the excessive development of healthcare services, the examples below are not exhaustive.

#### 2.1.1 Community Hospitals

Community hospitals have historically been implemented in many countries, for instance in the UK, Canada, Australia, Finland, Italy, and Sweden (39, 52, 53). There are different approaches to community hospitals, and in many countries, they typically serve the more rural populations. The scope of services provided in community hospitals is often developed to alter local needs. It differs widely, and includes inpatient, outpatient, diagnostic, day care, primary care, and outreach services (53). In addition, the services lie on a continuum between serving a “geographic purpose” and having a specific focus on mainly older people. Further development of the community hospital is based on major reforms aiming to integrate health and social care (53).

Community hospitals are often staffed by a mixture of PCPs, nurses, allied health professionals, and healthcare assistants. A 2016 scoping review showed that there were many examples of collaborative working arrangements between community hospitals and other healthcare organizations, including co-location of services, shared workforce with primary care, and close collaboration with acute specialists (39). The review indicated that community hospitals may offer an effective and efficient alternative to hospitals, and reported fewer readmission and less community care needed for older people treated in community hospitals compared to hospitals (39). Moreover, studies have found that patient experience is highlighted as positive, and even better at community hospitals compared to general hospitals (54, 55). The cost-effectiveness has in some cases been found to be similar or even better than in hospitals (53, 56).

### 2.1.2 Hospital at Home

In a Hospital at Home, specialist healthcare is provided in the patient's home (48, 57-60). Here, multidisciplinary healthcare teams conduct medical treatment and care for acute conditions in a short period of time (48). However, the organization of healthcare teams in the Hospital at Home differs, including e.g., nurses, physiotherapists, and occupational therapists and physicians. The organization of the Hospital at Home also differs in for example the number of home visits or the availability of after-hours support, as well as medical services provided, such as home oxygen or intravenous fluids (48, 58, 61).

The two most important Hospital at Home models are “early supported discharge” and “admission avoidance” (48, 49, 58). “Early supported discharge” accelerates the discharge of patients from hospital. It also functions as a partial substitute for longer hospital stays (49). The “admission avoidance” model admits patients directly into a Hospital at Home, either from a PCP or through an admission from the emergency department in the hospital without inpatient stay (58, 62). Findings from a systematic review showed that compared to in-hospital care, “admission avoidance” Hospital at Home had no additional negative impact on health outcome. In addition, “early supported discharge” Hospital at Home made little or no difference to the risk of hospital readmission (49). Further, no indication of higher risk of transfer to hospital at six months follow up was found. Patients who received care at home were more satisfied than those who were treated in hospital (48).

Hospital at Home may decrease the risk of living in an institutional setting (49). “Admission avoidance” Hospital at Home, with the option of transfer to a hospital, may

provide an effective alternative to inpatient care for a selected group of older people initially requiring hospital admission (48). Due to potential benefits in costs and clinical outcomes, preliminary comparisons suggest prioritization of Hospital at Home “admission avoidance” models over “early supported discharge” hospital models (58). A recent US RCT of Hospital at Home for admission avoidance indicated a reduction in costs, readmission within 30 days, health care utilization and increased physical activity compared to traditional hospital healthcare service (63).

### 2.1.3 Nurse-led Units

The Nurse-led unit includes a range of services that have been considered to manage the transition between hospital and home more successfully for patients with extended recovery times (47). Nurse-led units are commonly managed by nurses (47, 64). Both patients, carers, and staff who refer to Nurse-led units are highly satisfied with the service (64, 65). Comparisons between Nurse-led units and usual inpatient care managed by PCPs show reduced discharge to institutional care and early readmissions, and no increase in mortality (47). In a study conducted in the UK comparing nurse-led and doctor-led care under management of bronchiectasis, there were no significant differences between the two different models in terms of lung function, infective flareups (exacerbations), or quality of life (62). However, the study identified an increased cost for nurse-led units, due to more hospital admissions and greater use of antibiotic injections (62). A systematic review comparing nurse-led and doctor-led primary care found longer consultation length and higher readmission rates in nurse-led care (65).

### 2.1.4 Emergency Department Interventions

Several models of organizing emergency departments for avoiding hospital admissions have been developed (45, 46). Overcrowding in emergency departments during the Covid-19 pandemic generated a surge of interest and rethinking in management of outpatients, also resulting in further models (66). One model is dedicated units for general or eligible patients, such as observation units or separate emergency department units for pediatric or geriatric patients. This can include consultation liaison teams, pediatrician-driven triage, or including a PCP to the emergency care team. Another model is that patients are assessed in the emergency department and then identified by the attending emergency physician for an

inpatient observation or alternatively, with a follow up strategy with an alternative outpatient plan (46). One example is the Practical Alternative to Hospitalization (PATH), where emergency physicians assess and construct a follow-up program in an outpatient setting. All patients receive a next day scheduled telephone call from an application to monitor symptoms, adjust treatment plans, and address patient or family concerns, and to verify clinical status. To ensure adherence to the management plan, a next day call to caregivers is also included (46). In other models, a solution has been to bring hospital specialist physicians to the patients, something that have been assumed to be a solution at the more rural emergency departments. Studies indicate a decrease in hospital admissions after implementing emergency department interventions (45, 67).

#### 2.1.5 Community Paramedic Practitioners

Paramedic practitioners are widely implemented across Australia, Canada, Finland, Ireland, the UK, and the US (50). The paramedic practitioners are specially trained for advanced, lifesaving, out-of-hospital services (51). They have an important role within the acute chain of the healthcare service, and increasingly in community care. Examples of tasks provided by paramedic practitioners include: patient assessment and management, health education and learning sharing, and health information (50, 51). Community paramedicine programs indicate a reduction in acute healthcare utilization, prevention of hospital admittance, and in positive patient outcomes with high patient satisfaction (50, 68). However, there is a paucity of understanding regarding how the paramedic practitioners work to contribute to primary care workforces (69).

Paramedic practitioners supporting alternatives to hospitalization appear safe, with a potential to reduce specialist healthcare use and length of time receiving care, as well as with positive patient experiences. However, studies on other patient-related outcomes and costs are lacking (43).

## 2.2 Norwegian Alternatives to Hospitalization

### 2.2.1 General Practitioner Hospitals

The General Practitioner hospitals [in Norwegian; sykestuer] are municipal units, and have historically covered healthcare services in remote areas (70). Traditionally, the service included pre- and posthospital observation, as well as treatment of simpler acute conditions where patients otherwise would have been hospitalized. The General Practitioner hospitals were often organized as small bed units inside nursing homes. To maintain the function of general observation of patients with all diagnoses pre- and posthospital, the General Practitioner hospitals were supplied with adequate personnel and equipment. PCPs were responsible for medical supervision according to fixed agreements (71).

A survey study from Nordkapp showed that the majority of admitted patients were older people with all types of diagnoses. Admission was particularly appropriate to avoid frequent hospitalization, especially in patients with well-known diseases, such as heart failure, cancer, asthma, chronic obstructive pulmonary disease (COPD), psychiatric illness, and more combined disease and substance abuse problems (72).

In 1998, Aaraas completed a PhD project based on data from a hospital and the General Practitioner hospitals in Finnmark. One of the studies from his PhD project prospectively explored 395 patients admitted to 15 General Practitioner hospitals (73). Of all the admittances, 45 % of the stays were assumed to replace hospital admissions. In total, 19 % of the General Practitioner hospital patients were transferred to the hospital, because they needed higher levels of healthcare services. Also, 9 % were transported from the hospital back to the General Practitioner hospital as a posthospital function. Those transferred to the hospital had significantly shorter length of stay, compared to those only treated at the General Practitioner hospitals (3.6 days versus 9 days) (74). Also, 61 % of the patients were assessed as candidates for higher level hospitals if the General Practitioner hospital had not existed. No negative health effects were associated with treatment in a General Practitioner hospital (75).

Results from 35 435 patients admitted to two hospitals (one located in a peripheral municipality with a General Practitioner hospital, and one located in a central municipality without such healthcare service) showed that the more peripheral municipality had

significantly lower in-hospital bed occupancy rate compared to the hospital from the more central municipality (38 % versus 52 %) (70).

A prospective study with 2496 doctor-patient contacts indicated that the General Practitioner hospital beds were used mostly for patients with medical needs, but also for patients with social and nursing needs. Long travel distance by car to the hospital was also a factor contributing to admittance to a General Practitioner hospital (76). In addition, the General Practitioner hospital most likely provided healthcare at lower costs compared to general hospitals, nursing homes, and home care services (77).

### 2.2.2 Intermediate Care Units

A PhD project conducted by Gaaraasen in the Søbstad Teaching Nursing Home in Trondheim municipality, led to the implementation of intermediate care units throughout Norway (78). Søbstad was established in 2001 with intermediate care beds for patients discharged from the hospital, to optimize recovery after hospital stays before returning to home. It was staffed with more trained nurses compared to in common nursing homes, and with PCPs serving the unit during the week. The nursing home had diagnostics laboratory equipment to measure haemoglobin, CRP, and blood glucose. Urine examinations were also available. In addition, they had equipment for more advanced treatments like intravenous pumps and continuous monitoring of oxygen-saturation in blood. Findings from an RCT showed that hospital patients had higher rates of readmissions than patients in the Søbstad group (35.7 % versus 19.4 %). After 26 weeks, more patients in the Søbstad group were independent of community care compared to the hospital group (25 % versus 10 %). However, more patients were admitted to long-term nursing homes from the Søbstad group (79). There was a higher mortality rate after 12 months among patients in the hospital group compared to the Søbstad group (31.4 % versus 18.1 %). However, patients treated at Søbstad were observed during a longer period of time than patients in the hospital group (335.7 days versus 292.8 days) (80). Garaasen concluded that intermediate care beds were cost effective compared to a hospital stay in the longer run for patients over the age of 60 (78, 81, 82).

Johannessens' PhD project (83) explored the role of an intermediate care unit in a clinical pathway between primary healthcare and hospital. Results showed that healthcare personnel perceived that the unit led to time-consuming discussions between the unit and hospital. It was also difficult to find eligible patients for the unit. Patients were generally pleased with the services. However, Johannessens' studies were conducted in a unit

established as a collaboration between a hospital and five municipalities, that were later closed down (83).

### 2.2.3 Hallingdal Sjukestugu

Hallingdal sjukestugu, a unit connected to Ringerike hospital, has been developed during a 30-year period, aiming to fulfil local needs. The travel distance from Hallingdal Sjukestugu to Ringerike hospital is approximately two hours by car (84). Hallingdal sjukestugu comprises four intermunicipal MAW beds and 14 intermediate care beds administered by the hospital. It offers a broad range of healthcare services to somatic inpatient, and somatic and psychiatric outpatient clinics. It is also a day treatment centre with dialysis and palliative care, a digital X-ray satellite to Ringerike hospital, and a base for helicopter and ground ambulances (84).

In 2014, Lappegard conducted a PhD project evaluating Hallingdal sjukestugu as an alternative to hospitalization (84). The main conclusion was that Hallingdal sjukestugu may serve as an alternative to hospitalization if 1) the patients are correctly selected, 2) there is a proper professional level of medical care, and 3) the staff has systematic observation skills (85).

Results from a small RCT with 60 participants allocated to Hallingdal sjukestugu (n=33) and Ringerike hospital (n=27) showed a higher readmission rate in the group allocated to Hallingdal sjukestugu (12.1 % versus 7.4 %). Length of stay was similar in the two groups (5.1 days versus 5.3 days). No statistically significant differences were found in health outcomes between the two groups (86). However, patients referred to Hallingdal sjukestugu reported higher satisfaction compared to those admitted to Ringerike hospital (87). Many patients highlighted the small, quiet, and homelike atmosphere in the unit and shorter travel distance for relatives to visit. The staff highlighted an interdisciplinary and holistic approach, local ownership, proximity to local PCPs, and close cooperation with the specialist healthcare services at the hospital (87).

### 2.3 Municipal Acute Wards

MAWs were implemented from 2012 until 2016 (88). In the implementation process, the Norwegian Association for General Practice published a guideline for how the municipalities could solve the establishment of MAWs (12). The guideline did not specify diagnoses or health problems that were considered suitable for treatment at a MAW. However, it outlined four groups of patients that otherwise would be treated in a hospital: 1) patients with a clarified diagnosis, 2) patients with a worsened condition of a well-known diagnosis, 3) patients with low risk for a worsened condition, and 4) patients in need of observation. MAWs were intended for short-term stays of maximum three days (12). Helse og omsorgstjensteloven § 3-5 [The Act relating to Municipal Health and Care Services] pointed out that the municipalities were responsible for the quality provided at the MAWs (88). Consequently, the local municipalities must decide which patients are suitable for admittance to the MAWs. Figure 1 shows the most common conditions treated in the MAWs in Norway in 2019 (89).

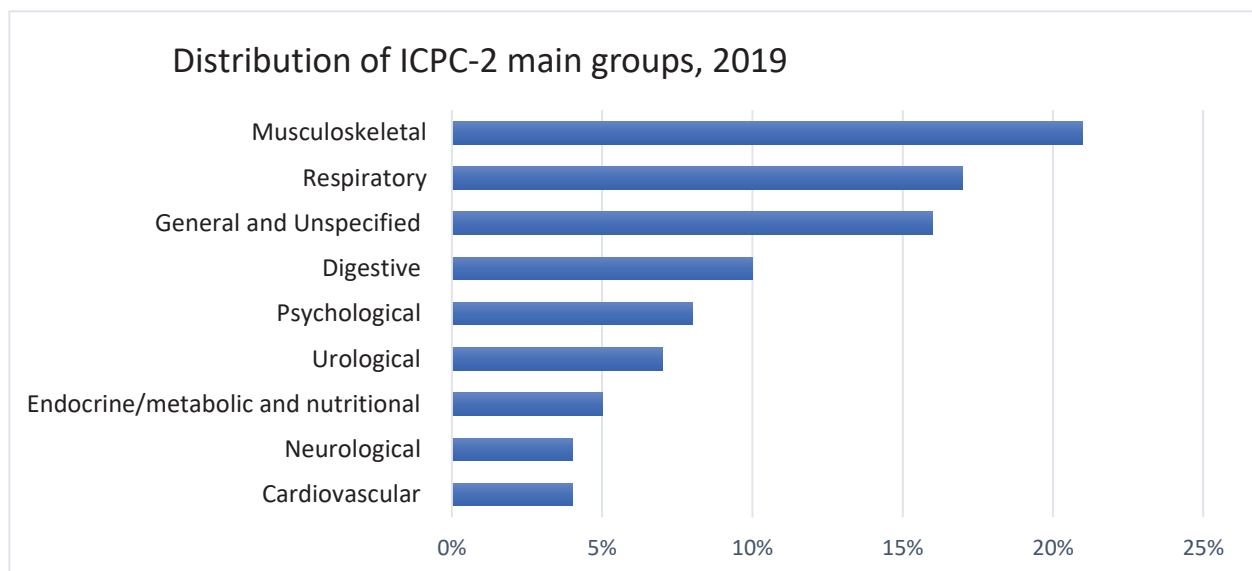


Figure 1. Distribution of diagnoses in MAW patients in 2019, national level. ICPC-2 = The International Classification of Primary Care -2 (89).

The municipalities have been free to organize MAWs as appropriate for the local context, infrastructure, and available resources (10, 90). Consequently, the organization differs widely (7, 9, 91, 92). In 2019, intermunicipal collaboration with MAW beds was



established in 67 % of municipalities (13). Most of patients admitted to an intermunicipal MAW lived in a host municipality (13, 87, 93) The same year, 735 beds in 216 different MAWs were registered (13). In 2020, available MAW beds within each municipality varied between 0.25 and 72, also depending on the size of the catchment area (89). Most MAWs (64 %) had one or two beds, 21 % had three to five beds, and only 15 % more than four beds (7, 9, 92).

In 2019, most MAWs were co-located with nursing homes (54 %), and some were organized in short- or long-term units (13). Figure 2 shows co-locations at the MAWs (13). Municipalities where a MAW is located in a nursing home often have few MAW beds. On the other hand, municipalities that have a MAW co-located with a local medical center, a district medical center, or similar, often have more MAW beds.

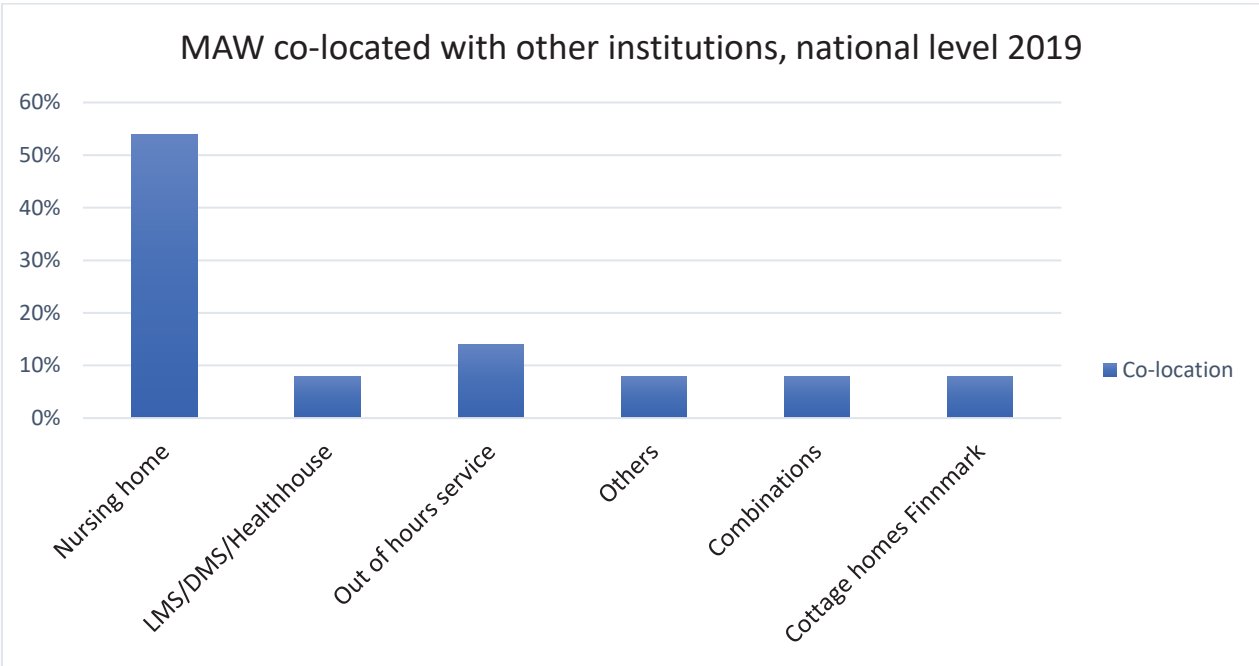


Figure 2. Percent of MAWs co-located with other institutions. LMS = local medical center, DMS = district medical center (13).

The medical competence available at the MAWs also differs widely, and is dependent on size and co-location with other kinds of healthcare services (13, 94). Some MAWs have employed physicians on a 24-hour basis, while others have employed physicians only at daytime on weekdays (95). Physicians are also employed in part-time positions, something that has been assumed to be a challenge for the continuity of care at the MAWs (96, 97). Typically, MAWs co-located with nursing homes are served by a MAW physician at daytime and a PCP from the out-of-hours service in the evening and night (98). It is reported that

MAWs organized within long-term care units in nursing homes had lower nursing coverage relative to other organizations. Central and Northern Norway had a lower ratio of registered nurses than South-Eastern and Western Norway. Across the country, nurses comprised 56 % of the staff at the MAWs. Vatnø et al. (98) found that few nurses at the MAWs had a master's degree, and no nurses had specialized competence in geriatrics, acute care, or mental healthcare (98).

Studies indicate that there has been a lower bed utilization rate in MAWs than expected (95, 99). In 2013-2014, 34 % of the MAW beds were occupied (9), while in 2019 the mean bed occupancy rate was 43 % (13). Several hypotheses for low bed utilization have been discussed (9); admitting PCP and the population are not familiar with MAW services, MAW services are not implemented and integrated with the other municipal healthcare services, information about the MAW has not been received by the PCPs, the admissions routine is more complicated for the referring PCPs than referring to the hospital, or the PCP may be critical to the quality of care provided at the MAWs.

In 2016, Swanson and Hagen estimated a reduction of 1.9 % in hospital admittance for older people above 80 years, caused by the establishment of the MAWs (95). Moreover, they found that having a physician employed full-time was a predictor for reduction in hospital admissions (95). In 2023, findings by Hagen og Tjerbo (100) indicated that the implementation of MAWs decreased the number of acute admissions at medical departments for older people above 80 years by 3 %, with an additional effect of 1 % if the MAW was organized with a physician on site 24/7 or was located to an out-of-hour service. Moreover, in 2019, Kakad et al. (101) found that larger MAWs had higher utilization rates than smaller MAWs, and that the occupancy rate at the hospitals did not affect the occupancy rate at the MAWs (101).

According to Johannesen and Steihaug (96), one challenge was to achieve smooth collaboration between the MAWs and the hospital. Different professions (PCPs, nurses) and workplaces (PCP office, out-of-hour services, MAW, or home-nursing) had different opinions about what kind of patients were suitable for a stay at the MAWs. The admitting PCPs meant that the spectrum of patients included in the admission-criteria was too limited, and this was a leading cause for discussions between providers (96). In addition, patients' admittance and discharge was assumed to be more time- and resource-consuming than elsewhere in the healthcare service (96, 97).

## 3.0 The Study Site: Municipal Acute Wards in Østfold County

### 3.1 Characteristics of the MAWs

Østfold county developed five intermunicipal MAWs in 2012/2013, as the first county to establish MAWs that include all municipalities. The MAWs in Østfold are in five cities: Askim, Fredrikstad, Halden, Moss, and Sarpsborg. Askim MAW covers three municipalities (Indre Østfold, Marker, Eidsberg), Fredrikstad MAW covers two municipalities (Fredrikstad, Hvaler), Halden MAW covers two municipalities (Halden, Aremark), Moss MAW covers four municipalities (Moss, Våler, Rygge, Vestby), and Sarpsborg MAW covers two municipalities (Sarpsborg, Rakkestad).

The number of MAW beds in each unit ranges from 4 to 11, all co-located with short-term beds. The MAWS are staffed with nurses all day, with a nurse-assistant ratio ranging from 0.88 to 1.38 during the study period<sup>3</sup>. A MAW physician is employed in daytime during weekdays and weekends at four of the MAWs. The fifth did not have a MAW physician employed on weekends during the data collection period, but in the period 2013-2018. The travel distance from a MAW to Østfold hospital ranges from 15-45 minutes by car. Available diagnostic tools are: various blood tests, blood gas (at the MAW or at out-of-hours service), X-ray (at daytime – results available within two days), ECG, and bladder scanning.

In 2016, the five MAWs and Østfold Hospital Trust developed a service called the “diagnostic loop”. This is an opportunity for the referring PCP to send the patient to the emergency department at the hospital for extended diagnostics, for example ultrasound examination, computer tomography, or extended laboratory tests, before final admission to a MAW. The patient is sent either by ambulance, taxi, or private car to the emergency department. After diagnostics, the patients are examined by one of the hospital physicians who decide if the patients are appropriate for treatment at one of the MAWS, or if the patient need more specialized treatment in hospital. Before sending the patient through the “diagnostic loop”, the referring PCP has to call the MAW to ensure that they have beds available. The bed is then reserved for the next six hours, and the hospital must send the patient within this time frame. The nurses at the hospital coordinate and make agreements

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<sup>3</sup> Nurse-assistant ratio implies that for every 0.88 nurses, there was 1 assistant, and for every 1.38 nurses, there was 1 assistant. Hence, sometimes the MAWs had more nurses than assistants, and sometimes less.

with the nurses at the MAWs, on when the patients are to be transferred from the hospital to the MAW.

### 3.2 Regulation and Collaboration

In line with Helse og omsorgstjensteloven § 6-1 and 6-2 [The Act relating to Municipal Health and Care Services] (88), a collaboration agreement for patient flow is made between Østfold Hospital Trust and the Østfold municipalities respectively. An administrative committee consisting of managers, physicians, and nurses from the five intermunicipal MAWs and the Hospital Trust have meetings once every month. The manager of the Collaboration unit at Østfold Hospital Trust coordinates the meetings and information across the municipalities and the hospital. In addition, a collaboration committee of PCPs and leaders with background as PCPs and as hospital physicians meet regularly. In 2019, the two committees agreed on eligible patients for treatment at a MAW, and a local guideline with inclusion and exclusion criteria was made for guiding the involved professionals in their decision making. The list below includes examples and is thus not exhaustive (see Table 1).

<b>Table 1. Examples of criteria for MAW admission in Østfold county from the local guideline.</b>	
<b>Inclusion criteria</b>	<b>Exclusion criteria</b>
Acute back pain with need for analgesia	Referrals to a MAW will delay hospital admission or hinder necessary treatment in specialist healthcare
Respiratory – COPD exacerbation, pneumonia, infections, and antibiotic need	
Obstipation – emptying regime	Neurologic “red flag”; bladder or sphincter palsy, riding pants anesthesia, increasing muscle palsy
Palliation	Serious complication to malignant illness

### 3.3 Previous Research on the MAWs in Østfold County

After the implementation, Leonardsen evaluated the MAWs in Østfold in a PhD project in the period 2014-2016 (102). Results from interviews with patients admitted to the MAWs showed that they felt safe when treated at MAWs, even if they stated that the diagnostic services were not like those available in hospitals. Factors like geographical proximity and homelike treatment facilities were highlighted as positive. In addition, patients had the impression that the staff had more time for caring, which was emphasized as being seen “as a whole person” (93). In a cross-sectional study, patients’ experiences from staying at a MAW were examined. Here, the majority of patients reported that they were treated with respect and dignity at the MAWs, but they also reported some issues for improvement related to information provided by nurses and MAW physicians, involvement in decisions about their care and treatment, and related to continuity and transition (103).

Through interviews with PCPs at general practitioner offices in 2015, Leonardsen et al. (104) found that PCPs struggled with deciding which patients were suitable for treatment at a MAW. They were unsure about the quality and safety of healthcare services provided there, due to the innovation the MAWs implied (104). They also reported an uncertainty regarding their own responsibility for the MAW patients (105).

### 3.4 Mortality and Bed Occupancy in the Five MAWs

Administrative data collected and reported to the Norwegian Directorate of Health shows a mortality rate at the MAWs in Østfold at 0.7 %, or 122 out of 17038 stays in the period 2014-2020. Mean length of stay in the same period was 3.4 days (see Table 2).

<b>Table 2. Mortality during stay and length of stay at the MAWs 2014-2020, n=17038</b>	
Mortality, number (percent)	122 (0.7)
Length of stay in days, mean (standard deviation)	3.4 (3.3)
Source: Administrative data collected from the MAWs in period 2014-2020.	

Table 3 shows the percentage of occupied beds at the five MAWs in the period 2014-2020. Occupancy rate is calculated based on the proportion of occupied beds relative to the total number of beds at a given time every day. The highest occupancy rate was in 2015, when 66 % of MAW beds were occupied, while the lowest level was in 2020. However, covid-19 may have affected the occupancy rate in 2020.

<b>Table 3. Number of beds occupied at the MAWs in the period 2014-2020, n=17038</b>						
	<b>MAW 1 (%)</b>	<b>MAW 2 (%)</b>	<b>MAW 3 (%)</b>	<b>MAW 4 (%)</b>	<b>MAW 5 (%)</b>	<b>Total (%)</b>
2014	47	72	56	62	43	50
2015	89	69	64	64	45	66
2016	89	85	67	56	42	63
2017	83	70	60	60	56	61
2018	75	71	59	71	65	62
2019	54	64	53	69	68	54
2020	62	29	34	47	39	38
Source: Administrative data collected from the MAWs in period 2014-2020.						

## 4.0 Healthcare Quality

The World Health Organisation (WHO) defines quality of care as “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes“ (30). The WHO highlights that all countries are committed to achieve “Health for All”, and that quality of care should be developed in accordance with evidence-based professional knowledge. Quality is a wide concept, and it can be difficult to operationalize. In the strategy plan ...og bedre skal det bli! from Nasjonal strategi for kvalitetsforbedring i Sosial og Helsetjenesten [...and better it will be! from the National strategy for quality improvement from social and health services] (106), quality of healthcare services is described in accordance with WHO’s conceptualization of quality (30, 106):

- effective – providing initiatives with good function
- involving good utilization of resources - maximizing the benefit of available resources and avoiding waste
- equitable – providing care that does not vary in quality on account of gender, ethnicity, geographic location, and socio-economic status
- people-centred – providing care that responds to individual preferences, needs, and values
- coordinated – ensuring patient pathways characterized by continuity of care
- safe – avoiding harm to people for whom the care is intended – reducing errors and unfortunate incidents to a minimum

### 4.1 Quality Indicators in Healthcare

A quality indicator is an indirect measure that gives an indication about the quality of the particular area being measured (107). The purpose of using quality indicators is to monitor and document the quality in healthcare services, in order to evaluate and improve the services provided (107). The Norwegian Directorate of Health has a mandatory responsibility for developing, communicating, and maintaining the quality indicators. The purpose is to reduce unwanted variation, make right prioritizations, and increase the quality in healthcare service. (107).

Quality indicators should be interpreted together to give a more complete picture of quality. Donabedian’s approach to describe the quality of care, which is built on the concept

of “input-process-output”, is widely accepted (107, 108). Donabedian divided the quality indicators into three different types (108):

- Structure (frameworks and resources, competence, available equipment, registries)
- Process (activities in the patient process, such as diagnostics and treatment)
- Outcomes (survival, health gain, and patient and user satisfaction)

#### 4.1.1 Quality Indicators in this Thesis

To assess whether the MAWs represent equal healthcare quality to that of the hospital, outcome quality indicators were chosen in this thesis. The chosen indicators were: 30 days readmission rate, length of stay, and 30 days mortality rate. To describe patients’ experiences, the following patient reported outcomes (PROMS) were included: self-reported health-status, self-reported health-related quality of life, and self-reported experiences (109, 110).

##### 30-days Readmission

Low quality on the inpatient stay has been found to be associated with higher readmissions rate (111). The highest readmission rates have been reported shortly after discharge. Readmissions are mostly measured 1, 2, 4, and 12 months after discharge. However, most of the preventable readmissions occur within the first month. Therefore, it is suggested to use the 30-days readmission rate as a quality indicator (112, 113).

##### Length of Stay

The effect of length of stay on readmissions rates is rather complex. On the one hand, short length of stay can increase the readmission rate (114, 115). On the other hand, short length of stay has several benefits, because longer length of stay is associated with risk of hospital acquired infections, immobilization, delirium, and increased mortality (114, 115). For the healthcare services, shorter length of stay implies more available beds for new patients, and most likely a better utilization of hospital beds (114-117), hereby representing quality.



## 30-days Mortality

Mortality is one of the most utilized outcomes for assessing risk and safety, and for comparing healthcare quality over time or between institutions/healthcare levels. Here, both inpatient mortality and 180 days mortality are commonly used. However, the 30-day mortality rate is the most widely used measure (118). 30-day mortality measures risk for mortality better than in-hospital mortality. Hence, 30-days mortality have better face validity than in-hospital mortality (119). However, 30-days mortality must also be interpreted with caution, since this most probably will be affected by the patient group targeted (120).

## PROMS

Patient Reported Outcome Measures (PROMS) measure the patient's perception of healthcare services. They are a means to gain insight into how patients value healthcare (109). PROMS are globally acknowledged to incorporate patients' perspectives in evaluation of healthcare services (121). In clinical trials, PROMS provide an opportunity to more precisely specify and build the rationale for patient-focused objectives, to enable for more accurate interpretation of conclusions about the treatment effects for patient-focused outcomes (122).

In this thesis, three different PROMS were used: "Patient reported health status", "Patient reported health-related quality of life", and "Patient reported experience". "Patient satisfaction" and "patient experience" are two separate concepts, though complexly related. Patient-reported satisfaction measures are assumed to be more subjective and outdated, representing the gap between patients' expectations and patients' experiences (109, 122).



## 5.0 Study Aims

The main aim of this PhD project was to explore different aspects of the Municipal Acute Ward as an alternative to hospitalization.

More specifically, the aims were to:

1. explore Primary Care Physicians' perspectives on the Municipal Acute Ward as an alternative to hospitalization
2. explore characteristics of patients admitted to the Municipal Acute Wards in Østfold in the period 2014-2020
3. assess the quality of healthcare services in Municipal Acute Wards versus the hospital



## 6.0 Research Methods

### 6.1 Overall Study Design

The data collection and analyses took place simultaneously during the PhD-period. This included both qualitative and quantitative study designs (123-125). The three different approaches gave an opportunity to explore the MAW concept from different angles. The use of three different research methods was assumed to be a strength, giving a broader understanding of the issue. The three methods were conducted simultaneously for the data and results to interact with each other for analyses, interpretation, and dissemination. Hence, the overall project may be claimed to have a convergent parallel mixed-methods design (126).

An overview of the PhD thesis and the three studies included is presented in Table 4. Study I comprises an in-depth exploration of the referring PCPs' perceptions on patient admissions to the MAWs, which may explain why they did or did not choose to refer patients to the MAWs. Study II explores the characteristics of MAW patients, to gain knowledge about the patient pathway in and out of the MAWs, that might give an indication on how the MAWs have been utilized. Study III compares different quality indicators between the five MAWs and the hospital, which may indicate whether the MAW represents a quality alternative to hospitalization.

<b>Table 4. Overview of the PhD project and the three studies that provided the data for Papers I–III</b>		
<b>Main Aim</b>		
<b>To explore different aspects of the Municipal Acute Ward as an alternative to hospitalization through three different approaches</b>		
Aim I To explore PCPs’ perspectives on the MAW as an alternative to hospitalization	Aim II To explore characteristics of patients admitted to the Østfold MAWs in the period 2014-2020	Aim III To assess the quality of healthcare services in MAWs versus hospital
<b>Study Design</b>		
Qualitative	Quantitative	Quantitative
<b>Data Collection</b>		
Semi-structured, individual interviews	Registry data	Randomization and quantitative measurements
<b>Analysis</b>		
Thematic content analysis	Regression modelling	Descriptive statistics and comparisons between groups
Study I	Study II	Study III
Paper I	Paper II	Paper III

#### 6.1.1 Rationale for Combining three Methods in the Thesis

This PhD thesis builds upon results from Leonardsen’s (main supervisor) PhD work, where the findings indicated that PCPs at the general practitioners’ office were skeptical about referring patients to the MAWs, and that they consequently rather admitted patients to the hospital (104). Leonardsen’s interviews with PCPs at the general practitioner offices were conducted in 2014-2015, when the MAWs recently had been implemented. Additionally, MAW statistics showed that 60 percent of MAW patients were admitted from PCPs in out-of-hours services. To take a different approach than the recent study, we designed a qualitative study exploring PCPs in out-of-hours services perspectives on admitting patients to MAWs. This would provide updated information about whether the skepticism was present in this different group of physicians, also some time after the MAW implementation (Paper I).

To explore how the MAWs were used, a registry data study was designed, including patient characteristics from the five MAWs in the period 2014-2020. This would provide

knowledge about the patients that the PCPs chose to refer directly to the MAWs, and about which patients the MAW personnel perceived to be out of the scope of the MAWs. (Paper II).

To fill the knowledge gap regarding the quality of healthcare, an RCT was designed to compare the quality of services provided in the MAWs versus a hospital (Paper III). Figure 3 shows the progression of the PhD project:

<b>Figure 3. Progression of PhD project</b>	
2019 Autumn	The interview study was planned Patient allocation in the RCT started
2020 Spring	Interviews of PCPs started
2020 Autumn	The MAW registry data study was planned Analysis in the qualitative study Interviews of PCPs finished
2021 Spring	Paper I published Analysis of MAW registry data Patient allocation in the RCT finished
2021 Autumn	Analysis of RCT data
2022 Spring 2022 Autumn	Paper II published Paper III submitted
2023 Spring	Writing thesis

## 6.2 The PhD Candidates' Subject Position

The PhD candidate has 20 years of clinical background as a critical care nurse, with work experience from intensive care units at several hospitals in Norway. As a critical care nurse, the PhD candidate has a great deal of professional pride in offering optimal care and treatment to the patient. Critical care nurses take much responsibility in being proactive and preventing deterioration of illness in critical care settings during weeks of treatment. Patients in critical care settings are usually emergently ill, and time is often limited, especially the first hours. During the first hours of treatment, information is scarce or even absent, and urgent decision-making is required (127). Clinical decision-making in critical care settings requires both skills on pattern recognition in the most acute situations, also known as non-analytical reasoning, and a more analytical reasoning towards the long term treatment in critical care setting (127). Consequently, the PhD candidate might be very focused on the MAW nurses' assessment skills and competence. Further, her experience from treatment in a high technological hospital environment, and what that means for the patients, might have led to a strong opinion: That it must be better for the multimorbid old person to be treated at a smaller unit like a MAW.

In addition, the PhD candidate has worked within management, which includes work-scheduling and budget planning. This work included a possibility to manage and create routines for professional development, even if the daily work tasks were hectic. The year before entering this PhD project, the PhD candidate worked as a lecturer for critical care nursing students. This experience might have led to a focus on the importance to strengthen the MAW nurses' competence in assessment skills and procedures, in order to manage the many challenges at the MAWs.

In qualitative research, it is important that the researcher have a reflection about her abilities to capture and understand the field. In addition, the researcher must reflect over herself as an active part interacting with other persons based on earlier experiences, knowledge, and attitudes (126, 128). This means that the researcher must position herself to acknowledge how her background influences her interpretations (128). Such a self-examination is not described to be a common method in quantitative research, as this method conveys more objective data. Therefore, it is not exposed to the researchers' subject position in the same degree as in qualitative research.



### 6.3 Covid-19 pandemic Consequences for the PhD Project

The Covid-19 pandemic affected the PhD project, and especially the empirical data collection. The first outbreak of Covid-19 occurred after six months of data collection in the RCT. The inclusion of patients had been established as a routine at the out-of-hours services and at the MAWs. Because of the pandemic capacity-issues, we had to stop randomization to the hospital and hence, the data collection. The RCT was re-started after three months, leading to new information rounds to managers, nurses, and physicians.

In January 2021, the director of the hospital set the whole RCT on hold for an unsettled time. Then, it was decided to finalize the data collection, assuming that it was not possible to restart the study a third time. The consequence was that the planned sample size was not reached. As stated in Paper 3, sample size calculations showed a need to include 500 participants in total, when accounting for drop-outs and mortality; 340 to the MAWs and 160 to the hospital. The 2:1 allocation was done to reduce the burden of additional patients for the hospital. However, only 164 patients were included, and this greatly reduced the ability to detect superiority in either trial arm. Hence, when strictly considered, the results from the RCT only serves as an indication that the acute healthcare services provided in MAWs are of similar quality as those in hospitals.

## 6.4 Paper I

To explore the PCPs' perspectives regarding admission of patients to MAWs as an alternative to hospitalization, semi-structured interviews were chosen. This is suitable when the purpose is to gain a richer understanding and description of a concept (129, 130). The PCP in out-of-hours services have a gatekeeper function in the healthcare service, and the most frequent admissions to the MAWs are from PCPs in out-of-hours services (13, 131, 132). It was assumed that their perspectives potentially could affect the utilization of the MAWs.

### 6.4.1 Empirical Basis

All participants were PCPs working at the five out-of-hours services located in the county, in contrast to earlier research conducted by Leonardsen et al. (87, 104). The PCPs were recruited both with strategic and snowballing methods (129, 133). The strategic approach comprised that PCPs from all five out-of-hours services were invited, to ensure that PCPs from both rural and central areas were represented. In addition, efforts were made to include PCPs with different experience, age, and gender. The purpose was to achieve representativeness of the whole population of PCPs in Østfold (134). Inside each out-of-hours service district, the snowball selection method was used. This selection is a method where a subject is asked to name persons in his or her network, and this nominated person is the next to be recruited. Similarly, this next person is also asked to suggest names (135).

After 18 interviews, the PhD candidate and the main supervisor concluded that a saturation had been reached. This was indicated by no further themes being identified (133, 136). To ensure this, three more interviews were conducted.

### 6.4.2 Data Collection

The data collection was performed during the first outbreak of the Covid-19 pandemic. The PhD candidate conducted all the interviews face-to-face. To keep infection control, the PhD candidate chose to do all interviews within one out-of-hours district, before moving on to the next district. Because there were few patients visiting the PCPs at the out-of-hours services in this period, it was easy to recruit the PCPs. Mostly, the PCPs were interviewed during evening and night shifts when at work. Almost all interviews were conducted in the period April 2020 until June 2020, and ending in August 2020.

An interview guide was developed based on findings from earlier studies within the field (87, 93, 97, 104, 137), and through iterative discussions among the researchers (appendix 1 in Paper I). Two highly experienced male senior physicians with background as PCPs participated in a pilot interview. After the pilot, the PCPs received a questionnaire relating to the interview guide (appendix 2 in Paper I). This included three parts: 1) Questions about the relevance, formulation, and understandability of the interview guide questions (138, 139), 2) Capacity and how time consuming it was to answer the questions (138, 139), and 3) Consistency within the interview guide (138, 139). The aim was to find out whether two or more questions were perceived similar, and whether the participants lost their interest to answer throughout the interview. The pilot showed that the questions were assumed to cover important aspects of implementing MAW as an alternative to hospital, and only a few wordings were changed after the pilot test.

#### 6.4.3 Data Management and Analysis

The qualitative study used thematic analysis in line with recommendations from Braun and Clarke, to identify themes and patterns of meaning in the data (133, 136, 140). The analysis was mainly inductive, meaning that it was not shaped by theory, but it was coded line by line, aiming to generate an analysis from the bottom up. However, the analysis was still shaped to some extent by the researcher's knowledge and epistemology (141).

Thematic analysis according to Braun and Clarke consists of six phases, where each phase builds on the previous. Although this sequential division, analysis is typically a recursive process, with movement back and forth as the analysis is progressing.

##### Phase 1 Familiarising Yourself with the Data

The audiotaped interviews were transcribed verbatim within two days after each interview. First, the PhD candidate wrote down the whole interview with "slow function" on the recorder. Then all the text was corrected for typos. Further, to verify the quality of the transcript, the PhD candidate listened to the whole interview again, ensuring that everything had been captured correctly. In addition, non-verbal communication (i.e., coughing, laughing, breaks, nodding) was noted in the text. The first phase also involved reading and re-reading the transcripts (also by the main supervisor), to become immersed and intimately familiar with the content in the data material. In addition, the PhD candidate made notes on the initial

analytical observations and insights in reflexivity notes. One of the earliest initial themes that emerged was that there was “a need for higher medical competence among the physicians” working in the MAW. This was modified after more interviews.

#### Phase 2 Coding

In this phase the focus was to generate succinct codes to capture important features of the data. A word document with a three-column table was made. The transcript was placed in the first column. Inductive codes were identified by marking the transcribed text yellow. In column two, the codes were transferred. Both the PhD candidate and the main supervisor coded all the data individually, line by line (in Norwegian). Then, the codes were compared and discussed until consensus was reached.

#### Phase 3 Generating Initial Themes

Initial themes were then generated based on the codes identified in phase 2 and placed in the third column. The codes examined together with the collated data from the reflexivity notes, and the researchers then began to develop broad patterns of meaning. Both the main supervisor and the PhD candidate individually identified the initial themes, and then compared and discussed these. After every fifth interview, the PhD candidate made a list with codes and initial themes and discussed this in digital meetings with all the researchers.

#### Phase 4 Developing and Reviewing Themes

In this phase, the initial themes were developed into candidate themes. These themes were checked against the coded data and the entire dataset. The purpose was to ensure that the themes told a convincing story of the data. All the researchers were involved in this process. All the researchers agreed on the most important findings. However, based on different backgrounds, there were some small differences in what the researchers wanted to highlight. After several discussions we chose not to include the themes “effectiveness and utilization”, “increased offer in treatment”, and “limitation in healthcare services”. Other themes were split or combined, and some were discarded. The subthemes “the squeezed responsible physician” and “staffing and competence” was combined into “competence and responsibility”. At last, two main themes remained.

#### Phase 5 Refining, Defining, and Naming Themes

In this phase, the researchers made detailed analysis and defined the scope and focus of each theme. The main themes were named to determine the “story”. Two main themes emerged from this phase: “What if something happens tonight” and “User participation”.

#### Phase 6 Writing Up

The final phase was to write the “story”. This involved weaving together the analytical narrative, data extracts and quotes, and contextualising the findings with existing literature.

#### Reflexive Approach

Reflexivity is central to the construction of knowledge in qualitative research, and it is a strategy to ensure quality of the research process (141). Consequently, the PhD candidate wrote down impressions and reflections before and after the interviews, in line with a reflexive approach, as described by Braun and Clarke (133, 140)

The interviews at the out-of-hours services were conducted after the PhD candidate had been collecting patient data in the same environment for seven months. The challenges and discussions about the data collection in the RCT interfered with the PhD candidate’s reflections and interpretations before and after the interviews. However, Braun and Clarke view qualitative research as creative, reflexive, and subjective, with researcher subjectivity understood as a resource and not a limitation (140).

The data in the qualitative study was developed through interaction using a semi-structured interview guide. The PhD candidate then followed up themes of interesting meaning related to the research questions. This research method is underpinned by the theory of Braun and Clarke. They describe qualitative research as meaning and meaning-making, always context-bound, positioned, and situated (140). Through dialogues with PCPs about the inclusion challenges in the RCT, it became obvious that many PCPs wanted the MAW as an option for patients they otherwise struggled to find “other beds” for. In contrast, they were critical to the quality of care at the MAWs, first and foremost because they assumed the medical competence to be too low to represent an alternative to hospitalization. The PhD

candidate reflected about how these perceptions may have altered what they choose to share in the research interview, keeping in mind the possible consequences. These issues were also included throughout the analysis process and in discussions with the supervisors.

## 6.5 Paper II

To gain knowledge about how the MAWs have been used, the characteristics of MAW admissions in a seven-year period were explored.

### 6.5.1 Empirical Basis

Study II consisted of routinely collected administrative data on patients above 18 years, from the five MAWs in Østfold in the period 2014-2020. Nurses in administrative positions at the different MAWs registered anonymized patient information at patient discharge monthly. The MAWs collect the information in Excel-forms, and the hospital merges all five Excel-forms into total reports to monitor activity (142). Data washing and operationalization of variables of the MAW registry data were conducted from January 2021 until March 2021.

The PhD candidate had several discussions with the statistician responsible for the MAW registry at the hospital, as well as the MAW nurses responsible for registration for validating the variables. Discussions included how the registration had been done, and how the nurses had worked together with the PCPs for assessing the different aspects of the registration.

From the Norwegian Directorate of Health (13), the guidance was to collect ICPC-2 diagnosis. In addition to ICPC-2 diagnosis, some MAWs had also reported admissions categorized in symptoms: musculoskeletal symptoms, observation, infection, dehydration, psychiatric symptoms, constipation, social causes, chronic obstructive pulmonary disease, diabetes mellitus, and substance abuse. Our registry data consisted of 16 786 patients with 280 different ICPC-2 diagnosis. In order to compare with Hernes et al. (143), the ICPC-2 diagnoses were reorganized into groups of reasons for stay categorized by symptoms (143). However, we ended up getting a very skewed impression over reasons for stay. For example, respiratory symptoms became a very small group of patients. However, ICPC-2 diagnosis in respiratory main groups is the most common reason for stay in our data material. Therefore, it was decided to use ICPC-2 admission diagnosis in main groups in the analysis.

To fulfil the aims of the study, the PhD candidate recoded the variables from the already collected data into relevant independent variables. The total dataset consisted of 17 038 patients admitted to the MAWs in the period 2014-2020, of which 215 had been admitted

to the MAWs directly from hospital. These patients were excluded, as they were not relevant to the research questions in this project.

The MAW data is sent to Østfold Hospital Trust, where this file routinely is reviewed every month. If errors are identified, the file is sent back to the nurses responsible for collecting data. Plotting errors can then be corrected. Combined with the PhD candidate's data cleaning procedure, the completeness of the data increased the validity (144-146). Table 5 gives an overview of the registry data and construction of candidate variables.

#### Outcome Variables

1. Outcome variable "Admitted via diagnostic loop" was constructed from the information "Admitted to" in the administrative data material.
2. Outcome variable "Transferred to hospital" was constructed from the information "Discharged to" in the administrative data material.



<b>Table 5. Construction of Independent Variables from Administrative MAW Data</b>	
<b>Registered Information in the Administrative MAW Data</b>	<b>Covariates (Independent Variables)</b>
MAW	MAW 1-5
Date of admission	Date of admission
Date of discharge	Date of discharge
Admitted from	Out-of-hours service, home, nursing home, home with home-nursing, diagnostic loop
Referring physician	PCP from out-of-hours services, PCP from general practitioner office, nursing home PCP
Gender	Female, male
Main diagnostic group at admission (reason for admission)	ICPC-2 main group at admission (reason for admission)
Main diagnostic group at admission	ICPC-2 main diagnosis code at admission
Co-diagnosis 1 at admission	One comorbidity diagnosis
Co-diagnosis 2 at admission	Two comorbidity diagnosis
Main group at discharge	ICPC-2 main group at discharge
Main diagnosis at discharge	ICPC-2 main diagnosis at discharge
Treatment	Oral medication Intravenous fluid therapy Intravenous medication Mobilization and pain relief Observation Oxygen therapy Nebulizer therapy Emptying regime/constipation Bladder catheterization Wound therapy Blood transfusion Nutritional therapy Physical therapy
Discharged to	Home Nursing home Home with home-nursing Hospital
Years	2014 2015 2016 2017 2018 2019 2020
Age	Age
Number of days in unit	Length of stay
Admission day	Weekend, weekdays
Time of admission	Day, evening, night

ICPC-2: International Classification of Primary Care. MAW: municipal acute ward.

## Number of Comorbid Diagnoses

The variable “Number of comorbidities” was constructed as an independent variable. The number of comorbidities was categorized as 0, 1 or > 2. This variable was constructed from patients’ registered “co-diagnosis 1 at admission” = one comorbidity diagnosis and “co-diagnosis 2 at admission” = two comorbidity diagnosis, as shown in Appendix 1, Paper II. If the patients did not have a registered comorbidity, this was retired as 0 comorbidities. Diagnoses chosen were in line with earlier literature, and also assessed by a senior consultant physician and a specialist nurse (143, 147).

### 6.5.2 Data Management and Analysis

The statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS) version 27 (148). Descriptive statistics were used to present characteristics of the sample. Number and percentage were reported for nominal variables. Mean, standard deviation (SD), median, and inter-quartile range (IQR) as appropriate, were reported for continuous variables. Even with a normal distribution, we chose to present both mean/SD and median/IQR to show the skewness in the data.

Logistic regressions were conducted to explore associations between the outcome variable and the independent variables. The results were reported as Odds ratio (OR) and 95% confidence interval (CI).

Univariate regression analysis was conducted to show the strength of association between each independent variable and the outcomes. Correlations were conducted between all the independent variables to measure if there were any collinearity between the variables. No correlations were over 0.7. Hence, all the independent variables were included in the final model (146).

## 6.6 Paper III

An RCT design was assumed to be the best research design for comparing healthcare service quality in MAWs and hospitals, being the most rigorous and robust research method (149). This design is conducted under controlled conditions. Confounding factors that possibly may have an impact on the findings is controlled with random allocation of an intervention to compare groups (149). In this project for example, the patient's current illness, mental/physical condition, and age may have had an impact on the outcome of the treatment provided, regardless of whether they were treated in a MAW or in the hospital.

In total, 11 different healthcare institutions were involved in the RCT: Østfold Hospital Trust, the five out-of-hours services, and the five MAWs. Data collection in the RCT was conducted from September 2019 until February 2021, but was paused due to the Covid-19 outbreak from April 2020 until June 2020, as mentioned earlier.

Before we started to include patients, the PhD candidate made laminated short procedures for inclusion of patients for: PCPs at out-of-hours services, MAW physicians, hospital physicians, nurses at the out-of-hours services, the MAWs, and the emergency department. The PhD candidate also made posters for all waiting rooms in all participating wards, also including information to patients.

### 6.6.1 Empirical Basis

Participants in study III were recruited from all the five out-of-hours services Østfold. They were invited by a study nurse according to inclusion and exclusion criteria:

#### Inclusion Criteria:

1. Age  $\geq$  18 years
2. Ability to provide written, informed consent
3. Eligible for admission at a MAW according to established admission criteria
4. Assessed and referred by a PCP at the general practitioner office, by an out-of-hours PCP, or a PCP in a nursing home

#### Exclusion Criteria:

1. Psychiatric or cognitive impairment
2. No Norwegian national identification number
3. Acute disability in old people, requiring extensive diagnostic procedures

4. Previous admission to a MAW during the project period (to prevent patients being included more than once in the project)
5. Insufficient Norwegian language skills to respond to the questionnaires

#### 6.6.2 Data Collection

Patient data were collected at the time of inclusion and from the patients' medical journal after discharge from the MAW or the hospital. Table 6 shows the patient data collection process.

<b>Table 6. Patient Data in the RCT</b>	
<b>Data Collection Time</b>	<b>Data Category</b>
At inclusion	Date of admission
	Birthdate and year
	Gender (male/female)
	Blood pressure (factor in NEWS) (systolic/diastolic, in mmHg)
	Pulse-rate (factor in NEWS)
	Temperature (factor in NEWS) (in degrees Celsius)
	Consciousness/Agitation status (Alert versus Confusion, Voice, Pain, Unresponsive)
From patients' medical journal	Date of discharge
	Readmittance (all causes) within 30 days*
	Mortality (all causes) -30 days*
	Components for calculation of Charlson Comorbidity Index
Self-reported data from patients at inclusion	NORPEQ* EQ5D5L* Rand-12*
Self-reported data from patients four weeks after discharge	Rand-12*
NEWS = National Early Warning Score. CCI = Charlson Comorbidity Index. NORPEQ = the Nordic Patient Experience Questionnaire. EQ5D5L = European Quality of Life-5 Dimension-5 Level version. Rand-12 = Research And Development 12 item Health Survey. * = outcome measures. The rest are background variables.	

After four to six weeks, patients were asked to answer a questionnaire and return it to the PhD candidate by post. The patients that did not return the questionnaire were called by the PhD candidate, and they could answer the questionnaire by phone.

Three different questionnaires for measuring PROMS were used. The primary outcome of the RCT was patient experiences, as measured by the validated and reliability tested Nordic Patient Experience Questionnaire (NORPEQ). The NORPEQ (150) includes eight questions covering important aspects of patient experiences with health personnel: whether the doctors were understandable, doctors' and nurses' professional skills, nursing care, whether the doctors and nurses were interested in the patient's problems, and information relating to tests. Two additional items ask about general satisfaction and incorrect treatment (151).

The secondary outcome "self-reported health-related quality of life" was collected with the validated and reliability tested questionnaire EQ-5D-5L (European Quality of Life-5 Dimension-5 Level version), and patients' "self-reported health status" was collected with the Rand-12 (Research And Development 12 item Health Survey). The EQ-5D-5L (152) consists of five questions relating to patients' self-reported health-related quality of life within five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Response alternatives are on a five-point Likert scale, where 1 = no problems, 2 = slight problems, 3 = moderate problems, 4 = severe problems, and 5 = extreme problems. The EQ-5D-5L also includes an analogue Visual Analogue Scale (VAS) with self-reported health ranging from 0 as the poorest health status to 100 as the best health status. VAS was not used in this thesis. The five-level version has an increased sensitivity and precision in measurement compared to the three-level version. It is therefore superior to the three-level version. Moreover, the five-level version is recommending use across applications, including economic evaluation, clinical, and public health studies (152, 153).

The validated and reliability-tested Rand-12 questionnaire (154-156) is measuring health status with 12 questions (154-156). In addition, it measures how health status affects a person's life. This is a shorter form than the more well-known Rand-36 questionnaire. The Rand-12 was used to measure patients' physical and mental health status the four last weeks after discharge. One may argue that there are some questions in the two questionnaires that measure the same aspects (157). That is why VAS from EQ-5D was excluded, and question 1 in Rand-12 was used instead. Due to the different approaches in these two questionnaires, we chose to combine them: the Rand-12 for measuring patients' self-reported health status, and the EQ-5D-5L for measuring patients' self-reported health-related quality of life. Rand-12 also give the possibility to build component scores. It is recommended due to its low respondent burden and its reported reliability, validity, and responsiveness (157, 158).

Charlson Comorbidity Index (background variable) is used to classify comorbid conditions which might alter the risk of mortality (147, 159). Charlson Comorbidity Index is one of the most widely used comorbidity indexes, and it is used in thousands of studies (159, 160). It includes 19 conditions, each assigned a weight based on their hazard ratio. The total score is the sum of these weighted scores (147). The 19 conditions were ranked on scores from minimum 0-1 to maximum 0-6 on each item, which resulted in a total obtained maximum score of 37. Patients' comorbid conditions as documented within the time-frame one year before the current admission were collected by the PhD candidate manually from the patients' medical record at the hospital (161). Time-frame is shown to be an important confounder in the assessment of comorbidities (162). There are discussions in defining the optimal window for collecting comorbid conditions. Maringe et al. (162) suggested that six years of prior comorbidity data were optimal for a valid and reliable prediction for mortality. Many other studies have suggested comorbidity data one year prior as the most optimal timeframe for prediction of mortality risk (147, 159, 163, 164).

#### Challenges in the RCT

As stated in Chapter 6.3, inclusion in the RCT turned out to be the most challenging part of the data collection in the PhD project, even if strong efforts were made to achieve the calculated sample size. This was affected by the Covid-19 pandemic, but there were also other challenges in the data collection.

In total, 20 study nurses were recruited. They became the PhD candidates' daily contacts when needed, through emails and by phone. All nurses from the out-of-hours services, the MAWs, and the emergency department, received an email with information about the project and the procedures for data collection from their nearest manager, in addition to information provided on education days. All PCPs got information about the project through many canals; "fastlegeportalen" (an electronic information portal for PCPs in Østfold), from their own medical director in the municipalities, and in PCP meetings in the municipalities.

Nevertheless, the inclusion went very slow the first weeks of the data collection period. There was a need for much emphasis on the PCPs and the nurses at the out-of-hours services to include patients. The managers at all institutions informed the physicians and the nurses in weekly information letters. The PhD candidate experienced that one of the success factors was to visit the different study sites regularly. This was a time-consuming process.

The staff at all institutions got rewarded for the work with the study several times with cakes and chocolates.

The first 1.5 year of the PhD period, the candidate spent a lot of time at the study sites to inform and motivate the staff to include patients. Until the data collection in the RCT was finalized on January 30<sup>th</sup>, 2021, the PhD candidate was present at all the out-of-hours services, at the MAWs, and in the emergency department at the hospital, at least every fortnight. Table 7 gives an overview of resource use for the PhD candidate in the data collection in Autumn 2019/Spring 2020. In total, the PhD candidate used approximately 600 hours in meetings and to follow up the data collection.

Foundations of study Start-up meetings with the managers Follow-up meetings with the managers and study nurses	40 meetings
Education on teaching days to physicians at the out-of-hours services, MAWs, and in the hospitals	5 times
Education on teaching days to nurses at the out-of-hours services, MAWs, and in the hospitals	15 times
Director meeting at the hospital, «Samarbeidsutvalget for fastleger» (SUFF), and «Administrativt samarbeidsutvalg» (ADMS) for the MAWs	2 times
Follow-up data collection at the out-of-hours services (n=5)	26 visits each= 130 visits
Follow-up data collection at the MAWs (n=5)	14 visits each= 70 visits
Follow-up data collection at the Emergency Department	14 visits

Both PCPs and nurses perceived that inclusion of older people, as well as frail and multimorbid patients, could be ethically challenging. They emphasized that hospital treatment would entail an unnecessary burden for such frail patients, which is in accordance with problems Lappegard et al. (86) experienced in their RCT. On one occasion, an old frail man included in the study waited for ambulance transport to the hospital for eight hours at the out-

of-hours service. It is also well known that the waiting time in the Emergency Department is often many hours. Another ethical challenge was uncertainty related to whether the patient was cognitively impaired, and hence oriented enough to be included.

The nurses were initially skeptical to the project because they assumed the inclusion of patients seemed to be too extensive. PCPs thought that the project was important to conduct. However, many of them expressed frustration because this was another task in an already hectic workday. This became a tempered discussion in one of the PCP meetings. The PCPs argued they already had a high workload. They found it annoying that they were forced to include patients without payment. PCPs in the out-of-hours services are paid through a fee for service systems. Research has no code in this system, and it is not a paid task. Even if the nurses that included patients, the PCPs had to call the MAW and/or the hospital if patients were randomized to hospital. This could imply waiting time on the phone, and perhaps a discussion with the hospital physician.

### 6.6.3 Data Management and Analysis

All analyses were performed with SPSS version 27 (148). Characteristics of patients in the two study arms (MAW versus hospital) were presented using descriptive statistics. Frequency and percent were reported for categorical variables. Mean, SD, median, and IQR were used as appropriate for continuous variables.

To test for statistically significant differences between the two study arms in NORPEQ scores, we used the non-parametric Mann-Witney U test, since the distribution in reported answers were skewed. To test for differences on remaining variables, which were normally distributed, independent t-tests were used.

In Norway, the oldest and most used UK syntax for development of an EQ-5D index is recommended (165, 166). The variables for EQ-5D are weighted against a UK population study, and led to the EQ-5D index value. The PhD candidate calculated the EQ-5D index at inclusion, as well as four weeks after inclusion. To measure the effect of treatment, the PhD candidate used the EQ-5D difference, calculated as the EQ-5D score after four weeks, minus the EQ-5D score at inclusion.

To develop sum score based on the Rand-12 questionnaire, the PhD candidate used a syntax from The Norwegian Institute of Public Health (NIPH) (158, 167).



## 6.7 Ethics

Medical and health research in Norway is regulated by the Norwegian Health Research Act (168, 169). All the studies in this project followed the Declaration of Helsinki ethical principles for medical research (170). Written informed consent was obtained from all patients at inclusion time at the out-of-hours services in the RCT-study, and from all PCPs before the interviews. Both the consent form to the patients and to the PCPs was in line with the proposals from the Norwegian Centre for Research Data (NSD, now: Norwegian Agency for Shared Services in Education and Research, Sikt), with information of the study, the aim, inclusion criteria for participation, and information on possible withdrawals from the study. In this project, the protocols were assessed and approved by both the Regional Committee for Medical Research (REK) and NSD.

The first study (qualitative interviews with PCPs) was approved by NSD (ref nr 340271). In line with Norwegian legislations, there was no need for additional assessment from REK to conduct the interviews. All the participants were ensured anonymity and confidentiality before the interviews started. The participants were informed orally and in writing about the study. The interviews were audiotaped, and they had the right to withdraw their consent at any time, without any negative consequences. Data was stored on a password locked, encrypted computer.

Even if the registry data study used anonymized data, there are regulations on how data can be utilized (171). The study was approved both by REK (ref nr 8924 – 2019/118) and NSD (ref nr 931735). A DPIA for the registry study were also conducted. Data responsible was Østfold University College, data owner was the five MAWs in Østfold and Østfold Hospital Trust, and approval for utilizing the data was collected by all the data owners. Data was stored on a password locked, encrypted computer.

The RCT was approved by REK (ref nr 2018/687- 8642) and NSD (ref nr 340271). A Data Protection Impact Assessment (DPIA) was also conducted and approved for this study (ref nr 340271). Data was collected from all institutions every fortnight, and then stored in a password protected, locked safe at Østfold University College. In the data collection process, several ethical assessments were made.

## 7.0 Results

### 7.1 Paper I

#### ***What if something happens tonight? A qualitative study of primary care physicians' perspectives on an alternative to hospital admittance***

**Aim:** To explore PCPs' perspectives on admission to a MAW as an alternative to hospitalization.

**Methods:** Qualitative, semi-structured interviews were conducted with 21 PCPs at the out-of-hours services. Data were analyzed using thematic analysis.

**Results:** Two main themes were identified through the analysis. The first theme was “What if something happens tonight?”, with subthemes a) safety for all, b) competence and responsibility, and c) collaboration across health service levels. The second theme was “User participation”.

The PCPs had different thoughts about what kind of healthcare level the MAW represented, as they described the MAWs as a “mini-hospital”, a “peripheral hospital unit”, a “specialized nursing home” or a “primary healthcare service level”. Even if they found it difficult to select appropriate patients to admit to the MAWs, they all agreed that “the typical MAW patient” was an old patient with an acute need for medical treatment or care. The PCPs perceived that it was important for all involved healthcare personnel (i.e., the admitting PCP, the MAW PCP, the MAW nurses) and the patients, that all felt safe when patients were admitted to the MAWs.

The main barrier for admitting patients to the MAWs was low medical competence in the MAW, because physicians were only available during office hours. They were anxious that a tentative or preliminary diagnosis would not be reassessed. Thus, the PCPs felt a legal, medical, and ethical responsibility for the patient. The PCPs lacked diagnostic tools, updated information about the patient from their medical record, and had only patients' own narratives as a basis to make their decisions. The PCPs appreciated the “diagnostic loop” and assumed that this would increase patient safety. Some of the PCPs argued that there was a need for hospital physicians, especially specialists in internal medicine or geriatrics at the MAWs.

The PCPs expressed that user participation was an integrated part of their work. Consequently, they weighted patients' wishes as far as they could. However, they also reported that patients and relatives from time to time have unrealistic expectations. Therefore, the PCPs were clear that it was their medical assessment that determined whether patients were admitted to MAW or to the hospital.

Conclusion: Findings in this sub-study give insight into the many considerations' PCPs face when referring patients to a MAW rather than to a hospital. Their main issue was to ensure safe services of good quality, and they were not convinced that MAWs could provide such services.

## 7.2 Paper II

### ***Finding good alternatives to hospitalization. A data registry study in five municipal acute wards in Norway***

**Aim:** To assess whether the MAW represents the alternative to hospitalization as intended by means of: 1) describing the characteristics of patients intended as candidate for MAWs by PCPs, 2) exploring factors associated with patients sent back from hospital after extended diagnostics with the diagnostic loop prior to admission to MAWs, and 3) exploring factors associated with patients being transferred from the MAWs to hospital.

**Methods:** Registry data study on administrative data from five MAWs in South-eastern Norway from the period 2014–2020 (N = 16 786).

**Results:** Of all the admissions (N = 16 786), 60 % were female patients, the median age was 78 years, and the median length of stay was three days. More patients were referred from a PCP working in out-of-hour service (55.6 %) than from a PCP at a general practitioner office (41.1 %). After a stay at the MAW, 39.8 % were discharged directly back home, 25.9 % were discharged back home with home nursing, and 15.8 % were discharged to a short-time care nursing home. The most common treatment provided in the MAWs were “oral medication” (57.7 %). About 1/3 of patients received “intravenous fluid therapy” (32.7 %) and “intravenous medication” (27.7 %), followed by “mobilization and pain relief” (22.4 %). Most frequent symptoms were from “respiratory” (22.7 %) and “musculoskeletal” (15.7 %) organ systems.

There were 1779 (10.4 %) patients who were admitted to the MAW after extended diagnostics in the diagnostic loop. These patients were “older”, had more “comorbidities”, and longer “length of stay”, compared to patients directly admitted to the MAW. Several were “admitted during night”, compared to the whole patient population (32.9 % versus 18.8 %). More patients in this group were “sent to home healthcare services” after discharge, than the other MAW patients (31.6 % versus 25.9 %). They also received treatment with “oral medication” more frequently (64.4 % versus 57.7 %) than the group in total. Compared to patients admitted directly to the MAW, patients “receiving oral medications” (OR 1.23, 95 % CI 1.09-1.40) and “observation” (OR 1.25, 95 % CI 1.08-1.45) had increased odds of being transported to the MAW after extended diagnostics at the hospital. The MAW with the shortest “travel distance to the hospital” (OR 2.29, 95 % CI 1.92-2.72) and “patients admitted

at night” (OR 1.83, 95 % CI 1.59-2.10) had the highest odds of getting extended diagnostics in the hospital prior to MAW admission.

There were 2406 (14.3 %) patients that were transferred from the MAWs to hospitals. Compared to patients only staying at the MAW, patients needing oxygen therapy (OR 2.14, 95 % CI 1.81-2.51), intravenous medication (OR 1.60, 95 % CI 1.45-1.81), intravenous fluid therapy (OR 1.32, 95 % CI 1.19-1.47), and from MAWs with long travel distance from hospital (OR 1.46, 95 % CI 1.22-1.74) had increased odds of being transferred to hospitals.

Conclusions: Findings in this sub-study indicate that the MAWs do not represent the alternative to hospitalization as intended. The results show that patients receiving extended diagnostics before admission to a MAW got basic medical treatment and care, while patients in need of advanced medical treatment were transferred to the hospital. Moreover, findings indicate that the MAW represents an intermediate healthcare level in-between primary and specialist healthcare.

### 7.3 Paper III

#### ***Patient experiences and clinical outcomes of admissions to municipal acute wards versus hospital. A multicenter randomized controlled trial in Norway***

**Aim:** To compare the quality of healthcare services in patients admitted to a MAW versus patients admitted to the hospital. The primary objective was to compare patient experiences as measured by NORPEQ after admission to a MAW versus a hospital. The secondary objective was to compare readmission, length of stay, self-assessed health-related quality of life as measured by EQ-5D-5L, and health status measured by the Rand-12, in patients admitted to a MAW versus a hospital.

**Methods:** A multicentre randomized controlled trial (RCT) was conducted. Intention-to-treat and per-protocol analysis were both conducted.

**Results:** In total, 164 patients were included in the study. In the intention-to-treat analysis, 115 was randomized to MAW (77 female) and 49 (29 female) to the hospital. The randomization was successful. The mean Charlson Comorbidity Index score was 4.5 (range from 0-37), mean EQ-5D index score was 0.3 (range from 0-1).

There were no statistically significant differences in NORPEQ score between the MAW and the hospital group: The NORPEQ total mean score was 88 in the MAW group and 86 in the hospital group. Overall, participants in both groups scored their experiences as positive on all items.

There was a significantly larger change in mean EQ-5D score from baseline and at 4-6 weeks, in favour of the MAWs compared to the hospital (0.2 versus 0.02),  $p < 0.05$ . Physical component score after 4-6 weeks was significantly higher at the MAWs; 30.5 at the MAWs versus 27.1 at the hospital (range from 0-100),  $p < 0.05$ . Mental component score measured after 4-6 weeks was 48.3 versus 50.7 (range from 0-100) in MAWs versus hospital respectively. However, the results were not significant. There was a non-significant difference in 30-days readmission rate (27 % versus 24.5 %) and in length of stay (mean 3.6 days versus mean 2.8 days) between the MAW group and the hospital group.

**Conclusion:** Findings in this sub-study indicate that the MAWs may provide equally good quality of care compared to the hospital. Unfortunately, the study did not reach the anticipated sample size. Still, point estimates for patient outcomes were in favour of MAWs, with some reaching statistical significance.

## 8.0 Discussion

The PhD thesis adds knowledge about the MAWs in Østfold, and whether they represent an alternative to hospitalization. This may guide further direction for authorities and policymakers on these units and similar healthcare services. The project is the first to explore the perspectives of PCPs working in out-of-hours services on referring patients to a MAW (Paper I). Additionally, registry data of 16 786 MAW patients allowed for a thorough description of the characteristics of: patients admitted to MAWs, patients admitted to MAWs through a diagnostic loop, and patients transferred to hospital from MAWs (paper II). Lastly, the multicenter RCT allowed for comparisons of quality indicators between MAW and hospital services (paper III). Due to the brevity of data included in this thesis, some of the overarching findings discussed below may be generalizable to other MAWs in Norway.

Primary healthcare has traditionally offered basic nursing and care close to the patient's residence, and is the responsibility of the municipalities (172). On the other hand, the specialist healthcare has offered more specialized diagnostics and treatment (172). The MAWs are located in primary care. They are intended to be an alternative to hospitalization for eligible patients. Hence, the MAWs need to comprise a higher level of healthcare service than the nursing homes. This PhD thesis indicates that in practice the MAWs are not currently used as an alternative to hospitalization (173). An important point for discussion is thus what can be done to ensure that MAWs fulfil such intentions.

### 8.1 Meeting PCPs Skepticism towards MAW Referrals

Several studies have raised questions about patient safety at the MAWs, partly due to risk of suboptimal diagnostics and treatment provided (96, 97, 104, 105).

Findings in Paper I show that PCPs are skeptical to the MAW concept and healthcare services provided at the MAWs (174). These findings are in line with results from studies exploring PCPs at the general practitioner office perspectives on referral to MAWs (104, 105, 175).

First, in Paper I, the PCPs questioned the quality of services provided in MAWs. Hence, the PCPs must be safeguarded that the MAW is a healthcare service with similar

quality as hospitals. Second, findings from Paper I indicated that there might be discussions between the admitting PCP and the nurse at the MAW regarding the eligibility of the patient (Paper I). Achieving trust between the referring PCP and the MAW nurse seems to be a core element, which will improve the interprofessional collaboration. Finally, an important factor for admission to the MAW described by PCPs in Paper I, is the need to confirm who has the medical responsibility for the patient when the MAW physician is not on duty.

#### 8.1.1 Safeguarding of the Quality of Healthcare Services Provided in MAWs

The findings in this PhD project indicate that the patients receive healthcare services of similar quality at the MAWs compared to the hospital (176) (Paper III). Patients reported high quality during their stay, as measured by PROMs (Paper III) (176). Similar findings from decentralized healthcare services have been published both nationally and internationally (9, 39, 53, 87, 177). A qualitative study conducted in the same five MAWs as in the current PhD project, indicated positive patient experiences. On the other hand, a survey revealed problems, such as privacy issues or issues related to information before discharge, as reported by patients after discharge from a MAW (177, 178). However, a cross sectional study exploring patient experiences in an acute geriatric ward at a hospital reported considerably higher frequency of problems than in MAWs after a stay (179). An RCT conducted in the UK exploring patient outcomes after chemotherapy at a community hospital versus a general hospital found strong evidence of higher satisfaction for patients treated decentralized. This resulted in a recommendation of establishing a decentralized healthcare service for providing chemotherapy (180). Even though patient experience is an acknowledging quality indicator, it seems like this does not “convince” PCPs of MAW quality.

Even though no significant differences were identified, descriptive results from the RCT showed that the group allocated to the MAWs had approximately stayed one day longer than the group allocated to the hospital. In contrast, the 30 days readmission rate was approximately the same in both groups (25 % in the hospital group versus 27 % in the MAW group). In our sample, the mortality was higher for patients in the hospital group (10 % in hospital versus 4 % in the MAWs) (Paper III) (176). Also, Hilland et al. (181) found that the introduction of MAWs was not associated with increased mortality rates for people over 80 years. In addition, it was also not associated with increased readmission rates for people under 67 years (181). Overall, these outcomes may be an indication that MAW patients in our sample received the same healthcare quality, whether they were admitted to a MAW or the



hospital. This may be clinically significant, even if it is not statistically significant. In the RCT from Hallingdal sjukestugu, length of stay at both locations was five days, while the 30 days readmission rate was 12 % at the MAW and 7 % at the hospital (non-significant) (211). Higher 30 days readmission rate at the MAW may indicate a lower level of quality provided at the MAWs. However, the study from Hallingdal was based on a small RCT with 27 and 33 patients in each group respectively. It covered four MAW beds at a community hospital. Readmissions can be caused by several factors, such as the complexity of patients' condition, and a failure to adequately hand the patient back over to the home (182). It may also indicate that the challenges lie in the patients' pathways.

PROMS as measured with EQ-5D showed better self-reported health-related quality of life measured 4-6 weeks after discharge from the MAWs compared to the hospital. In addition, patients allocated to the MAWs reported better health status, as measured by the physical component sum score from Rand-12 (176). An RCT from the UK measured post-acute care for older people provided in community hospitals compared to general hospital care, using the EQ-5D (183). Here, one-week post-discharge, the EQ-5D index showed a ratio of 0.40 versus 0.38, for community hospitals versus hospitals. After three months, the ratio was 0.36 versus 0.35 (183, 184), indicating a slightly more positive trend in the community hospital. A review including several international RCTs concluded that community hospitals offer a viable, and often preferable, alternative to hospitalization based on PROM-findings (53). Exploring PROMS is important, because they provide a patient perspective that might not be captured by a clinical measurement. PROMS highlight issues about treatment or the disease that matters for the patients, and there are associations between PROMS and adherence to a treatment. For these reasons, patient advocates are vocal about the importance of including PROMS to highlight any unmet needs or care areas that need improvement (185). To support PCPs' trust in the MAWs, results from Paper III are important to convey to the PCPs,

Results from the mortality analysis showed a MAW mortality rate of 0.7 % from 2014-2020 (see introduction page 30). This indicates that nearly no patients died at the MAWs during the stay. From the RCT, 30-days mortality rate was 10 % in the hospital group, compared to 4 % in MAW group (Paper III) (176). In contrast, Lappegard et al. (86) found that 9.1 % of patients allocated to the MAW died, compared to 7.4 % allocated to the hospital. However, this was not significant. Garåsen et al. (79) found a lower mortality rate (12.5 % at the community hospital versus 20 % at the hospital) for patients transferred to an intermediate care unit at a community hospital after hospital discharge (79). Such varying results may

support the PCPs' skepticism, since there may be a possible higher risk when choosing the "non-traditional" alternative. Mortality as a quality indicator must be viewed in relation to several factors, such as general morbidity in the population, and the level of treatment that it is possible to provide (107).

In the 2016 study, PCPs at the general practitioner offices reported to have little knowledge about the MAW services, even if information had been sent out to all (104). Five years later, it may seem that the PCPs skepticism still relies on the lack of knowledge about MAW services and consequences of referring patients to a MAW (Paper I) (174). Based on the PhD candidates' experiences from data collection in the RCT, it seemed that personnel both in MAW, out-of-hours services, and hospitals were unsure of what the MAW represents today, and what it was meant to represent. The PhD candidate used approximately 600 hours to inform and follow up on the data collection. However, it underlines that there is a need for extensive communication and proactive information to all PCPs in the municipalities (9, 186). Matthew et al. (187) suggested that a mandatory period in a MAW during physicians' education may be a solution for making the MAWs more well known in healthcare service (187).

The MAWs were aimed to be healthcare services for patients who otherwise would be treated at a hospital. This thesis indicates that the differences between a MAW and a hospital to a great extent are related to medical competence and diagnostic opportunities. To achieve a sustainable alternative to hospitalization in primary care, it is necessary to ensure correct, relevant, and updated information about the services that are actually received by all involved parts (23).

### 8.1.2 Establishing Trust between Healthcare Professionals

The other main factor for PCPs skepticism to referring patients to the MAWs, was a lower medical competence at the MAWs compared to hospitals, indicating a potential threat to patient safety in MAWs (Paper I) (174). Staffing the units has been pointed out as one of the main challenges for implementation of intermediate care models in primary care (188). However, community hospitals have been established in many countries, such as Australia, New Zealand, Canada, UK, Scotland, Ireland, Greece, Sweden, and the Netherlands. Medical doctors have been reported to represent a small proportion of the staff, and they were not available all days (39, 52). Only 14 % of rural community hospitals in New Zealand had a PCP available all day, and at Hallingdal sjukestugu there were only on-site PCPs during

weekdays (39, 84, 188). A Cochrane systematic review with 18 RCTs studied the impact of nurses working as substitutes for physicians. The findings suggested that care delivered by nurses, compared to care delivered by physicians, probably generates similar or better health outcomes for a broad range of patient conditions (65).

Results from Paper I indicate that the PCPs perceived that high morbidity among MAW patients required a wide range of medical expertise among physicians and nurses working at a MAW. Moreover, medical competences in internal medicine and geriatrics were highlighted as important for being able to provide treatment and care to MAW patients. This was supported by the Norwegian Directorate of Health in 2016 (10), stating that nurses in MAWs should be competent to handle advanced procedures, such as oxygen treatment, blood sampling, catheterization, administration of intravenous fluids and drugs, as well as competence to handle medical technology, such as electrocardiogram (ECG) and pulse oximeter (10). Whether this has been fulfilled remains unclear.

PCPs in Paper I perceived that nurses working in hospitals were better trained to handle acute cases than nurses in the MAWs (Paper I) (174). Landstad et al. (189) found that nurses working in MAWs had a considerable responsibility to work independently and safely, and they needed advanced ethical qualifications, broad medical knowledge, advanced clinical skills, and the ability to take a holistic approach (189). Such competences are beyond a bachelor's degree in nursing. Consequently, there may be a need for further specialization for nurses to handle treatment of patients in specialized units, such as the MAWs (190). On the other hand, results from analysis of 16 786 patients showed that 14.3 % of the MAW patients were transferred to a hospital after admittance to a MAW (Paper II) (173). This indicates that the staff at the MAW are capable to observe, assess, make decisions regarding patients' condition, and appropriately handle acute situations. In total, findings in this PhD thesis show that the picture is complex. Providing more evidence to this picture may help the PCPs in their decision-making process, aiming to achieve treatment of patients at an appropriate level in right time. However, Sognstad et al. (191) described the transfer of primary care from a generalist approach to highly specialized care service as a continuum of care. This transfer demands for an increase in specialized staff within the municipalities, including nurses and other healthcare personnel in addition to physicians (191).

Results from Paper I also described collaboration difficulties and disagreements (interpreted as lack of trust) between PCPs and MAW nurses on whether the patients were suitable for a stay at the MAW (174). Interprofessional collaboration is identified as critical to the provision of effective and efficient healthcare (192). Meetings where all professions are

involved may promote a collaborative behaviour (193). Given the complexity of patients' healthcare needs, a strategic interprofessional training program may be an initiative for better cooperation and mutual understanding of each other's situation (194).

Trust is an important factor for better cooperation and higher tolerance among healthcare professionals (29, 30). To some degree the PCPs deal with uncertainty in their decision-making, and they need to trust other professions for coping with this (Paper I) (174). In addition, some trust is required to initiate collaboration and to counteract fear of opportunistic behaviour. Consequently, trust is associated with willingness to take risks to some degree (31). Tolerance of uncertainty is widely discussed in medicine, and PCPs' response to uncertainty has been associated with increased hospital referrals and ordering of more diagnostic tests (195). Trust-building requires a willingness to discuss, and therefore it is necessary to create an environment open for discussions (186). Traditional organizational structures heavily rely on management control (196). In modern organizations, the focus is on the management of human capital, namely proactive employees and collaboration (196). Discussions between the admitting PCPs, the nurses, or/and the PCPs at the MAWs and managers could create a common understanding of each other's situation, and an opportunity to agree on solutions for admitting patients to the MAWs.

### 8.1.3 Clarification regarding Juridical Responsibility for the Patient

Findings in Paper I underlined an unclearity regarding to whom the referring PCP transfer the medical and juridical responsibility to after moving the patient physically to a MAW. During the interviews, many PCPs thought that it was vague whether they have the medical responsibility or not after moving the patients to a MAW (174). This was also emphasized by PCPs in general practitioner offices in 2016 (104).

The municipalities have the overall responsibility for offering the necessary health and care services for the population. This means that the municipality has the responsibility for professionally sound treatment of patients who have been transferred to a MAW. However, it is the PCP at the out-of-hours service who has the legal responsibility behind the decision of transferring the patient to a MAW (2-4). As such, the PCP at the out-of-hours service must ensure that the patient receives a professionally sound healthcare service (5). This implies healthcare of such a standard that it fits the patient's individual needs. A PCP at the out-of-hours service has a duty to do a proper assessment before transferring a patient to a MAW. On the other hand, a PCP at the out-of-hours service who transfer a patient to the hospital also

transfers the legal responsibility (197). When the patient was transferred to a MAW, the responsibility seemed to be a grey zone for PCP from out-of-hours services. This question needs a clearer answer to facilitate patient transfers by PCP from out-of-hours services.

## 8.2 Adjusting the Gap between Intention and Reality

The MAWs were implemented due to political initiatives, and not based on an expressed need from healthcare personnel and the services themselves (9). Findings from Paper I and II indicate that the MAWs are not used as intended (173, 174). Hence, it may be argued that the gap between political intentions behind the MAWs and how the MAWs are used, need to be adjusted.

First, findings from Paper I and II indicate that there is ambiguity regarding which healthcare level the MAWs represent (173, 174). PCPs perceived that the MAWs operated in the interface between hospital and primary healthcare services, but was still at a lower healthcare service level than the hospital (174).

Second, findings from Paper I indicate that the referring PCPs, as well as both MAW nurses and physicians, perceived difficulties agreeing on the eligibility of patients (174).

### 8.2.1 Defining the MAW Service Level

Findings in this PhD project indicate that the MAWs are not used as alternatives to hospitalization (Paper I and II) (173, 174). Results from Paper II indicate that hospital physicians considered that MAW patients from “the diagnostic loop” in need of nursing and care were eligible for a MAW. Patients in need of more advanced treatment were eligible for hospitals (173). This indicates that the MAW is used as a lower level healthcare service than hospitals. Thus, MAWs seem to be an intermediate healthcare service in the interface between hospitals and nursing homes, for patients needing institutionalization. This is supported by previous findings from the same MAWs (104). An explanation may be that the MAWs can refuse to accept a patient, while the hospitals on the other hand, have a mandatory obligation to accept patients, even if the hospital is overcrowded (88). Hence, it seems essential to define what level of care is appropriate to which patients, to support referring PCPs decision-making process.

A study conducted at MAWs in Eastern Norway indicated that the MAWs were used as nursing homes, because there was a constant shortage of beds there (96). This is supported by two studies from more rural locations in North and South-Western Norway, in MAWs co-located with both a nursing home and an out-of-hours emergency service (99, 198). From a MAW in Western Norway, 25 % of the patients were transferred to the hospital due to deterioration, and 14.9 % had a medical condition not in line with the MAW admission

criteria (143). A 2020 study argued that the MAW admission criteria have been too narrow and rigid, and that the MAWs should accept patients without a clarified diagnosis (96). Studies from the general practitioner hospitals [sykestuer] in Finnmark (74), Søbstad nursing home in Trondheim, and MAW beds at Hallingdal sjukestugu indicate that the political intention with MAWs as alternatives to hospitalization may not be adequate. Findings from Paper I indicate a need for institution beds in the municipality offering medical treatment for acutely ill older patients. Due to a low functional level and many comorbidities, the home nursing care or other supportive services were not adequate anymore. However, due to the acute deterioration or illness, patients could not be admitted directly to a nursing home.

Moreover, in this PhD project, one in four MAW patients were transported between the MAWs and the hospital during the stay. 14 % of all patients admitted to a MAW were transferred to the hospital, and 10 % of all patients were admitted to a MAW via the “diagnostic loop” (Paper II) (173). Hernes et al. (143) found that one of four patients were transported from the MAW to the hospital because of a deterioration. This is in line with the intention of the MAWs: ensuring that patients in need of specialist services do not remain in the MAW. Studies have shown an increased risk of delirium due to transfers inside, outside, or in-between healthcare institutions (199, 200). The burden for patients being transported between a MAW and a hospital is essential to explore further.

Consequently, there is still a need for close communication between politicians and healthcare professionals to align healthcare reform intentions to what is needed.

### 8.2.2 Selecting the right Patient to the MAW

Findings from Paper II show that the mean age of MAW patients in the period 2014-2020 was 78 years. Moreover, 80.4 % of the MAW patients were admitted from their home (173). The PCPs reported that many fragile old people live in their own homes (Paper I). This was supported by register data, showing that only 39.8 % were discharged back to their home after a stay at MAW (Paper II) (173, 174). The PCPs also reported that relatives in many cases were exhausted and did not have capacity to take care of the patient at home anymore (174). Hence, the PhD thesis provides a picture of a fragile patient group living at home, and the challenge of developing healthcare services aligned with their needs.

The leading reason for healthcare reforms worldwide (201-206) is an increase in the number of patients with a non-urgent condition needing medical treatment. Internationally, studies indicate that non-urgent emergency department admissions contribute to between one-

third and one-half of all hospital admissions (207-209). This was also an essential argument for implementation of the MAWs in Norway as alternatives to hospitalization. One of the main challenges in developing alternatives to hospitals seems to be selecting the right patients (210). This is described both nationally and internationally when establishing new healthcare services (96, 210). A study exploring hospital physicians' perspectives on older patients' pathways found that physicians described being in a squeeze between prioritizing patients and trying to ensure a proper flow of patients through the hospital wards, but with restricted possibilities to influence on the admissions. They also experienced that many older patients should never have been hospitalized, but instead should have received medical treatment in primary healthcare (211). Also, studies indicate that patients are discharged from hospitals with more complex medical conditions than they had previously (212, 213). From the PCPs' point of view, there was actually not a pressing need for the MAWs, but a need for beds in nursing homes (96).

When referring patients to a MAW, the PCPs experienced disagreements with MAW personnel about suitable patients (Paper I) (174). Criteria for guiding both the referring PCPs and the MAW personnel have been developed. Still, PCPs find it difficult to decide which patients are suitable. Triage is widely used to sort and prioritize patients arriving at the emergency department in hospitals or at an out-of-hours service in primary healthcare. Even though a triage system may provide an indication on the patients' condition, to date it does not function as a decision-support for where patients should be taken care of. One of the most used triage scales in Europe is the Manchester Triage Scale, widely validated and reliability tested (214). Manchester Triage Scale is based on presenting signs and symptoms as described by the patient (215). The scale considers five triage priority levels: level 1, immediate assessment; level 2, very urgent; level 3, urgent; level 4, standard; level 5, non-urgent (214). Manchester Triage Scale is a tool for sorting patients at the arrival point. Implementing Manchester Triage Scale (or similar tools) could be a helpful tool for selecting MAW patients, if a recommendation of referral site based on the score is included. For example, Krämer et al. (216) used the administrative data of admission, which was erroneous and did not provide information about urgency, to make a tool for classification of hospital admissions into emergency or elective care. They used supervised machine learning techniques and trained the model with physician-expert judgments (216). The model was accurate in 96 % of the cases. This model seemed to be successful, and it may be a valuable tool for repetition with administrative data from the MAWs (as used in Paper II). Hence, such



innovations may be used to provide decision-support tools for PCPs when deciding where to refer patients.

Findings from this PhD thesis and previous research emphasize the need for more research on what kind of patients the MAWs should cover.

### 8.3 The MAW in Relation to other Alternatives to Hospitalization

Different alternatives presented in the introduction section in this thesis, pages 17-23, are included to provide some examples of models that have been implemented internationally and nationally. Hence, the examples are not exhaustive, but all models are directed to or used for older people (Paper I and II). None of the alternatives led to higher medical risks for the patients or negative impact on health outcomes.

Results from this thesis indicate that the main challenge for PCPs referring patients to MAWs is the fear of patients receiving suboptimal treatment and observation (Paper I). The MAWs in this study were staffed with PCPs and nurses. MAW PCPs were present at daytime during weekdays. In both the general practitioner hospitals [sykestuene] in Finnmark and at Hallingdal sjukestugu, PCPs provided medical supervision 24/7. Whether physicians are present 24/7 or not, varies between the different alternatives to hospitalization, but presence of physicians does not seem to influence health outcome. An exception is the nurse-led units, which indicated longer consultations, higher costs, and increased proportion of readmissions (47, 62, 64).

PCPs in Paper I doubted the medical competence of the nurses in the MAWs, for instance their ability to handle acute situations and reconsider patients' medical condition. The importance of the nurses' roles in community hospitals has been emphasized in several studies: in 18 community hospitals in Ireland, nurses were often responsible for the patient from admission to discharge without the patient seeing a physician (39). Paper II shows that 14 percent of the MAW patients were transferred to the hospital. Hence, this indicates that nurses were able to identify patients that need a higher-level service. The Official Norwegian Report [NOU] from 2023 Tid for handling [Time for action] emphasized the importance of reconsidering how tasks are distributed between different healthcare personnel (and technology) (28). Nurse practitioners (nurses with a master's degree in general nursing) are highlighted to have an important role to ensure a sustainable healthcare service in the future.

One reason for PCPs' concern about suboptimal treatment was limited diagnostic resources available for decision-support, as well as limited opportunities for x-rays and extended blood samples at the MAWs (Paper I). Ten percent of the MAW admissions were via the "diagnostic loop" (Paper II). Unfortunately, we do not know how many MAW candidates that are sent into the "diagnostic loop", who remained in hospital, since these numbers are not available. The diagnostic opportunities in the MAWs are quite like that of alternatives to hospitalization, such as community hospitals, general practitioner hospitals

[sykestuer], Søbstad nursing, and Hallingdal sjukestugu (39, 74, 78, 84). Hence, it may be argued that the diagnostic opportunities in the MAWs are sufficient.

The MAWs were organized as beds co-located with short-term nursing homes (Paper II). This is in contrast to e.g. community hospitals (39, 53), representing non-urgent in-patient units, or emergency department initiatives, representing urgent care units inside a hospital (39, 53). As such, the MAW physical organization is more similar to the organization of the general practitioner hospitals [sykestuene] in Finnmark (74). The MAWs in this thesis comprise four to eleven beds. Nationally, the range is from 0.25 to 72 (89). Hence, it may be understandable that PCPs and other healthcare personnel strive to accept MAWs such as acute in-patient services as alternatives to hospitalization.

Hospital at Home models are expanding internationally, lowering the demand for hospital beds, decreasing costs, reducing the risk of hospital-acquired complications, preserving some semblance of patient independence, and allowing recovery in a familiar home setting (57).

A systematic review suggested prioritization of the admission avoidance models over early-supported discharge, due to potential benefits in costs and clinical outcomes (58). Both patients and their next of kin can thus avoid unnecessary travel to hospital, which is a burden especially for older people (199, 200). However, whether the MAWs should also include early supported discharge opportunities, or if it should be replaced with Hospital at Home, may need more exploration.

## 8.4 General Methodological Considerations

This PhD project includes different methodological approaches to explore the MAWs as alternatives to hospitalization. A critical consideration of including three methods in a PhD project, is that it is conceptually demanding (126, 129). However, the research group have expertise in different methodological approaches, which means that the work has been safeguarded. In study I, an author with medical expertise from general practice and primary care was included.

### 8.4.1 Qualitative Study

Using a reflexive approach, the PhD candidate became more aware of factors that might influence the interviews. For example, a clear attention towards interesting reasoning and arguments from the PCP could have been elaborated more. Sometimes, the PhD candidate asked the next question in the interview guide too quickly. As a result, the physicians did not get enough time to reflect upon and answer the question.

Almost all the interviews took place in an office at the out-of-hours service. One interview was suddenly interrupted after 10 minutes because of an emergency alarm. This interview was not included, because it was assumed to be short. Consequently, it did not contain all questions from the interview guide. But the knowledge that an alarm could go off at any time, or that patients were sitting in the waiting room for a long time, may have contributed to shorter and not so rich interviews.

### 8.4.2 Registry Data Study

In the registry data study, logistic regression analyses were chosen to gain knowledge about factors associated with whether the patient was transferred to a hospital or remained at the MAWs, by using administrative data. In addition, the study explored factors associated with whether the patient was admitted to the MAW via the diagnostic loop. The most interesting issue would be to compare these patients to patients who remained in the hospital. However, these data were not registered, and hence, they are lacking in the study.

Which variables to include from the single regression analyses in the multiple regression model was thoroughly assessed. There are several methods to do this within traditional regression modelling. It can be completely theoretical and only include variables

known to be associated with the outcome in previous literature. It can also include all variables with p-values below a fairly liberal significance level (e.g. 0.25 or 0.20). Finally, it can be purely exploratory, only including variables with  $p\text{-value} < 0.05$  (145, 146). Initially, the research group hypothesized that all variables may be associated with both primary outcomes. It was also statistically feasible to include all the variables in the multiple regression model, due to the large sample size.

#### 8.4.3 RCT

The randomization in the RCT was carried out in blocks of 100, with a 2:1 allocation to the MAW and the hospital respectively. A digital randomization tool picked out 32 random numbers between 1 and 100 that represented patient numbers that should be referred to the hospital. This was done in each of the five MAWs respectively. The study had to end before all the patients had been included, and we had a higher prevalence of patients referred to the MAW than intended. In retrospect, it could have been more appropriate to do the randomization in blocks of 10 to ensure a more equal distribution of patients to MAW and the hospital.

All the questionnaires used in the RCT were validated and reliability tested. Permissions for utilization were given before the PhD candidate started. In retrospect, another questionnaire we might have used was the validated and reliability tested PPE-15 (177). The PPE-15 covers seven dimensions of care: respect, coordination, information/communication/education, physical comfort, emotional support, involvement of relatives, and transitions and continuity (217, 218). There is an overall weak to moderate correlation between the NORPEQ and the PPE-15 items, indicating that the two questionnaires to some extent measure the same components (177). One of the strengths of the NORPEQ is the possibility to sum a total score relating to the patients' experience, hereby indicating quality of healthcare services, and also to measure incorrect treatment and overall satisfaction (151). Moreover, the PPE-15 does not contain any questions for measuring physicians' professional skills, which we assumed as important for measuring healthcare quality, based on previous research findings from interviews with PCPs.

As stated in chapter 6.3, we did not reach the estimated sample size to show superiority of MAW versus hospitals for the primary outcome NORPEQ. In an additional analysis, we estimated a 95 % bootstrapped confidence interval for the mean NORPEQ difference MAW minus hospital, yielding a result from -3.8 (hospital better) to 9.3 points

(MAW better). The interval indicates that if switching to a non-inferiority objective (219), and assuming that a NORPEQ difference of 4 is clinically relevant, as there in the sample size calculation is at least equality in patient experience when admitted to a MAW compared to the hospital. This is implied, since the interval does not exceed the clinically relevant 4 points in favour of the hospital.

## 8.5 Validity and Reliability

The overall goal of mixed methods research is to expand and strengthen a study's conclusions (126). Adding multiple and complementary data have enhanced the overall validity in this PhD project. Developing healthcare systems demands for more complex research, and therefore triangulation with a mixed approach, is well suited to answer the aim (126). The major advantage of working with the studies in parallel, is that the data are collected simultaneously (129), which provides an opportunity to compare results from both qualitative and quantitative studies, and validate findings from different methods (220). In contrast, sequential mixed method studies with more explorative approach for explanatory designs are more suited for connecting information from one study to the next (126). In this project, we could have chosen to do a sequential mixed method explanation design and conducted the registry data study first, to get the overall impression on patient flow, then the RCT study, and lastly the qualitative study. However, due to the time limit in the PhD period, this was not feasible.

The major drawback with mixed method design, and especially in a PhD project, is that this is assumed to be difficult for a single researcher to conduct alone (129). In mixed methods design, quality criteria are described as interference quality and interference transferability (external validity and generalizability) (129). Interference quality is an overall criterion for evaluating quality of the conclusion, and the interpretation that the conclusion is based on. Even if the mixed method design is suitable for triangulation and corroboration, it can be challenging to achieve high interference quality (129). Interference quality arises from the meta-analysis when all three studies are merged. It is dependent on the quality criteria of all three studies involved (trustworthiness in qualitative study and validity in the two quantitative studies).

### 8.5.1 Trustworthiness in the Qualitative Study

Analogous to the quantitative criteria of internal validity, reliability, objectivity, and external validity, four criteria for ensuring trustworthiness in qualitative research is described in Polit and Beck (129); credibility, dependability, confirmability, and transferability (129).

Credibility is referring to confidence and truth of data, and the researchers' ability to create a true story when interpreting the narratives (129). The PhD candidate transcribed all the interviews within two days of the interview, which increased the awareness of the

interview technique. Reflexivity notes were written down before and right after each interview, which contributed to highlight awareness of the research process (140). Both the PhD candidate and the main supervisor coded all transcripts independently two or three days after every interview. All researchers participated in the analysis and interpretation process. Through a stepwise research process, combined with the study being conducted in such a way that the trustworthiness of findings was managed, the credibility of the study increased.

Dependability is defined as the stability of data over time and condition, and is analogous to reliability in quantitative research (129). The PhD candidate used a digital recorder, and a rigid transcription was done to ensure all data was collected, including verbal and non-verbal utterance. Then, all researchers were able to verify the results. This increases the dependability in this study. The responsibility and the choices the PCPs face when admitting patients to a MAW as an alternative to hospitalization is similar. However, the study was conducted in a smaller geographical area, where PCPs know the staff at the MAW better. This could possibly have influenced the findings and decreased the dependability.

Confirmability is referred to as the objectivity in the analysis (129). More than one researcher must confirm the relevance or meaning in the information the participants provided. In this study, this was achieved through discussion of codes, subthemes, and themes between all researchers, until agreement was achieved. To increase the confirmability, the results must reflect the participants voice, and not the researcher bias, motivation, or perspectives. We might have benefitted from conducting a member check, in returning findings back to the participants after the final analysis, to increase the confirmability. The purpose with the member check is to verify or assess the trustworthiness of the findings (221). However, there are ethical consideration with conducting a member check. First, in all research the protection of participants is important, and an anonymous process with a consent from all participants is necessary. Second, with a member check it might be a discussion of whose voice is telling the story, and from whom the interpretation comes from. However, findings from an interview are created from the discussion between the participants in the interview.

#### 8.5.2 Validity in the Registry Data Study

Validity of registry data has been characterized by completeness and validity of the included variables (222). Completeness refers to whether all individuals in the population are included in the registry. The MAW administrative data are mandatorily collected, and all the patients



are registered. Even if all variables were collected according to the mandatory guidelines from The Norwegian Directorate of Health, there were some missing observations among the variables (13). In Paper II, the missing observations are described in Table 2. Missing numbers were ranging from 0 missing observations to 913 observations. The validity of the variables included from the MAW administrative registry was assumed high, in terms of completeness.

The second dimension is content validity. Content validity is related to whether a variable measure what it was intended to measure, and if all variables together measure the total picture (129, 222). A weakness with the administrative registry was that it contained ICPC-2 codes for diagnosis and not ICD-10 codes, which arise as a common problem in registry data research (222). The ICPC-2 coding was developed 40 years ago and designed for PCPs. Consequently, it reflects concepts and ideas from the early 1980s (223). The ICD-10 coding have been through several adjustments, and it is developed for specialist health care. Hence, using ICPC-2 diagnosis may represent a more inaccurate measure. Because patients in the MAWs are assumed to be hospital patients, the ICD-10 system would be preferable. However, this is not the case, and the ICPC-2 system is still in use. Therefore, a variable constructed based on ICPC-2 might not have the same sensitivity and specificity as it would have if based on ICD-10. Consequently, the predictive value might also be lower.

Patient characteristics, such as comorbidity, are usually measured and controlled for in clinical outcomes research. The PhD candidate constructed a comorbidity variable based on the ICPC-2 coding system. Two comorbidity measurement tools developed by Charlson et al. (147) and Elixhauser et al. (224) are frequently used to measure burden of disease or case-mix with administrative data (147, 224, 225). However, none of these algorithms were developed for the ICPC-2 system (225). To control for clinical characteristics, we instead used the same method as Hernes et al. 2020 (143).

Nurses in administrative positions registered MAW data every month. A statistician at the hospital was responsible for merging datafiles and checking for errors. If an error was detected, the nurse at the MAW got a message and corrected the error. In total, this led to a higher data quality (222). In addition, the same nurses at all five MAWs were responsible for registration throughout the period from 2014-2020.

This means that the registrations were done in a similar manner throughout, and that different meanings and contexts should not have affected the registrations. In addition, the registry data study was based on a large and complete dataset covering five MAWs over a seven-year period, which allowed more reliable estimates than previous studies in the field.

Moreover, errors have been revised along the way and during data washing by the PhD candidate. A further strength of using registry data, is that the data collection is done independently of the study, and the researcher's context has no impact on the data collection (222). The data should therefore have high content validity.

Face validity refers to whether a test appears to measure what it is supposed to measure (129). In general, with registry data, data are not collected for the purpose of research. This may reduce face validity, because it could have been an advantage to use other variables to measure the outcome (129, 222). For the purpose of exploring patient characteristics and associated factors for being transferred to hospital or for being admitted to the MAW through the “diagnostic loop”, it might have been beneficial to include variables, such as The National Early Warning Score (NEWS) or laboratory tests.

### 8.5.3 Validity and Reliability in RCT

Internal validity is the degree to which it can be inferred that the experimental intervention, rather than uncontrolled, extraneous factors, is responsible for the observed effect (129). The RCT design increases the internal validity, because a random assignment of treatment is performed (226). During data collection, neither PCPs nor nurses knew where the patient was going to be treated. Thus, there should be no systematic differences between the groups, other than the treatment they received. The randomization was assumed to be successful both in the MAW group and the hospital group. Patients were similar in gender, mean age, represented similar ICPC-2 main diagnosis, scored similar on Charlson Comorbidity Index, and the same degree of morbidity scored by NEWS. Despite the fact that RCTs are considered a gold standard within clinical research, there are still several challenges related to inclusion that apply to our study as well (226). It is highly likely that it is the healthiest group of patients who are included in the study, because they are able to consent. Cognitive disorientation was one of the main reasons why it was difficult to include patients in the study. This could bias the sample compared to the population of MAW patients, and it could reduce the external validity of the study.

Content validity in the RCT is related to whether the quality indicators together measures what it is intended to measure (129). In this RCT, acknowledged quality indicators were used to compare the quality of care between the MAWs and a hospital (112, 113, 116, 121). To get an even broader perspective of quality of care, and then increase the content validity, we may of course have chosen other/more quality measures.

NEWS, the patient's objective health status, was measured at inclusion. If NEWS had been included 12, 24, and 48 hours after inclusion in the study, it would have been possible to get further insight on the effect of the MAW or hospital stay on patients' physical status. In addition, laboratory values linked to symptoms might have provided further information on whether the treatment which the patient received was correct. However, it was assumed to not be feasible to design such a study.

The questionnaires used in the study were psychometrically tested. The validity and reliability of the questionnaires have previously been tested both nationally and internationally (Cronbach's alpha national level: 0.85 on NORPEQ; 0.81 on General health item in Rand-12) (150, 227-229). The psychometric properties of the instruments were good. They measured what they were intended to measure, and the transfer value to other cultures and other settings was also reliable. Independent consistency reliability with Cronbach's  $\alpha$  was measured in all the three questionnaires used in the RCT. This yielded Cronbach's  $\alpha = 0.78$  in EQ-5D, in NORPEQ  $\alpha = 0.81$ , and in Rand-12  $\alpha = 0.76$ , thus indicating a high reliability in the sample. There was a high level of agreement among the patients measured by NORPEQ. Most of the patients experienced both hospital and the MAWs as a good healthcare service. On a scale from 0-100, where 0 represented poorest outcome and 100 represented best possible outcome, patients in this study reported high scores on patient experience (88 at the MAWs and 86 at the hospital). The five MAWs in Østfold have developed local guidelines for the admission of patients, and it should hence be similar.

A strength in the RCT is that the research process was thoroughly established and carefully followed up throughout the data collection period. This increases the internal validity of the study (230). Clinical project assistant nurses, nurses, and physicians were trained in the inclusion of patients. The goal was that inclusion would be carried out in an equal manner by everyone. The PhD candidate was available around the clock if the nurses and physicians had questions regarding the inclusion. When challenges arose, it was easy for the PhD candidate to sort these out, because the study was established on all levels. This was crucial for the success of the data collection. An example is a discussion between a PCP and a hospital physician, whether a MAW patient could be sent to hospital. The hospital physician found it challenging to admit a patient who might potentially receive better treatment in primary healthcare. Here, the PhD candidate settled the argument by referring to the importance of study inclusion.

Another challenge for inclusion was the assessment regarding a patients' ability to make consent for participating in the study, as a key principle for research ethics (231). If a

tool had been implemented to score confusion, such as the Confusion Assessment Method (CAM), we would have had a more objective assessment of consent competence (232). However, in this study, consent competence was assessed subjectively and individually. This has probably led to that a large proportion of patients who could have been included in the study, were not. Therefore, it is probable that only the healthiest patients have been included in the study.

During the data collection 4-6 weeks after admission, most of the patients were called by the PhD candidate, which is a recommended strategy to increase recruitment (230). Conducting a telephone interview was challenging. Some patients had hearing loss, and sometimes the questions had to be asked several times. This may have meant that the patient did not give the answer they would have if they had checked the questionnaires themselves. It has been discussed whether telephone interviews give the same answers as face-to-face interviews. In the guidelines for EQ-5D, it is pointed out that the questionnaire is very well suited for telephone interviews (233). There were no questions about the meaning of the individual questions, either on EQ-5D, NORPEQ or Rand-12, which strengthens the internal validity of the study.

## 8.6 Generalizability of Findings from Paper I, II, and III

In Paper I, the findings are not generalizable, but they have a general transferability to other MAWs and similar settings. Detailed descriptive information about the study process has been provided, and readers are enabled to make interference extrapolated to other settings themselves (129).

In Paper II, both urban and more rural MAWs were included, covering a diverse population to describe the patient flow to and from the MAWs. The sample covered all admissions ( $n = 16\ 786$ ) over a seven-year period. This might be considered to increase the generalizability of the findings. The MAWs in our sample was within one hospital catchment area, had relative short travel distance to hospitals compared to many other MAWs, and the average size of the MAWs was also larger than the average of MAWs nationally (13). Conceptually, this might decrease the generalizability to MAWs organized in another setting (128).

In Paper III, the strict inclusion criteria may have contributed to selection bias (128). Patients assessed as appropriate for admission to a MAW, patients with all ICPC-2 codes, and all patients over 18 years were included. This should be representative for most of the MAW patient population, and it increases the generalizability. On the other hand, the total number of included patients was too small, and the calculated sample size was not reached. However, this is the first multicentre RCT conducted. The included sample is also larger than in the previous RCT from Hallingdal sjukestugu. It could have been an option to conduct a casus-control study, and use propensity score matching, to be able to compare “MAW patients” treated in MAWs and in a hospital.

In addition, the included sample could represent a biased sample. Many patients were not considered for inclusion, due to lack of cognitive orientation, not able to make consent, they did not speak Norwegian, and some patients did not want to participate. All these exclusions have possibly led to selection bias.

Perhaps more patients might have been included in the RCT if the PhD candidate had been more present at the out-of-hours services during data collection. However, 20 study nurses worked with the data collection during period.



## 9.0 Conclusion

This is the first thesis combining qualitative data, registry data, and data from a multicentre RCT in the analyses of MAWs in Norway. The thesis indicates that the MAW is not an alternative to hospitalization, such as intended from the health authorities before implementation. Results from the qualitative study found that PCPs question the medical quality of the MAW services, related to low competence and few diagnostic tools. The registry study showed that the MAWs are mainly used for older people requiring basic nursing and care. The results also showed that patients were transferred to hospitals when they needed more advanced medical treatment. Results from the RCT indicates equality in patient experiences when admitted to a MAW compared to the hospital. There was a significant larger positive change in self-assessed health-related quality and self-assessed health status for patients allocated to a MAW. Collated, findings in this thesis indicate that the MAWs may provide safe, sound, and quality healthcare services for selected patients as an alternative to hospitalization. However, this knowledge must be distributed to PCPs to meet their skepticism, and to authorities to re-establish the focus on MAWs as a viable organization of healthcare services.





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RESEARCH ARTICLE

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# What if something happens tonight? A qualitative study of primary care physicians' perspectives on an alternative to hospital admittance

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## Abstract

**Background:** Due to demographic changes, hospital emergency departments in many countries are overcrowded. Internationally, several primary healthcare models have been introduced as alternatives to hospitalisation. In Norway, municipal acute wards (MAWs) have been implemented as primary care wards that provide observation and medical treatment for 24 h. The intention is to replace hospitalisation for patients who require acute admission but not specialist healthcare services. The aim of this study was to explore primary care physicians' (PCPs) perspectives on admission to a MAW as an alternative to hospitalisation.

**Methods:** The study had a qualitative design, including interviews with 21 PCPs in a county in southeastern Norway. Data were analysed with a thematic approach.

**Results:** The PCPs described uncertainty when referring patients to the MAW because of the fewer diagnostic opportunities there than in the hospital. Admission of patients to the MAW was assumed to be unsafe for both PCPs, MAW nurses and physicians. The PCPs assumed that medical competence was lower at the MAW than in the hospital, which led to scepticism about whether their tentative diagnoses would be reconsidered if needed and whether a deterioration of the patients' condition would be detected. When referring patients to a MAW, the PCPs experienced disagreements with MAW personnel about the suitability of the patient. The PCPs emphasised the importance of patients' and relatives' participation in decisions about the level of treatment. Nevertheless, such participation was not always possible, especially when patients' wishes conflicted with what PCPs considered professionally sound.

**Conclusions:** The PCPs reported concerns regarding the use of MAWs as an alternative to hospitalisation. These concerns were related to fewer diagnostic opportunities, lower medical expertise throughout the day, uncertainty about the selection of patients and challenges with user participation. Consequently, these concerns had an impact on how the PCPs utilised MAW services.

**Keywords:** General practitioner, Primary care physicians, Health services research, Interview, Primary healthcare, Quality improvement

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## Background

The increased proportion of older adults and people with chronic diseases in the general population has resulted in an increased demand for health services worldwide [1–3]. Hospital emergency departments in several high-income countries are overcrowded due to the large proportion of non-urgent patients [4–6]. Many countries are launching primary healthcare models as alternatives to hospitalisation, as well as aiming to increase coordination across healthcare levels to improve patient care, reduce costs and improve public health [7–10]. Community hospitals, observation wards and hospitals-at-home are examples of health service models at the interface between primary and secondary care that provide acute and/or non-acute services and offer a variety of treatment and diagnostic services [11, 12].

In Norway, health services are primarily divided into two levels: primary care services, including general practice, out-of-hours emergency services offered in casualty departments where patients may be assessed by primary care physicians, home-based care, nursing homes and municipal acute wards (MAWs), and specialist services, including hospitals, outpatient specialist care and contract specialists [13]. The MAW model has been in use since 2012 as an alternative to hospitalisation for adult patients who need acute treatment and care but not specialist health services [13, 14]. MAWs are located in the local community, near where people live. The inclusion criteria for admission to a MAW are as follows: patients who would otherwise be admitted to the hospital; maximum expected length of stay of 72 h; acute deterioration of a known, chronic condition; and other clarified conditions where the risk of acute deterioration is low. Eligible patients must be aged above 18 years [15]. In 2019, there were 216 MAWs in Norway, with a total of 735 beds [16]. MAW beds are located either inside nursing homes, in casualty departments or in separate units at local medical centres. MAWs range from small units with 3 or fewer beds to the largest units with 15 beds or more [16]. Studies have indicated that the MAW model is a good alternative to hospitalisation and that patients prefer to be admitted to a MAW rather than the hospital [17–20]. Moreover, a study indicated that implementation of MAWs led to a 1.9% reduction in hospitalisations for patients aged over 80 years [14].

In many countries, primary care physicians (PCPs) are assumed to be gatekeepers responsible for assessing patients within the catchment area of their practice and for referring them to specialist health care services [21]. Since 2001, when a list patient system was implemented, Norwegian inhabitants have the right to be listed with a specific PCP [22]. Outside of office hours, patients can also access PCPs in a casualty department, where the

PCP on duty does not necessarily know the patient or have access to his or her medical records [23].

Previous studies have indicated that PCPs' attitudes towards the development of health systems and the treatment of fragile patients may be barriers to the implementation of alternatives to hospitalisation [24–26]. Hence, for the implementation of new health service models, it is important to gain knowledge about the aspects that PCPs find important when referring patients to different healthcare services. Studies focusing on PCPs' perspectives on alternatives to hospitalisation are lacking. Consequently, the aim of this study was to explore PCPs' perspectives on the MAW model as an alternative to hospitalisation.

## Materials and methods

This qualitative study utilised semi-structured interviews with PCPs. The study adheres to the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines [27].

### Setting and participants

The study was performed within one hospital catchment area in a county in southeastern Norway with approximately 320,000 inhabitants. In total, there are 288 PCPs in the area working in private practice and/or in casualty departments. The county includes five MAWs with four to eleven beds. Three MAWs are located within a casualty department, and two MAWs are located 5 to 15 min from a casualty department. The staff consists of registered nurses, specialist nurses and physicians; nurses are present all day and night, and physicians are present during the daytime on weekdays. MAW personnel can take blood samples to be analysed in the hospital laboratory, and it takes about 2 days to get the results back. In four of the MAWs, X-ray services are available in the daytime.

It is possible for PCPs and MAW personnel to send patients to the hospital for extended diagnostics before admittance to a MAW, which is called a 'diagnostic loop'. Patients are sent by taxi or ambulance to the hospital's emergency department to provide blood samples, undergo X-rays or ultrasound scanning, or be assessed by hospital specialists before being transferred to a MAW. The MAWs operate according to a timeframe of a maximum of 6 h, within which the hospital must confirm the patient's transfer back to the MAW.

### Data collection

Strategic and snowball selection methods were used to recruit PCPs from both rural and central areas of the county [28]. The PCPs received information about the study and an invitation to participate by email, which was forwarded from the head PCP in each of the

municipalities. Based upon suggestions from the study nurses, potential participants were contacted by the first author either in the clinic, by phone or by email. Five PCPs refused to participate. After accepting an invitation, no PCPs withdrew their consent to participate. We aimed to achieve a maximum variation sample [28], including by geographical location, gender, age, years of experience as a physician and years of experience working in a hospital (if applicable) (see Table 2). Recruitment continued until the first and last author agreed that data saturation had been achieved, meaning that no new themes were identified in subsequent interviews [28].

An interview guide (Additional file 1) was developed in accordance with the literature on healthcare quality at different healthcare levels, patient satisfaction, healthcare status, outcome measures and patient-centred care [18, 19, 29–31] and through iterative discussions between the authors until consensus was reached. The guide was pilot-tested for content and face validity through interviews with two experienced PCPs (both male), and small changes were made. For example, we elaborated on question 4, which initially read, “Could you please describe the admission process”, adding “... who do you contact, what kind of documentation is needed?”

Semi-structured interviews were conducted by the first author in the PCPs’ offices from April to August 2020. The interviews lasted from 22 to 56 min, with an average duration of 38 min. All interviews were digitally recorded and transcribed verbatim by the first author within 2 days.

The research group included a critical care nurse/PhD candidate, a nurse anaesthetist/PhD, a physiotherapist/professor, and a PCP/professor, with one male and three females.

### Analysis

A thematic analysis with a reflective approach in line with recommendations from Braun and Clarke [28, 32, 33] was performed. The first author’s own thoughts and ideas were written down before and immediately after each interview. The purpose was to explore any dynamics and behaviour between the interviewer and the participant that could potentially impact the analysis. The reflection notes were read together with the transcripts and incorporated into the analysis through several discussions between the authors.

The interview transcripts were inductively analysed using a six-phase process. More specifically, the first phase included familiarisation with data through listening to the recordings (first author) and reading and re-reading the transcripts (first and last author). In phase two, the first and last authors inductively coded the transcripts individually, and then the codes and initial themes were

discussed until agreement was reached. In phase three, all authors were involved in searching for themes. The second and third authors sent overviews and reports via email, and the initial themes were discussed in virtual meetings. In this phase, Word and Excel were used as tools to structure the data material, and no further computer-assisted qualitative analysis software was utilised. During phase four of the analysis, the themes were reviewed. Some themes were merged, and some were divided. The first and last authors went back and forth between the transcribed material and the subthemes and themes, as well as the impressions from the first authors’ reflexivity notes, to identify the content and totality of the data. All authors then discussed the themes in relation to the whole data set, also keeping the first authors’ reflections in mind, as a process to increase the robustness of the analysis. In phase five, we identified and named the final two themes and three subthemes that were related to the aim of the study. In the sixth phase, the paper was written (see Table 1).

### Results

A total of 21 PCPs agreed to participate in the study: 12 males and nine females. The PCPs’ mean age was 39 years, their mean work experience as a physician was 11 years, and their mean work experience at a hospital was 2 years (Table 2).

The findings indicate that the PCPs had different views on which level of healthcare service a MAW represented. MAWs were described as a “mini-hospital”, a “peripheral hospital unit”, a “specialised nursing home” and a “primary healthcare service level”. Despite varying descriptions of MAWs, most of the PCPs had a clear idea of “the typical MAW patient”, frequently described as an elderly patient with an acute need for treatment with a higher level of health services. Two main themes were identified through the analysis. The first theme was “What if something happens tonight?” The subthemes were a) safety for all, b) competence and responsibility, and c) collaboration across health service levels. The second theme was “User participation”.

#### What if something happens tonight?

The PCPs’ main concern was related to what could happen if a patient who would otherwise have been hospitalised deteriorated after admittance to a MAW. All PCPs emphasised that it was important that healthcare services provided safety for themselves, for the personnel at the MAW and for the patient. The PCPs’ concern was also related to issues of staff competence at the MAW, as well as the distribution of responsibility and collaboration among health service levels.

**Table 1** Thematic analysis according to Braun and Clarke, 2006

Transcript	Codes	Subtheme	Theme
PCP 2: They (the physician and nurses at the MAW) often say that this is not a MAW patient. I have come across that quite often. Interviewer: Do you say any more about that then? PCP 2: Because they (the physician and nurses at MAW) believe this one ought to be in hospital. As a rule, you try to get a diagnostic loop instead. So then you meet them kind of halfway. Sometimes I can understand that too. They (the patients) have so much different stuff ... and where does one begin ... and then they might need a specialist for that. Interviewer: Too many of those patients have comorbidities. PCP 2: Yes. But sometimes I feel like this might be maybe... They (the patients) have a number of conditions. This is what they need help with right now. Not everything else.	Not a MAW patient Quite often The physician and nurses at the MAW believe the patient should be admitted to hospital Diagnostic loop Meet halfway Patients have a lot of different stuff (comorbidities) Where to start? Need a specialist Patients have a number of conditions This is what they need help with now Not everything else	Safety for all (here: for the admitting PCP, as well as for the physician and nurses at the MAW)	What if something happens tonight?

Abbreviations: PCP Primary care physician, participant number, I Interviewer

### Safety for all

There were great variations in whether the PCPs felt that admission to a MAW was a medically safe alternative to hospitalisation. Most PCPs reported uncertainty in making a tentative or preliminary diagnosis based on their time-limited judgement, sparse medical records, few laboratory tests and the patient's own narrative. Many of

the PCPs highlighted that they felt safer referring patients to a MAW when utilising the diagnostic loop at the hospital first, enabling, for example, extended blood testing or X-rays. In addition, many PCPs felt that it was safer for a physician at the hospital to perform a second assessment of the tentative diagnosis. An experienced PCP stated, "I also feel more secure about a patient who

**Table 2** Information on the study participants' gender, age, years of work experience as a physician, and years of experience from working in hospital at the time of data collection

Number	Gender	Age	Qualified physician	Work experience in a hospital
PCP 1	M	29	2	1
PCP 2	F	34	4	1
PCP 3	M	33	8	1
PCP 4	F	39	14	1.5
PCP 5	F	41	14	2.5
PCP 6	M	35	9	2.5
PCP 7	F	32	6	1
PCP 8	F	41	16	1
PCP 9	M	40	15	4
PCP 10	M	42	13	2.5
PCP 11	M	42	15	2
PCP 12	M	60	20	1
PCP 13	M	41	9	3.5
PCP 14	M	42	15	6
PCP 15	F	41	15	2
PCP 16	M	31	6	1
PCP 17	F	30	5	2.5
PCP 18	F	52	17	3
PCP 19	M	32	6	2.5
PCP 20	F	32	3	1.5
PCP 21	M	44	20	2

Abbreviations: PCP Primary care physician, F Female, M Male. Age = reported in years. Qualified physician = reported as years of work experience since graduation. Work in hospital = years of work experience from hospital

I admit to the MAW when he has been through a diagnostic loop ... I feel that it's a very good service ... the patient will have even more clarity, and the MAW will receive a treatment plan from the hospital" (PCP four). This excerpt indicated that the PCP found admission to a MAW to be riskier for the patient, as well as for herself, than admission directly to the hospital.

The PCPs felt responsible legally, medically and ethically for making the right decision. It seems that it was easier for the PCPs to place trust in the hospital personnel's diagnostic decisions and further treatment plans than to diagnose the patient herself, which would carry the possibility of making a mistake. However, many of the PCPs also emphasised that 'the diagnostic loop' involved a further need for transport to the hospital and that patients would then be exposed to long waiting times in the emergency department at the hospital. They also stated that many elderly patients are cognitively disoriented and that the hospital atmosphere would negatively affect their condition, which might present an increased risk for the patient.

All of the PCPs reported that a clear diagnosis with a clear treatment plan was a criterion for MAW personnel to feel safe enough to accept the patient. The PCPs found providing a clear diagnosis challenging, arguing that a medical diagnosis is associated with a probability of misinterpretation. Hence, the PCPs often sent a patient through a diagnostic loop, even if they did not find it necessary, just to make the MAW personnel feel safe.

Many PCPs also stated that patients who had previously spent time at an MAW wanted to be admitted there rather than to the hospital. In particular, this desire was often held by patients with deterioration of a chronic condition or by frail elderly patients with multimorbidity. The PCPs noted that some of their patients had reported back to them about negative experiences at the hospital, such as waiting for hours in an overcrowded emergency department or being placed in a corridor. The PCPs suggested that being admitted to a MAW provided a sense of security for these patients. PCP 5 spoke in a low but clear voice as she conveyed the following message: "I think it's the fact that it's local, so that the family is able to visit, and, among other things, that the rooms are pleasant and spacious ... there are lots of those practical things ... but they also feel really safe and cared for ... this is very important" (PCP five).

Hence, the PCPs found it important that healthcare services feel safe for both the referring and treating physicians, as well as for the patient.

#### **Competence and responsibility**

Most of the PCPs were concerned about competence or lack thereof among MAW personnel. Due to the

relatively high morbidity among patients eligible for admittance to a MAW, most of the PCPs emphasised a preference for a wide range of medical expertise among personnel working at a MAW. Many of the PCPs indicated that due to the need for advanced medical treatment in primary healthcare, MAWs should ideally be staffed with hospital physicians. Others stated that a MAW should be staffed with PCPs or geriatricians. They also reported that it might be demanding for inexperienced physicians to have the sole medical responsibility at a MAW, although this was often the case. Most of the PCPs had earlier work experience from a hospital and contrasted the lonely physician role at a MAW with team-based collaboration in a hospital. PCP 21 thought about this issue for a while and then said, "I think perhaps that a background in internal medicine ... But then general medicine can be a very good background for working there too. Although it should be clarified, there can still, for example, be things that aren't clear-cut, and then it is important to have that breadth" (PCP 21). The PCPs assumed that it would be quite demanding for a physician to be in charge of a MAW. Hence, they believed there should be a minimum competence required to work in a MAW.

Most of the PCPs reported that they found it to be a challenge that the MAWs were staffed by nurses all day and night, with physicians present only during the daytime. This staffing arrangement resulted in a lack of medical expertise outside of ordinary working hours and thereby limited opportunities to reevaluate the patient's medical diagnosis. The PCPs with experience working in a hospital also considered physicians' medical decision-making role in hospitals. Therefore, most PCPs felt that MAW patients were their responsibility in the evening and at night. PCP 20, for example, thought that this was a very heavy burden: "Imagine if a patient's condition suddenly worsens and that is not discovered! I think that is actually a major barrier" (PCP 20). This excerpt indicated the PCPs' lack of trust in the competence of nurses at MAWs. In contrast, the nursing services were described as generally good by most of the PCPs, especially regarding their ability to provide structured observations and basic care. Nevertheless, some of the PCPs experienced a lack of preparedness in acute situations; as PCP 19 noted, "You do not see the really serious cases at the MAW; they are in hospital. I have been called out (to see a patient), and the opposite has been the case. They (the nurses) concluded that it is very serious. Then, you find yourself standing there, and the patients aren't so critical after all ...." (PCP 19). This PCP believed that the nurses' competence in handling acute cases was better at the hospital than at the MAWs.

#### **Collaboration across health service levels**

The PCPs perceived that the MAWs operated at the interface between the hospital and primary healthcare

services but were still at a lower health service level than the hospital. They also reported several barriers to collaboration between the two health service levels. The collaboration was described in different terms, such as that the “systems do not talk to each other”, that there are “bottlenecks in the system” and that there is “a tiresome bureaucracy”.

Collaboration between PCPs and hospital physicians was assumed to be essential to clarify the patient's condition and to establish a mutual understanding of one another's situations. Nevertheless, the PCPs described a hierarchical relationship between hospital physicians and PCPs. Some of the PCPs described hospital physicians as specialists and as therefore being able to provide decisional support. However, due to national legislation, PCPs have a legal right to refer patients to the hospital even if hospital physicians disagree. PCP 11 stated clearly, “Sometimes, there can be a great deal of discussion regarding patients. But I've been working with this for so long now, so on the whole, I've made my decision if I call ... and if there will be a discussion (with the hospital personnel), I just say we can agree to disagree about this ... but the patient comes to you anyway. It is my privilege to be able to make referrals, and they are obliged to make an assessment” (PCP 11). Hence, this excerpt suggested an imbalance in the relationship between hospital physicians and PCPs created by two different traditions: primary care and specialist health care.

In contrast, the collaboration between MAW physicians and PCPs was described as two-way communication about risk assessment, tentative diagnoses and treatment plans. However, some of the PCPs also reported disagreements based on different interpretations of MAW admission criteria and the clarify of the patient's condition. PCP eight described this issue as follows: “So that's generally what we find a bit difficult when there are admissions to the MAW ... there are some restrictions and ... a bit difficult ... they admit patients ... but their requirements are more demanding regarding the kind of patients they will admit” (PCP eight). This quotation indicated that the collaboration between PCPs and MAW physicians also involve some challenges.

In the evening and at night, the PCPs had to communicate with the nurses at the MAW when admitting a patient. Many of the PCPs described this communication as somewhat more complicated than communicating with a physician colleague. In these situations, the PCPs encountered even more discussions and disagreements, which they interpreted as nurses feeling uncertain about whether they should accept the patient. Some of the PCPs attributed this disagreement as nurses and physicians not speaking the same language, requiring both the patient's medical condition and treatment to be

explained in a simplified way when a PCP communicated with a nurse. This suggests that physicians and nurses had different needs. The nurses wanted the PCPs to develop a treatment plan, and the PCPs wanted a colleague to discuss both treatment and diagnosis.

#### **User participation**

When deciding the level of treatment, the PCPs found it important to determine whether the patient was able to provide consent and expressed frustration with patients and relatives who had unrealistic expectations regarding treatment and admittance. This was especially challenging when the PCPs encountered conflicts with their assumptions of what constituted professionally sound practices.

The PCPs stated that it was important to involve the patient in his or her own treatment. Mapping the patient's expectations and desires was assumed to be key to supporting the patient's true participation. Some patients clearly requested to be admitted to the MAW rather than to the hospital. The PCPs then found it important to identify the reason why the patient required admission to a MAW or to the hospital. The PCPs highlighted good communication as being key to making the best choice for the patient and noted that good communication required that the patient be able to provide consent. PCP 17 thought about this topic for a while and then said, “One tries as best as one can to comply with the patients' wishes as well ... that obviously means a lot... I quite often ask what they are imagining ... what they are thinking ... whether they are scared ... or what ... are they worried about staying at home ...” (PCP 17). For this PCP, involving the patient in her assessment was assumed to be essential.

Many of the PCPs also stated that relatives often had a central role in communicating the patient's wishes and needs. The PCPs assumed that relatives may be able to provide more complete and comprehensive descriptions of the patient's habitual condition than patients themselves. PCP five explained this assumption in this way: “Call relatives .... also get a realistic impression of their functional status. I actually think that many of those who come here are in a poor condition. But maybe they are like that all the time, so is there such a great difference?” (PCP five). Nevertheless, due to both the time of the day and the limited amount of time to make a decision, including relatives was not part of the PCPs' usual practice.

In many cases, the PCPs reported that many patients would not have survived at home without relatives compensating for the patient's frailty due to old age, multimorbidity and a low level of functioning. The PCPs explained that it was not always that the patient wanted to be admitted to a MAW or hospital but that relatives

did not have the capacity to take care of the patient at home anymore. Hence, the PCPs described that they had to take both patients' and their relatives' wishes into consideration when deciding the level of treatment.

## Discussion

This study contributes knowledge about PCPs' perspectives on the MAW model as an alternative to hospitalisation. Several factors affected the participating PCPs' judgement of whether the use of MAWs is a safe alternative to hospitalisation, both from their own perspectives and from those of MAW personnel, patients and patients' relatives. Moreover, disagreements regarding admission criteria, concerns related to the competence of MAW personnel, the unclear distribution of medical responsibility and collaborative challenges between primary and hospital health service levels all impacted the PCPs' decisions on where a patient should be treated. Involving patients and relatives in the decision about the treatment level was also assumed to be important but challenging.

The PCPs were worried about what would happen if a patient's condition deteriorated in the evening or night when there was no physician on duty at the MAW or if the PCP had misjudged the situation. A recent study of 2744 admissions to a MAW showed that 23.6% of admitted patients were transferred to the hospital as a result of deterioration or the identification of a clinical condition that required hospital care [34], which underlines the PCPs' worry. To compensate for the PCPs' insecurity and to avoid later hospitalisation, the diagnostic loop was considered a good solution. In addition, 'the loop' was requested by physicians and nurses at the MAWs. In contrast, a recent study found that PCPs felt that the diagnostic loop was an inappropriate use of time and resources [31]. Managing diagnostic uncertainty has been reported as a recurring challenge for physicians [35]. Several studies have shown that more experienced PCPs tolerate more risks and diagnostic uncertainty than other physician groups, who rely more on examinations to make a diagnosis [9, 36, 37]. This was not in line with findings in a recent study.

The PCPs reported that many patients wanted to be admitted to a MAW, especially older adults who had been to a MAW before. Such positive patient experiences of MAWs have also been highlighted in other studies [18–20]. However, a Cochrane review also showed that patients with acute illness were satisfied with receiving treatment in primary care after a short hospitalisation [38]. Hence, the issue of whether patients who are acutely admitted to either a MAW or a hospital are able to objectively evaluate the services separately should be examined. It may also be argued that a patient's condition when treated in an MAW is less acute and therefore impacts his or her impression of the stay.

In cases of deterioration or misjudged conditions, the PCPs were not convinced that admission to a MAW was a safe alternative to hospitalisation. They reported that they would prefer that MAWs be staffed by hospital physicians or medical specialists, and they had the impression that MAW physicians were quite inexperienced. It may be argued that MAW physicians could also be described as PCPs due to their role in primary healthcare. Hence, this may indicate a lack of insight from the PCPs into the actual competence of MAW physicians. A comparison of PCPs and hospital physicians in hospitals-at-home in Denmark showed that the PCPs managed to avoid the hospitalisation of elderly patients with acute medical diseases to a greater extent than hospital physicians [37]. This finding indicates a gap between PCPs' assessments of their own, MAW physicians' and hospital physicians' competence.

Moreover, the PCPs in this study felt insecure because nurses staffed the MAWs for 24 h, while physicians were present only during the daytime. Vatnøy and colleagues found that reliance on nurses in acute inpatient settings requires that they have expertise to identify problems and take action [39]. The nurses in the MAWs were all registered nurses with a bachelor's degree, and many of them had a specialisation, e.g., in critical care, geriatrics or diabetes. In addition, many of the nurses had considerable experience working in hospitals before they started working at the MAW. Hence, the PCPs seemed to lack insight into the nurses' educational backgrounds and experience. Johannessen and Steihaug found that a lack of medical expertise was perceived as stressful and unsafe for nurses working in MAWs [31]. A Cochrane review indicated that nurse-led health services provide similar or better health outcomes, such as reduced mortality or reduced symptom burden for patients, than physician-led health services [40]. Regardless, neither the PCPs in the current study nor the personnel at the MAWs deemed nurses' competence to be sufficient to provide safe and quality health services. This finding may indicate that it is time to reconsider how MAWs or similar primary care alternatives to hospitalisation should be staffed in the future. In addition, this finding indicates a need to better inform physicians about nurses' competence, and vice versa.

The finding on PCPs' feelings of insecurity when admitting a patient to a MAW is supported by, e.g., Leonardsen et al. [29]. Nevertheless, another study indicated that there were no differences in mortality and morbidity after patient admission to a MAW than after admission to a hospital [17]. Therefore, research on these primary healthcare alternatives to hospitalisation is essential to ensure that the different health care levels are used as intended. The findings in our study show that hospital physicians were considered medical

specialists, while MAW physicians were considered collaborative partners. This finding was also reported in another study of general practitioners' perspectives on patient handovers in primary healthcare [41]. The Vanguard study in England indicated that collaboration is difficult because there are barriers between the different health care levels [42], which is supported by our findings. A lack of communication and collaboration between healthcare providers is one of the main factors for stress among PCPs in high-income countries [43]; hence, this situation demands action. A focus on better collaboration between primary healthcare services and hospitals is essential to ensure the exchange of knowledge and experiences related to various diseases and how they are handled [44, 45].

The PCPs in our study reported that patients' and relatives' participation in deciding the level of healthcare services was important but challenging. This finding is in line with findings of recent studies [30, 46]. Patients' involvement in decisions about their own health is associated with improved healthcare outcomes and patient satisfaction [47–49]. Such involvement requires that physicians ensure that the patient is cognitively oriented and sufficiently informed [50], which was also noted by the PCPs in our study. Since many older patients are cognitively impaired, it can be very difficult for them to be involved in accordance with a patient-centred care model [30, 51]. Conflict of the wishes of patients and their relatives conflict with what PCPs consider to be the best medical decision can result in PCPs taking a more biomedical view rather than a patient-centred care approach when deciding the medical treatment [52]. PCPs have an obligation to not only ensure the patient's medical safety but also involve the patient in his or her own medical treatment [49, 53]. Healthcare professionals report that patients have unrealistic expectations of what is feasible [54], which is supported by our findings. Thus, there is a potential ethical conflict between shared decision-making, on the one hand, and patient safety, on the other [53].

The implementation of MAWs in Norway was based on a political initiative, and important stakeholders, such as PCPs, were accorded minimal involvement in the development of the model. In a constantly developing healthcare system, organisational change is more likely to succeed if healthcare professionals have an impact on the changes [55]. The participating PCPs' uncertainty and concerns probably resulted in patients being referred to the hospital instead of the MAWs. Therefore, in the further development of the MAW model, it is important to consider these aspects to ensure quality services and safety for all stakeholders.

### Strengths and limitations

The qualitative research design entails a lack of opportunity for generalisation. Although the MAW model

may appear to be a Norwegian concern, similar models have been developed in many other Western countries. This supports the transferability of our findings [11, 12]. Transferability is also supported by the use of the maximum variation approach, ensuring the participation of PCPs from both rural and central geographical locations variation in the PCPs' age, gender, work experience as a physician, and experience working in a hospital.

A strength was that the interview guide was pilot tested by two experienced PCPs. A thorough transcription of the interviews was conducted: the PCPs' stories were written down verbatim, including both verbal and non-verbal utterances, ensuring the internal validity and consistency of the findings. The first author's reflexivity notes were consulted throughout the analysis process, and all authors were involved in the discussion of codes, subthemes and themes, thereby achieving confirmation.

Credibility refers to confidence in the "truth" of the findings [28], which was achieved through the thorough description of the data collection and analysis and transparency. The research group had a broad composition, with members of different genders and roles. The presence of different genders reduces gender bias, and our different roles contributed to a broader interpretation of the analyses of the PCPs' perceptions of the MAWs, also increasing the credibility of our findings.

### Conclusion

The PCPs in our study reported several concerns related to the security of patients, MAW personnel and themselves in the consideration of admission to a MAW as an alternative to hospitalisation. Their concerns had an impact on how MAW services and hospital services were utilised. Moreover, user participation was assumed to be challenging due to conflicts between patients' and relatives' desires and what the PCPs found professionally justifiable.

Our findings indicate that PCPs do not have an overview of the competence of MAW personnel and resources of MAWs. For new health service models to be implemented and utilised as intended, our findings indicate that including key personnel perspectives is essential. Hence, it is important to increase the flow of information about alternatives to hospitalisation. It is also important to control whether this information is actually received.

### Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12913-021-06444-x>.

**Additional file 1.**

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**Authors' contributions**

VN performed data collection and transcribed the data. VN and ACLL performed the coding and identified the initial themes. VN, ACLL, HL and PM performed the analysis and interpretation of the data. VN wrote a first edition of the full manuscript, and all of the co-authors (ACLL, HL and PM) participated in the drafting and critical revision of the manuscript for important intellectual content, as well as the approval of the final submitted version of the manuscript. All authors (VN, ACLL, HL and PM) contributed to the conception and planning of the work that led to the analysis and interpretation of data, as well as the manuscript. All authors have read and approved the final version of the manuscript.

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**Availability of data and materials**

Datasets generated and/or analysed during the current study are not publicly available due to local ownership of data, but aggregated data are available from the corresponding author on reasonable request.

**Declarations****Ethics approval and consent to participate**

The study was based on the principles stated in the Declaration of Helsinki on anonymity, written, informed consent and the right to withdraw without any negative consequences [56]. Informed consent was obtained from all the participants. The study was approved by the Regional Committees for Medical and Health Research Ethics (REC) (reference number 2018/687) and the Norwegian Centre for Research Data (NSD) (reference number 340271).

**Consent for publication**

Not applicable.

**Competing interests**

All authors declare that they have no conflicts of interest in relation to the submitted work.

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## Interview guide

### Admission of patients

1. How would you describe a typical MAW patient?
2. Which are your criteria for admitting a patient to a MAW?
3. Can you please describe the situation the last time you admitted a patient to the MAW?
4. Can you please describe the admission process – who do you contact, what kind of documentation is needed?
5. Which eventual challenges do you encounter when admitting a patient to the MAW?
6. Which eventual challenges do you encounter when admitting a patient to the hospital?
7. Are you familiar with the “diagnostic loop”? If yes, can you please tell me how you use this service?

### Medical quality

8. What do you think about the quality of the medical treatment patients get at a MAW?
9. What do you think about the quality of the medical treatment patients receive at a hospital?  
Follow up: What is included in good quality? What is something else that leads to quality?
10. When in doubt, which factors make you decide to admit the patient?
11. Which factors make you feel safe not to admit the patient?

### User involvement

12. Could you please describe a situation when the patient did not want to be admitted, even if you wanted it? Follow up: How did you act in this situation?
13. To what extent do you include patients’ desires about treatment in your decision?
14. To what extent do you feel that the system lets you include patients’ desires?

### The MAW model in healthcare services

15. What do you think about the MAW as a future healthcare service?

Is there something else relating to MAW services that you would like to add?



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# Finding good alternatives to hospitalisation: a data register study in five municipal acute wards in Norway

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## Abstract

**Background:** In Norway, municipal acute wards (MAWs) have been implemented in primary healthcare since 2012. The MAWs were intended to offer decentralised acute medical care 24/7 for patients who otherwise would be admitted to hospital. The aim of this study was to assess whether the MAW represents the alternative to hospitalisation as intended, through 1) describing the characteristics of patients intended as candidates for MAWs by primary care physicians, 2) exploring the need for extended diagnostics prior to admission in MAWs, and 3) exploring factors associated with patients being transferred from the MAWs to hospital.

**Methods:** The study was based on register data from five MAWs in Norway in the period 2014–2020.

**Results:** In total, 16 786 admissions were included. The median age of the patients was 78 years, 60% were women, and the median length of stay was three days. Receiving oral medication (OR 1.23, 95% CI 1.09–1.40), and the MAW being located nearby the hospital (OR 2.29, 95% CI 1.92–2.72) were factors associated with patients admitted to MAW after extended diagnostics. Patients needing advanced treatment, such as oxygen therapy (OR 2.13, 95% CI 1.81–2.51), intravenous medication (OR 1.60, 95% CI 1.45–1.81), intravenous fluid therapy (OR 1.32, 95% CI 1.19–1.47) and MAWs with long travel distance from the MAW to the hospital (OR 1.46, 95% CI 1.22–1.74) had an increased odds for being transferred to hospital.

**Conclusions:** Our findings indicate that MAWs do not represent the alternative to hospitalisation as intended. The results show that patients receiving extended diagnostics before admission to MAW got basic treatment, while patients in need of advanced medical treatment were transferred to hospital from a MAW. This indicates that there is still a potential to develop MAWs in order to fulfil the intended health service level.

**Keywords:** Health services research, Primary healthcare, Quality improvement, Register data, Regression analysis, Municipal acute wards, Pathways

## Introduction

Many Western countries organise their health care systems within two governmental levels. Hospitals provide specialised medical services, while primary healthcare

provides basic medical treatment and care [1–3]. In recent years, there has been a change towards decentralising medical treatment from hospitals to primary health care, and different initiatives have been implemented and tested [4–6].

In Norway, municipal acute wards (MAWs) were introduced in 2012 as an alternative to hospitalisation for patients with a clarified diagnosis who need acute medical treatment, but who are not in need of specialist health

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care services [7, 8]. Patients admitted to a MAW must be over 18 years old and have an acute deterioration of an already known condition and/or have a clarified condition that is expected to be fully treated within approximately three days [7]. National guidelines for selecting patients suitable for MAW admission are broad, and great emphasis has been placed on local self-government in selecting patients [7–9]. However, the patients must be assessed by either a general practitioner, an out-of-hours physician or a nursing home physician, all of whom are primary care physicians (PCPs), before MAW admission. More extended diagnostics beyond what the primary care physicians can offer, such as x-ray, ultrasound images or blood samples, can be provided in the hospital before admission to the MAW. Based on such extended diagnostics hospital physicians may claim a need for hospitalisation for the patient instead of an admission to a MAW.

Patients admitted to a MAW may experience a deterioration beyond what is thought appropriate for the MAW to handle, and are consequently transferred to hospital [10]. The selection of patients suitable for MAW admission thus can be challenging, and studies indicate that treating patients outside hospitals causes uncertainty for the responsible healthcare personnel [11–14].

The structure, equipment and range of services offered in MAWs varies. Some MAWs are organised as inter-municipal units, some are located in relation to a hospital, others close to a casualty clinic or a nursing home. Some MAWs have physicians and nurses present 24 h, while others have to use PCPs from a casualty or a nursing home for consultations. The number of beds in a MAW varies from small units with 3 beds or less to large units with 15 beds or more [15]. There is no national guidelines regarding medical-technical equipment and diagnostics that should be available or present at a MAW; i.e. some MAWs offer advanced diagnostics such as x-ray or computer tomography, while others do not have these possibilities [16, 17].

Whether the MAWs represent the alternative to hospitalisation that was intended from the health authorities is so far inconclusive. For example, one study showed that 52.7% of MAW patients admitted from home were discharged to nursing homes after a stay, indicating that MAWs were used as a pathway for such admission [18]. Another study argued that MAW patients were very old and had complex health problems when admitted, resulting in a prolonged length of stay and indicating that the patients' needed comprehensive care rather than specialised medical treatment [19].

This study aimed to assess whether the MAW represents the alternative to hospitalisation as intended. Our objectives were to 1) describe the characteristics

of patients intended as candidate for MAWs by primary care physicians, 2) explore the need for extended diagnostics prior to admission in MAWs, and 3) explore factors associated with patients being transferred from the MAWs to hospital.

## Materials and methods

The study adheres to the Reporting of Studies Conducted using Observational Routinely Collected Data (RECORD) guidelines [20]. All methods were carried out in accordance with relevant guidelines and regulations (see ethics approval).

### Study design and data sources

The study had a prospective, observational design, based on anonymous data collected from five MAWs in south-eastern Norway in the period 2014–2020. At discharge, nurses in administrative positions at the MAWs complete a mandatory reporting form with anonymised patient information.

The mandatory forms contain detailed characteristics of the MAW admissions: 'patients' gender', 'patients' age', 'treatment provided', and 'the International Classification in Primary Care (ICPC-2) main diagnosis leading to the admission'. Information about 'ICPC-2 additional diagnosis 1 at admission', and 'ICPC-2 additional diagnosis 2 at admission' are based on patients' comorbid conditions, but are not the reason for admittance to the MAW. The forms also contain information about the date of admission, whether 'the admission was day/evening/night', whether 'the admission was weekend/weekday', 'where the patient is admitted from', 'who the referring primary care physician is', 'date of discharge' and 'where the patient is discharged to'. The information collected in the forms are registered in a data file in each MAW. The files from the five MAWs are then merged into one file in the analysis department at the hospital.

The study was conducted within one hospitals' catchment area in South-eastern Norway. The five MAWs in this region were established in the period 2012–13. They were organised as inter-municipal units covering an area of 12 municipalities, with approximately 320 000 inhabitants. Table 1 gives an overview of the five MAWs' characteristics.

All adults  $\geq 18$  years admitted to one of the five MAWs during the study period were included (see Fig. 1).

### Variables collected

#### Outcome variables

The outcome variables of this study were 1) patients intended for MAW needing extended diagnostics, and 2) patients being transferred from the MAW to the hospital. The variable 'needing extended diagnostics' was



**Table 1** Characteristics of the five MAWs

	MAW 1	MAW 2	MAW 3	MAW 4	MAW 5
Number of beds	11	8	10	4	7
Travel distance to the hospital by car, minutes	30	15	30	45	45
Physician(s) present Weekdays (08–16)	yes	yes	yes	yes	yes
Physician(s) present Weekends (09–15)	yes	yes	yes	yes	no
Nurse(s) present	24/7	24/7	24/7	24/7	24/7
Travel distance to the casualty by car, minutes	0	0	5	5	15 <sup>a</sup>
Co-located with short-term care	yes	yes	yes	yes	yes
X-ray available	daytime	daytime	daytime	-	mobile X-ray to days per week
Laboratory haemoglobin, WBC differential, CRP, glucose and urine examinations available	daytime	daytime	daytime	daytime	daytime
Blood gas available	at causality	at causality	yes	no	at causality
ECG available	yes	yes	yes	yes	yes
Bladder scanning available	yes	yes	yes	yes	yes

**Abbreviations:** MAW Municipality acute ward, Casualty after-hours emergency services provided by primary care physicians in dedicated locations, as consultation wards (no treatment), WBC differential white blood cell differential, CRP C-reactive protein, ECG Electrocardiogram, Blood gas a group of tests that are performed together to measure the pH and the amounts PaO<sub>2</sub> and PaCO<sub>2</sub> (arterial pressure of oxygen and carbon dioxide), bicarbonate (HCO<sub>3</sub>), lactate, Haemoglobin (Hb), electrolytes, and blood sugar present in a sample of blood, Bladder scanning ultrasonic reflections measures the amount of urine inside the bladder

<sup>a</sup> means that travel time by car to the casualty was 15 min in 2019 and 2020. Travel distance by car in 2014 – 2019 was 0 min

coded yes/no. The variable ‘transferred to hospital’ was coded yes/no and was constructed based on the original variable in the registry ‘where the patient is discharged to’. This means that there is some overlap between the two outcomes, because some of the patients needing extended diagnostics also were transferred from the MAW to hospital.

### Treatment

Each patient can be registered with several medical treatment variables. Treatment variables are ‘Oral medication’, ‘Intravenous fluid therapy’, ‘Intravenous medication’, ‘Mobilisation and pain relief’, ‘Nebuliser therapy’, ‘Oxygen therapy’, ‘Observation’, ‘Emptying regime/constipation’, ‘Bladder catheterisation’, ‘Wound therapy’, ‘Blood transfusion’, ‘Nutritional therapy’, ‘Physical therapy’ (see Additional file 2). The variables were coded yes/no, based on treatment received.

### Diagnosis

The patients’ diagnosis are coded according to the International Classification of Primary Care (ICPC-2) [21]. The variable ‘ICPC-2 main group’ includes 17 alternatives relating to symptoms from different organ systems ‘Respiratory’, ‘Musculoskeletal’, ‘Digestive’, ‘Urological’, ‘Endocrine/metabolic and nutritional’, ‘General and unspecified’, ‘Psychological’, ‘Cardiovascular’, ‘Blood, blood forming organs and immune mechanism’, ‘Neurological’, ‘Skin’, ‘Pregnancy, childbearing, family planning’, ‘Female genital’, ‘Male genital’, ‘Social Problems’, ‘Ear’,

‘Eye’ (see additional file 2). Each patient is registered with one main diagnosis, and other registered diagnoses are included as comorbidities. The variables were coded yes/no.

### Comorbidities

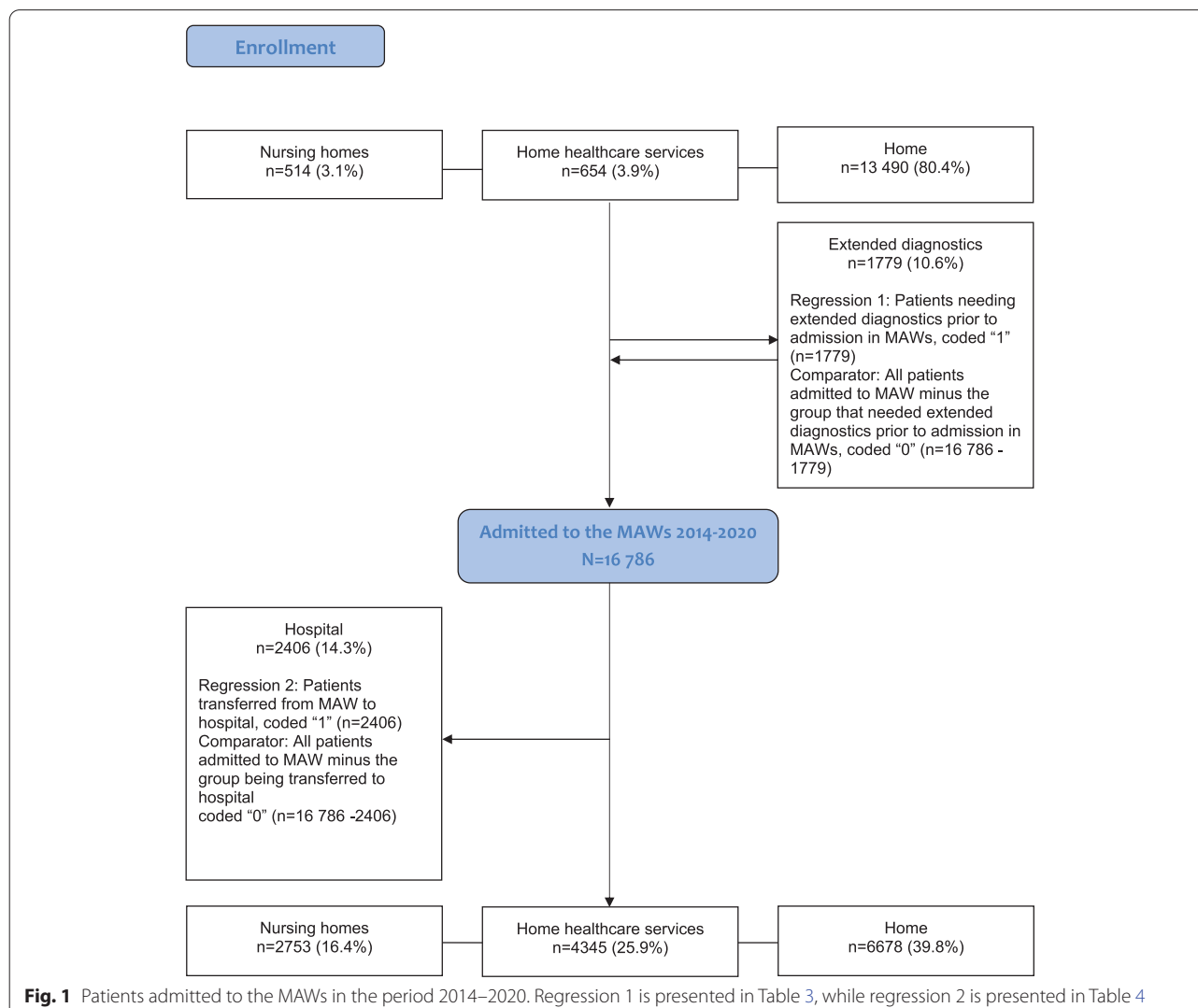
‘Number of registered comorbidities’ was calculated from the registered variables ‘alternative ICPC-2 code 1 at admission’ and ‘alternative ICPC-2 code 2 at admission’. They were selected according to the literature and were assessed by an experienced chief physician and a specialist nurse [10, 22, 23] (see Additional file 1).

### MAW admission and discharge

‘Where the patient is admitted from’ is categorised as ‘from home’, ‘from home healthcare services’, or ‘from nursing home’. ‘Where the patient is discharged to’ is categorised as ‘to home’, ‘to home healthcare services’, ‘to short-term care nursing home’ or ‘to hospital’. ‘Who the referring primary care physician is’ is categorised as ‘general practitioner’, ‘out-of-hour physician’ or ‘nursing home physician’. Admitting time is categorised as ‘day’, ‘evening’ and ‘night’. ‘Length of stay’ was calculated as ‘date of discharge’ minus ‘date of admission’.

### Cleaning methods

Plotting errors were removed and coded as ‘system missing’. Age values outside the range of the MAW admission guidelines were removed and coded as ‘system missing’. In the analyses, we implicitly assumed that the values were



missing at random, with a missing range from 1–913 on individual variables. All the variables were discussed for content both with managers in the MAWs who manually did the plotting, with physicians working in the MAWs, with statisticians at the analysis department at the Hospital Trust, and between the authors.

**Analysis**

Descriptive statistics are presented as numbers and percentages and as medians, means and standard deviations (SDs), as appropriate. To obtain associations between outcome variables and predictors/covariates, we first conducted univariate logistic regressions per outcome variable, i.e., 1) patients needing extended diagnostics prior to MAW admission, and 2) patients being transferred from the MAW to the hospital. Second, we conducted one multiple logistic regression analysis per outcome variable to obtain odds ratios

(ORs) and 95% confidence intervals (CIs). Statistical significance was set at  $p < 0.05$ .

Due to missing values for individual variables, there is a slight variation in the numbers included in the analyses (see Table 2). We were also unable to estimate effects in some of the ICPC-2 main groups and some of the treatment options in the multiple analysis due to insufficient observations (see Tables 3 and 4). Therefore, these variable categories were removed from the logistic regression analysis. The removed treatment variables were ‘wound therapy’, ‘blood transfusion’, ‘nutritional therapy’ and ‘physical therapy’. The ICPC-2 groups removed were ‘blood, blood forming organs and immune mechanism’, ‘pregnancy, childbearing, family planning’, ‘female genital’, ‘male genital’, ‘social problems’, ‘ear’ and ‘eye’. All analyses were performed with IBM Statistical Package for the Social Sciences (SPSS) Statistics version 27 [24].

**Table 2** Descriptive statistics for patients admitted to MAW in the period 2014 to 2020,  $N = 16\,786$ 

	Patients intended for MAW admission, $N = 16\,786$ n (%)	Extended diagnostics, $n = 1\,779$ n (%)	Transfer to hospital, $n = 2\,406$ n (%)
<b>Treatment</b> (missing:913)			
Oral medication	9682 (57.7)	1146 (64.4)	1306 (54.3)
Intravenous fluid therapy	5482 (32.7)	1275 (71.7)	943 (39.2)
Intravenous medication	4658 (27.7)	481 (27.0)	868 (36.2)
Mobilisation and pain relief	3755 (22.4)	482 (27.0)	439 (18.2)
Observation	2949 (17.6)	367 (20.6)	461 (18.7)
Oxygen therapy	1763 (10.5)	196 (11.1)	404 (16.8)
Nebuliser therapy	1904 (11.4)	201 (11.3)	301 (12.5)
Emptying regime/constipation	790 (4.7)	69 (3.9)	98 (4.1)
Bladder catheterisation	477 (2.8)	48 (2.7)	78 (3.2)
Wound therapy	467 (2.8)	50 (2.8)	51 (2.1)
Blood transfusion	433 (2.6)	10 (0.6)	11 (0.5)
Nutritional therapy	355 (2.1)	32 (1.8)	58 (2.4)
Physical therapy	199 (1.1)	31 (1.7)	14 (0.6)
<b>ICPC-2 main groups</b> (missing:873)			
Respiratory	3814 (22.7)	492 (33.4)	595 (24.7)
Musculoskeletal	2633 (15.7)	375 (21.1)	334 (13.9)
Digestive	1619 (9.6)	114 (6.4)	300 (12.5)
Urological	1504 (9.0)	157 (8.8)	253 (10.5)
Endocrine/ metabolic and nutritional	1362 (8.1)	78 (4.4)	177 (7.4)
General and unspecified	1318 (7.8)	111 (6.3)	233 (9.7)
Psychological	978 (5.8)	64 (3.6)	113 (4.7)
Cardiovascular	603 (3.6)	85 (4.8)	114 (4.7)
Blood, blood forming organs and immune mechanism	604 (3.6)	12 (6.7)	31 (1.3)
Neurological	585 (3.5)	75 (4.2)	69 (2.9)
Skin	573 (3.4)	60 (3.4)	86 (3.6)
Pregnancy, childbearing, family planning	163 (1.0)	36 (2.0)	17 (0.7)
Female genital	41 (0.2)	1 (<0.0)	11 (0.5)
Male genital	38 (0.2)	0 (0.0)	8 (0.3)
Social Problems	38 (0.2)	3 (<0.0)	2 (0.1)
Ear	33 (0.2)	2 (<0.0)	1 (<0.0)
Eye	7 (<0.1)	0 (0.0)	2 (0.1)
<b>Comorbidities</b> (missing:0)			
No comorbidities	14,078 (83.9)	1447 (81.3)	2027 (84.2)
One comorbidity	2212 (14.4)	298 (16.8)	338 (14.1)
Two comorbidities	396 (1.8)	34 (8.6)	41 (1.7)
<b>Gender</b> (missing:42)			
Female	10,051 (59.9)	1085 (61.0)	1354 (56.3)
Male	6693 (39.9)	691 (38.8)	1049 (43.6)
<b>Municipal acute Ward</b> (missing:0)			
MAW 1	4630(27.6)	463(26.0)	548(22.8)
MAW 2	2111(12.6)	428(24.0)	296(12.3)
MAW 3	4217(25.1)	392(22.0)	517(21.5)
MAW 4	1823(10.9)	181(10.2)	308(12.8)
MAW 5	4005(23.9)	315(17.7)	737(30.6)
<b>Referred from</b> (missing:432)			
General Practitioner	6900 (41.1)	651 (36.6)	916 (38.1)
Out-of-hour physician	9337 (55.6)	997 (56.0)	1430 (59.4)

**Table 2** (continued)

	Patients intended for MAW admission, N = 16786n (%)		Extended diagnostics, n = 1779 n (%)		Transfer to hospital, n = 2406n (%)	
Nursing home physician	117 (0.7)		4 (0.0)		15 (0.6)	
<b>Admitting time</b> (missing:0)						
Day	5287 (31.5)		739 (41.5)		736 (30.6)	
Evening	8349 (49.7)		454 (25.5)		1222 (50.8)	
Night	3150 (18.8)		586 (32.9)		448 (18.6)	
<b>Admission Weekend/ Weekday</b> (missing:0)						
Weekend	3911 (23.3)		434 (24.4)		601 (25.0)	
Weekday	12,875 (76.7)		1345 (75.6)		1805 (75.0)	
<b>Admitted from</b> (missing:349)						
Home	13,490 (80.4)				2025 (84.2)	
Home healthcare services	654 (3.9)				97 (4.0)	
Nursing homes	514 (3.1)				83 (4.4)	
<b>Discharged to</b> (missing:604)						
Home	6678 (39.8)		693 (39.0)			
Home with home-nursing	4345 (25.9)		562 (31.6)			
Nursing home (short time care)	2657 (15.8)		287(16.1)			
Nursing home (long time care)	96 (0.6)		7 (0.4)			
Hospital	2406 (14.3)		160 (9.0)			
	<b>Total</b>		<b>Extended diagnostics</b>		<b>Hospital</b>	
	Mean/Median	SD/IQR	Mean/Median	SD/IQR	Mean/ Median	SD/IQR
<b>Age</b> (missing:166)	73.5/78	17.8/66–86	75/80	17.2/68–87	72.6/77	17.7/65–86
<b>Length of stay</b> (missing:126)	3.4/3	3.3/1–5	3.8/3	3.3/2–5	2.9/1	2.7/1–3

N Number, MAW Municipal acute Ward, ICPC-2 The International Classification of Primary Care-2; Age in years; Length of stay in days, SD Standard deviation, IQR Interquartile range

## Results

### Descriptives of patients intended as candidate for MAWs by primary care physicians

The left column in Table 2 gives a descriptive summary of characteristics of patients intended as candidate for MAWs by primary care physicians from 2014 to 2020 ( $n = 16\,786$ ). Of these, 60% were female, the median age was 78 years with inter quartile (IQ) range from 66 to 86 years, and the median length of stay was three days with an IQ range from one to five days. The most frequent cause of admission was symptoms in the ICPC-2 main groups 'respiration' and 'musculoskeletal'. Treatments most commonly provided in the MAWs were 'oral medication', followed by 'intravenous fluid therapy', 'intravenous medication', 'mobilisation and pain relief', 'observation', 'nebuliser therapy', and 'oxygen therapy'. A majority of the patients (80.4%) were 'admitted from home'. After a stay at a MAW, 41.7% were 'discharged to home healthcare services' or to 'short-term care nursing home'. More patients were 'admitted from an out-of-hours physician' at the casualty than from 'a general practitioner' (55.6% versus 41.1%).

### Patients needing extended diagnostics prior to admission in MAWs

Table 2 (middle column) shows that 1 779 (10.6%) patients in the sample were assessed as needing extended diagnostics before admittance to a MAW. These patients were 'older', had more 'comorbidities' and had longer 'length of stay' compared to patients not needing extended diagnostics. Patients with diagnosis from ICPC-2 groups 'respiratory' and 'musculoskeletal' were most frequent (totally 38.4% versus 54.5%). Several were 'admitted during night' compared to the whole population (32.9% versus 18.8%). More patients in this group were 'sent to home healthcare services' than the other MAW patients (31.6% versus 25.9%). They also more frequently received treatment with 'oral medication' (64.4% versus 57.7%) than the group in total.

Table 3 shows the results of the logistic regression analysis on the effects of the explanatory variables of patients 'needing extended diagnostics' prior to MAW admission. In the univariate logistic regression analyses, receiving 'oral medications', 'mobilisation and pain relief' or 'observation' conferred a higher odds for needing extended diagnostics. Patients with symptoms in the ICPC-2 main group 'general and unspecified', 'digestive', 'psychological',

**Table 3** Univariate and multiple logistic regressions on patients needing extended diagnostics (total number of patients included in the regression analysis,  $n = 13,987$ )

	Univariate regression OR (95% CI)	Multiple regressions OR (95% CI)
<b>Treatment (reference no treatment on each treatment alternative)</b>		
Oral medication	1.36 (1.23–1.51)*	1.23 (1.09–1.40)*
Intravenous fluid therapy	0.81 (0.72–0.90)*	0.90 (0.73–0.95)*
Intravenous medication	0.97 (0.86–1.08)	1.02 (0.89–1.16)
Mobilization and pain relief	1.32 (1.18–1.47)*	1.05 (0.91–1.20)
Nebulizer therapy	0.99 (0.85–1.16)	0.73 (0.59–0.90)*
Oxygen therapy	1.06 (0.90–1.24)	1.08 (0.88–1.33)
Observation	1.25 (1.10–1.41)*	1.25 (1.08–1.45)*
<b>ICPC-2 main group (reference respiratory)</b>		
General and unspecified	0.63 (0.51–0.78)*	0.61 (0.48–0.77)*
Digestive	0.51 (0.41–0.63)*	0.53 (0.42–0.67)*
Cardiovascular	1.11 (0.87–1.42)	0.98 (0.73–1.30)
Musculoskeletal	1.11 (0.96–1.29)	1.04 (0.87–1.24)
Neurological	0.99 (0.76–1.28)	0.86 (0.64–1.16)
Psychological	0.47 (0.36–0.62)*	0.44 (0.33–0.60)*
Skin	0.79 (0.59–1.05)	0.81 (0.59–1.11)
Endocrine/metabolic and nutritional	0.42 (0.33–0.54)*	0.45 (0.34–0.59)*
Urological	0.79 (0.65–0.95)*	0.67 (0.54–0.83)*
<b>Comorbidities (reference comorbidity = 0)</b>		
One Comorbidity	1.21 (1.06–1.39)*	1.25 (1.08–1.46)*
Two Comorbidities	1.11 (0.78–1.60)	1.24 (0.84–1.85)
<b>Gender (reference female)</b>		
<b>Male</b>	0.95 (0.86–1.05)	1.03 (0.92–1.16)
<b>Age/10</b>	1.06 (1.02–1.09)*	1.09 (1.05–1.13)*
<b>Length of stay (in days)</b>	1.03 (1.02–1.05)*	1.01 (1.00–1.03)
<b>Municipal acute Ward (reference MAW 1)</b>		
MAW 2	2.28*(1.97–2.63)	2.29*(1.92–2.72)
MAW 3	0.92 (0.79–1.05)	1.00 (0.84–1.19)
MAW 4	1.11 (0.92–1.33)	1.24 (1.00–1.54)*
MAW 5	0.76 (0.66–0.89)*	0.94 (0.78–1.12)
<b>Referred from (reference general practitioner)</b>		
Out-of-hour physician	1.15 (1.03–1.27)*	0.44 (0.38–0.51)*
Nursing home physician	0.36 (0.13–0.99)*	0.41 (0.09–1.79)
<b>Admitting time (reference day)</b>		
Evening	0.36 (0.32–0.40)*	0.25 (0.21–0.29)*
Night	1.42 (1.26–1.60)*	1.83 (1.59–2.10)*
<b>Admission Weekend/Weekday (reference weekend)</b>		
Weekday	0.94 (0.84–1.05)	0.80 (0.69–0.93)*
<b>Discharged to (reference home)</b>		
Home healthcare services	1.28 (1.14–1.44)*	1.09 (0.94–1.26)
Hospital	0.62 (0.52–0.74)*	0.60 (0.49–0.73)*
Nursing home (short time care)	1.06 (0.91–1.22)	0.86 (0.72–1.03)
Nursing home (long time care)	0.70 (0.33–1.53)	1.28 (0.56–2.91)

Regressions were logistic

OR Odds ratio, CI Confidence interval, MAW Municipal acute ward, ICPC-2 The International Classification of Primary Care-2, N Number in multiple analysis

\*  $p$ -value significant at level 0.05

'endocrine/metabolic/ nutritional' and 'urological' had lower odds for needing extended diagnostics compared to the ICPC-2 main group 'respiratory'. MAWs with the shortest 'travel distance to the hospital', patients 'admitted from the casualty' and 'admittance at night' were positively associated with 'needing extended diagnostics'. 'Needing extended diagnostics' was positively associated with 'discharge to home healthcare services'.

In the multiple regression model, 'receiving oral medications' and 'observation' were still associated with a higher likelihood of needing extended diagnostics prior to MAW admission. The ICPC-2 main group 'general and unspecified', 'digestive', 'psychological', 'endocrine/metabolic/nutritional' and 'urological' had in the multiple model lower odds for needing extended diagnostics compared to ICPC-2 main group 'respiratory'. Further, the MAW with the shortest 'travel distance to the hospital' and 'patients admitted at night' had the highest odds of being needing extended diagnostics prior to MAW admission.

#### Patients being transferred to hospital

Table 2 (right column) shows that 2 406 (14.3%) patients were 'transferred to hospital' from the MAWs. The median 'length of stay' was one day, and there were more 'men' (43.6% versus 39.9%) compared to the MAW group in total. More patients in this group were 'referred from an out-of-hours physician' (59.4% versus 55.6%). The most frequent diagnosis was from ICPC-2 main group 'respiratory'. Patients from the ICPC-2 groups 'digestive' og 'urological' were more often transferred to hospital compared to other MAW patients. Furthermore, more patients received treatment with 'intravenous medications' (36.2% versus 27.7%), as well as 'oxygen therapy' (16.8% versus 10.5%).

Table 4 shows the results of the logistic regression analysis on the effects of the explanatory variables on the likelihood that the patient was transferred to hospital. The univariate-variable model showed that receiving 'intravenous fluid therapy', 'intravenous medications', or 'oxygen therapy' were highly associated with transfer to hospital, as were symptoms in the ICPC-2 main groups 'digestive' and 'cardiovascular, as compared to 'respiratory'. The longest travel distance from the MAW to the hospital, 'referred from out-of-hour physician' from the casualty and 'male' gender were also positively associated with transfer to hospital. Patient 'being admitted to MAW after extended diagnostics' had lower odds for being 'transferred to hospital'.

In the multiple regression model, the variables describing advanced medical treatment (i.e., 'intravenous fluid therapy', 'intravenous medications', and 'oxygen therapy') had higher odds of transfer to hospital. Further,

patients treated in the MAW with the longest travel distance had the highest odds of being transferred to hospital. The regression model showed still higher odds for transfer to hospital if the patient was 'male'. Patient 'send for extended diagnostics' had still lower odds for being 'transferred from MAW to hospital'.

#### Discussion

The aim of this prospective observational study was to assess whether the MAW represents the alternative to hospitalisation as intended by policymakers. Our results show that patients intended as candidates for MAWs by primary care physicians received basic medical treatment such as oral medication. Many patients also needed extended diagnostics in hospital before being admitted to a MAW. Patients who were transferred to hospital during the stay at a MAW were in need of advanced medical treatment, such as intravenous fluid therapy, intravenous medication and oxygen therapy.

Our findings show that patients treated at MAWs mostly receive basic rather than specialised medical treatment. Thus, the MAW appears to represent an intermediate unit rather than an alternative to the hospital. This is supported by studies claiming that the MAW represents an additional health service to already existing services [12, 14, 19]. Originally, the intention of the MAW was to establish an alternative to hospitalisation, particularly suitable for patients with a clarified condition or an acute deterioration of an already known condition. [7, 8]. Implementation of the MAWs has contributed to a reduction in acute medical admissions and has led to a 1.9% reduction in hospitalisations for patients aged over 80 years [18, 25, 26], which could indicate that the MAWs do replace hospitalisations. However, our findings show that the medical treatment provided at the MAW is rather basic and hence could alternatively have been managed at home with the help of home healthcare services. This indicates that the home healthcare services capacity or competence might be too low. Hence, capacity building in home healthcare services might further reduce the pressure on hospitals. Our findings do not necessarily indicate that there has been an improper or wrong use of MAWs; rather, the MAW fills a healthcare service gap in the interface between hospitals and homes.

Moreover, our results show that patients admitted to the smallest MAW who also had the longest travel distance by car to the hospital were most likely to be transferred to hospital. In contrast, patients admitted to one of the biggest MAWs with shorter travel distance by care to hospital had lower odds for being transferred to the hospital. This may indicate that the healthcare personnel are more uncomfortable managing the risks of treating acutely ill patients when they are farther from the

**Table 4** Univariate and multiple logistic regressions on patients transferred from MAW to hospital during the stay at MAW (total number patients included in the regression analysis,  $n = 14\ 202$ )

	Univariate regressions OR (95% CI)	Multiple regression OR (95% CI)
<b>Treatment (reference no treatment)</b>		
Oral medication	0.85 (0.78–0.93)*	0.86 (0.77–0.95)*
Intravenous fluid therapy	1.40 (1.28–1.53)*	1.32 (1.19–1.47)*
Intravenous medication	1.58 (1.44–1.73)*	1.60 (1.45–1.81)*
Mobilization and pain relief	0.75 (0.67–0.83)*	0.95 (0.65–1.08)
Nebulizer therapy	1.14 (1.00–1.30)	0.78 (0.65–0.93)*
Oxygen therapy	1.93 (1.71–2.18)*	2.13 (1.81–2.51)*
Observation	1.13 (1.02–1.27)*	1.29 (1.13–1.48)*
Emptying regime/constipation	0.84 (0.68–1.04)	0.88 (0.69–1.13)
Bladder catheterization	1.17 (0.92–1.50)	1.11 (0.84–1.46)
Wound therapy	0.73 (0.54–0.98)*	0.82 (0.60–1.14)
Nutritional therapy	1.27 (0.88–1.56)	1.55 (1.14–2.12)*
<b>ICPC2 main group (reference respiratory)</b>		
General and unspecified	1.16 (0.98–1.37)	1.07 (0.89–1.29)
Digestive	1.23 (1.06–1.43)*	1.13 (0.94–1.35)
Cardiovascular	1.26 (1.01–1.57)*	1.31 (1.02–1.68)*
Musculoskeletal	0.79 (0.68–0.91)*	1.04 (0.87–1.24)
Neurological	0.72 (0.55–0.94)*	0.69 (0.52–0.92)*
Psychological	0.71 (0.57–0.88)*	0.67 (0.52–0.86)*
Skin	0.96 (0.75–1.22)	1.12 (0.86–1.47)
Endocrine/metabolic/nutritional	0.81 (0.68–0.97)*	0.75 (0.61–0.92)
Urological	1.09 (0.93–1.29)	1.18 (0.99–1.42)
<b>Comorbidities (reference comorbidities = 0)</b>		
One comorbidity	0.97 (0.86–1.10)	1.06 (0.93–1.22)
Two comorbidities	0.96 (0.69–1.33)	1.05 (0.73–1.51)
<b>Gender (reference female)</b>		
Male	1.19 (1.09–1.30)*	1.16 (1.05–1.27)*
<b>Age/10</b>	0.97 (0.96–0.99)*	1.05 (1.02–1.08)*
<b>Municipal acute Ward (reference MAW 1)</b>		
MAW 2	1.22 (1.04–1.41)*	0.92 (0.77–1.10)
MAW 3	1.04 (0.92–1.18)	0.83 (0.72–0.96)*
MAW 4	1.51 (1.30–1.76)*	1.46 (1.22–1.74)*
MAW 5	1.68 (1.49–1.89)*	1.04 (0.91–1.20)
<b>Referred from (reference general practitioner)</b>		
Out-of-hour physician	1.18 (1.08–1.29)*	1.06 (0.93–1.21)
Nursing home physician	0.96 (0.56–1.66)	1.13 (0.51–2.50)
<b>Admitting time (reference day)</b>		
Evening	1.06 (0.96–1.17)	1.03 (0.91–1.17)
Night	1.02 (0.90–1.16)	0.85 (0.74–0.98)*
<b>Admission Weekend/Weekday (reference weekend)</b>		
Weekday	0.90 (0.81–0.99)*	1.01 (0.89–1.14)
<b>Admitted from (reference home)</b>		
Home healthcare services	0.99 (0.80–1.23)	1.11 (0.87–1.43)
Extended diagnostic	0.56 (0.47–0.66)*	0.63 (0.52–0.76)*
Nursing homes	1.09 (0.86–1.39)	0.86 (0.64–1.15)

Regressions were logistic

OR Odds ratio, CI Confidence interval, MAW Municipal acute ward, ICPC-2 The International Classification of Primary Care-2, N Number in multiple analysis

\*  $p$ -value significant at level 0.05

hospital [27]. In addition, our findings may indicate that the size of the MAW has an impact on how severe conditions the personnel can handle. A national study shows that MAWs located inside nursing homes had significantly more shifts with only one Registered Nurse (RN) on duty compared to MAWs located separately from other health care services [28]. Studies also indicate that there is a wide variation in whether patients are transferred to hospital from the MAW for further medical treatment, ranging from 7.8% to 23.6% [10, 18].

The extended diagnostics in hospital was used for one out of ten patients. The extended diagnostics service has become a better-known opportunity for clinicians to ensure that patients admitted to the MAW receive the right diagnosis; that is, the use of X-rays, laboratory tests and specialist assessment by hospital physicians are assumed to give the patients a more clarified diagnosis [7, 12]. However, most patients in MAWs are old, with a high degree of frailty [12, 19]. The risks of transporting frail elderly individuals are diverse, and their transport is associated with a significantly increased risk of morbidity and mortality [29–31]. Therefore, the decision to transport patients to hospital for extended diagnostics before admittance to MAW should be based on a weighing of the necessity of being diagnosed in hospital against the potential risk involved. A frailty index could help to identify older people at risk of health decline and mortality, guiding clinicians in their decision-making [32].

There has been a scepticism about the lack of physician coverage at MAWs throughout the day [12, 33]. It may be argued that for the MAW to be an acceptable alternative to hospitals, their equipment and expertise must be similar to those of hospitals. However, there are several studies that indicate that there is no threat to patient safety to be treated in nurse-led units [34, 35], and two single-centre randomised controlled studies found reduced morbidity after treatment in this kind of decentralised healthcare service [36, 37]. In a prospective observational study, it was shown that a ‘triage early warning score (TEWS)’ above 2 indicates that patients have critical symptoms, need advanced treatment, and are more likely to be transferred to hospital from a MAW [10]. Hence, implementing the use of the TEWS score at diagnosis may guide clinicians in deciding which patients are suitable for admission to a MAW and which patients should be admitted to hospital.

The success of MAWs in Norway is that the patients themselves want to go there, but there are concerns regarding patient safety from the view of PCPs [12, 38, 39]. The selection of patients suitable for admittance to such healthcare services as the MAW is still considered a challenge [12, 40]. Studies indicate the potential to use machine algorithms to ensure that the right patients are

directed to the right service level [40]. In addition, telemedicine has been suggested as well suited to guide medical decisions in more rural areas [41]. Our findings indicate that such solutions could be beneficial to help physicians refer patients to the right healthcare service and level.

### Strengths and limitations

One strength of this study is that it is based on a large and complete dataset covering five MAWs over a seven-year period, which allowed more reliable estimates than previous studies in the field. The five MAWs differed in size, geographical location, staffing and diagnostic opportunities and were also similar to community-based units internationally. This strengthens the external validity and generalisability of our findings.

The analyses presented here are explorative, and the significant findings should ideally be replicated in further studies. A limitation in this study is that we did not have data on patients needing extended diagnostics as assessed by PCPs who were hospitalised, but only on patients that hospital physicians agreed were suitable for treatment in a MAW and consequently were admitted as intended. This may bias the findings. This group can be healthier than those who were hospitalised. Hence, factors such as distance to hospital, from whom the patients are sent, when they are sent etc. may disturb the results by the fact that we only had the healthiest patients. Moreover, the ICPC-2 diagnostic system is designed for primary care, and the MAWs accept patients who otherwise would have been hospitalised. To encode diagnoses and symptoms in hospital patients, the standard is to use International Classification of Diseases ICD-10 coding system. Thus, the use of ICPC-2 codes might have underestimated the actual diagnoses that were given at the MAWs.

### Conclusion

Our findings show that there is no such as “the typical MAW patient” or a standardised MAW. Primary care physicians still seem to need the extended diagnostic opportunities in hospital. Moreover, patients transferred to hospital during the stay at MAW are in need of more advanced medical treatment, such as intravenous medication and oxygen therapy. This indicates that the MAW represent an intermediate healthcare level between primary and specialist healthcare. These findings emphasise the necessity of a governmental assessment of structure, equipment and range of services at the MAWs. This also includes a discussion about MAWs’ role in the healthcare system, what the MAWs should do, what kind of patients that can be treated at a MAW and what kind of competence and diagnostics are needed.



### Implications for further research

Large randomised controlled trials (RCTs) could provide more definitive evidence of the effectiveness and clinical outcomes of sending patients to a decentralised alternative to hospitals such as a MAW. We have conducted a multicentre RCT in these five MAWs to compare the effectiveness and clinical outcomes of MAWs versus hospitals, and analyses are ongoing.

### Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12913-022-08066-3>.

**Additional file 1.**

**Additional file 2.**

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### Authors' contributions

VN performed data cleaning, analysis and interpretation of the data. VN wrote the first draft of the full manuscript, and all of the co-authors (ACLL, HL and TAM) participated in the drafting and critical revision of the manuscript for important intellectual content, as well as approving of the final submitted version of the manuscript. All authors (VN, ACLL, HL and TAM) contributed to the conception and planning of the work that led to the analysis and interpretation of data, as well as the manuscript. All authors have read and approved the final version of the manuscript.

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VN received funding as a PhD candidate from Stiftelsen Damm. The funding body did not participate in the design of the study, data collection, analysis or interpretation of data, or writing of the manuscript.

### Availability of data and materials

Datasets generated and/or analysed during the current study are not publicly available due to local ownership of data, but aggregated data are available from the corresponding author on reasonable request.

### Declarations

#### Ethics approval and consent to participate

The study was approved by the Regional Committees for Medical and Health Research Ethics (REC) (reference number 2019/118) and the Norwegian Centre for Research Data (NSD) (reference number 931735). Approval was provided by managers at each of the MAWs (data owners). According to national guidelines, informed consent was waived due to the anonymity of the data.

#### Competing interests

All authors declare that they have no conflicts of interest in relation to the submitted work.

#### Consent for publication

Not applicable.

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## Appendix 1

The variable comorbidity is obtained from variable "co-diagnosis 1" and co-diagnosis 2" in the registry. Observation with following ICPC2 codes are incorporated into the variable comorbidity.

A-General and, unspecified	A28, A79
B-Blood, blood forming organs and immune mechanism	B72, B73, B74,B81,B82,B99
D- Digestive	D74,D75,D76,D77,D80,D84,D92,D94,D97
K- Cardiovascular	K72,K74, K75, K76 ,K77 ,K78 ,K79 ,K80, K83 ,K85 ,K86, K87,K88,K90,K91,K92,K93;K99
L-Musculoskeletal	L71
N-Neurological	N07,N08,N18,N19,N28,N29,N70,N74,N80, N81,N85,N86,N87,N88
P-Psychological	P05,P15,P16,P18,P19,P20,P70,P71,P72,P73 P74,P75,P76,P77,P78,P80,P82,P85,P86,P98
R-Respiratory	R79,R84,R85,R86,R92,R96
T-Endocrine/metabolic and nutritional	T05,T08,T73,T83,T86,T87,T89,T90,T91, T99,
U-Urological	U14,U75,U76,U77
X-Female genital	X75,X76,X77
Y-Male genital	Y77

Appendix 2

<b>Table 2 Explanation of variable development: treatment</b>			
<b>Variables</b>	<b>Valuenames</b>	<b>Capture</b>	<b>Coding</b>
<b>Treatment</b>	Oral medication, Intravenous fluid therapy, Intravenous medication Mobilization and pain relief, Nebulizer therapy, Others, Oxygen therapy, Observation, Emptying regime/constipation, Bladder catheterization, Wound therapy Blood transfusion, Nutritional therapy, Physical therapy	From register. Developed to variables by merging treatment opinions	Each value is coded «1» for yes, «0» for otherwise





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