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1. Comparison of home, clinic, and catheterization oxygen saturations during the interstage period

Authors Buysse J.; Li Y.; Penk J.; Wong J.
Source Progress in Pediatric Cardiology; Jun 2021; vol. 61
Publication Date Jun 2021
Publication Type(s) Article
Database EMBASE
Available at Progress in Pediatric Cardiology from ScienceDirect Available to PHE and Local Authority staff

Abstract Background: Home monitoring decreases mortality during the interstage period in patients with hypoplastic left heart syndrome. Oxygen saturations are used in medical decision making including hospitalization and timing of 2nd stage palliation. We examined if home, clinic, and catheterization saturations could be used interchangeably in making these decisions.
Method(s): Single center retrospective study of interstage patients from 2014 to 2018. Saturation data was compared between mean home and clinic saturations, catheterization pre-anesthesia saturation, and intra-catheterization saturations. Invasive saturations were obtained via co-oximetry. All other saturations were obtained via pulse oximetry. Home saturations were averaged over seven days centered around clinic dates or before catheterization date for comparison. Invasive saturations from the descending aorta were also compared to same day pre-anesthesia and intra-catheterization saturations.
Result(s): 209 clinic saturations and a median of 11 home saturations per clinic visit were collected. Home saturations were 2% lower than clinic saturations ($p < 0.001$). Home and clinic saturations correlated ($r = 0.34$, $p < 0.001$). Mean home saturations were 4% higher than catheterization saturations from the descending aorta ($p = 0.005$) and did not correlate well. Same day pre-anesthesia saturations were 5% higher than catheterization saturations ($p = 0.001$) and were similar to the mean home saturations. Neither home saturations, clinic saturations, nor saturation trends were associated with adverse outcomes.
Conclusion(s): Mean home saturations are lower than clinic saturations during the interstage period, but are within 2% and are correlative. Invasive catheterization saturations were significantly lower than home, clinic, and same day pre-anesthesia saturations.

2. Novel Use of Home Pulse Oximetry Monitoring in COVID-19 Patients Discharged From the Emergency Department Identifies Need for Hospitalization

Authors Shah S.; Gupta N.; Suppes S.; Karamanis M.; Capannari J.; Patte C.; Majmudar K.; Stein A.; Sethi S.
Source Academic Emergency Medicine; Aug 2020; vol. 27 (no. 8); p. 681-692
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PubMedID 32779828
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Available at Academic emergency medicine : official journal of the Society for Academic Emergency Medicine from Ovid (Journals @ Ovid)
Available at Academic emergency medicine : official journal of the Society for Academic Emergency Medicine from Unpaywall

Abstract Objectives: Our objective was to evaluate patient-reported oxygen saturation (SpO_2) using pulse oximetry as a home monitoring tool for patients with initially nonsevere COVID-19 to identify need for hospitalization.
Method(s): Patients were enrolled at the emergency department (ED) and outpatient testing centers. Each patient was given a home pulse oximeter and instructed to record their SpO_2 every 8 hours. Patients were instructed to return to the ED for sustained home SpO_2< 92% or if they felt they needed emergent medical attention. Relative risk was used to assess the relation between hospitalization and home SpO_2< 92% in COVID-19-positive patients.
Result(s): We enrolled 209 patients with suspected COVID-19, of whom 77 patients tested positive for COVID-19 and were included. Subsequent hospitalization occurred in 22 of 77 (29%) patients. Resting home SpO_2< 92% was associated with an increased likelihood of hospitalization compared to SpO_2>= 92% (relative risk = 7.0, 95% confidence interval = 3.4 to 14.5, p < 0.0001). Home SpO_2< 92% was also associated with increased risk of intensive care unit admission, acute respiratory distress syndrome, and septic shock. In our cohort, 50% of patients who ended up hospitalized only returned to the ED for incidental finding of low home SpO_2 without worsening of symptoms. One-third (33%) of nonhospitalized patients stated that they would have returned to the ED if they did not have a pulse oximeter to reassure them at home.
Conclusion(s): This study found that home pulse oximetry monitoring identifies need for hospitalization in initially nonsevere COVID-19 patients when a cutoff of SpO_2 92% is used. Half of patients who ended up hospitalized had SpO_2< 92% without worsening symptoms. Home SpO_2 monitoring also reduces unnecessary ED revisits.

3. Use of remote patient monitoring in the care of COVID-positive patients in oncology

Authors Pugliese L.; Garcia J.; Holland J.C.; Majeed J.; Silverman M.; Moy M.; Kemeny E.; Reidy D.L.; Robson M.E.; Connor M.A.; Stetson P.D.; Polubriaginof F.C.G.
Source Journal of Clinical Oncology; 2021; vol. 39 (no. 15)
Publication Date 2021
Publication Type(s) Conference Abstract
Database EMBASE
Available at Journal of Clinical Oncology from Ovid (Journals @ Ovid)

Abstract Background: Cancer patients face an increased risk of developing acute complications from COVID-19. Remote monitoring can help with the critical need for early detection of symptoms among those diagnosed with COVID-19, enabling timely symptom management that can mitigate clinical deterioration. In response to this need, Memorial Sloan Kettering Cancer Center fast-tracked a program to monitor patients with COVID-19 from home, using an electronic symptom-tracking questionnaire and digital pulse oximeter to track patients' status and alert care teams to intervene if symptoms worsened. A multi-disciplinary group composed of Oncology providers, advanced practice providers, nursing, nursing informatics and biomedical informatics formed to manage the program.
Method(s): Memorial Sloan Kettering launched a remote monitoring program for patients diagnosed with COVID-19 on March 25, 2020. All patients testing positive for COVID-19 were enrolled in the program and asked to complete a daily symptom tracking questionnaire accessed through their patient portal or administered verbally over the phone. A subset of high risk patients were also provided with a digital pulse oximeter linked to their patient portal and capable of transmitting readings directly to the care team. Clinicians received alerts for patients reporting symptoms or an oxygen saturation below 92%. Alerts resulted in an immediate response from the care team to determine if the patient needed additional care. We retrospectively evaluated the program usage, outcomes and learnings from March 25, 2020 to December 22, 2020.
Result(s): In total, 1,721 patients were enrolled in the program from March 25, 2020 to December 22, 2020. Among these, 210 were deemed high risk patients who received a pulse oximeter in addition the daily symptom questionnaire. Over this period, 27% of patients triggered an alert from an electronic symptom questionnaire, and 63% of patients with a pulse oximeter triggered an alert from their device. Among patients who triggered an alert of any kind, 3% were triaged to a higher level of care. Patients reported that the program was highly valued and alleviated anxiety about their care. Iterative improvements were made to the program over time in response to the evolving knowledge about care for patients with COVID-19.
Conclusion(s): Memorial Sloan Kettering was able to quickly implement a program to detect and triage symptoms among patients with COVID-19 and cancer. Refinements were made over time to many aspects of the program in response to learnings about care related to COVID-19, including to clinical eligibility, alert criteria, monitoring duration and workflows. The program also demonstrated value for patients who felt more comfortable with their care while being monitored remotely. This program established a successful model for remote monitoring of patients with COVID-19 with the potential to be scaled to other institutions or clinical areas.

4. Reply: Portable, consumer-grade pulse oximeters are accurate for home and medical use: Implications for their use in patients with COVID-19

Authors Luks A.M.; Swenson E.R.

Source Annals of the American Thoracic Society; Jul 2021; vol. 18 (no. 7); p. 1261
Publication Date Jul 2021
Publication Type(s) Letter
PubMedID 33617754
Database EMBASE
Available at Annals of the American Thoracic Society from Ovid (Journals @ Ovid)
Available at Annals of the American Thoracic Society from Unpaywall

5. Triage into the community for COVID-19 (TICC-19) patients pathway - Service evaluation of the virtual monitoring of patients with COVID pneumonia

Authors Nunan J.; Walden A.P.; Clarke D.; Calthrop A.; Malakouti A.; Tannetta D.; Khalil R.; Xu X.H.; Chan N.B.; Li W.
Source Acute Medicine; 2020; vol. 19 (no. 4); p. 183-191
Publication Date 2020
Publication Type(s) Article
PubMedID 33215171
Database EMBASE
Available at Acute medicine from Unpaywall
Abstract Introduction: COVID-19 pneumonia presented a unique problem for healthcare systems with the potential to overwhelm hospitals and lead to unnecessary morbidity and mortality. Safe triage and follow up systems are required to manage this unprecedented demand.
Method(s): We designed a pathway for the triage and assessment of patients based on their resting oxygen saturations and response to a 30 metre rapid walking test. We admitted patients to a 'Virtual Ward' for remote oximetry monitoring from the Emergency Department, step down from inpatient wards and from the local Primary Care 'Hot Hub'. This allowed the safe and managed readmission of those patients who deteriorated at home.
Result(s): During the first wave of COVID-19 we entered 273 onto the pathway for Virtual Ward follow up. Of these, 31 patients were readmitted to hospital, two were admitted to Intensive Care and one patient died. Median oxygen saturation at presentation was 97 % (IQR 96-98%) and following a 30 metre walk test 96% (IQR 94-97%). Median NEWS-2 score was 2 (IQR 1-3). On feedback 99.5% of patients were likely or extremely likely to recommend the service to their family and friends. There was a cost avoidance of 107,600 per month.
Conclusion(s): It is safe, feasible and cost effective to set up a triage system with remote oximetry monitoring for patients with COVID-19 and overwhelmingly patients find it a positive experience.

6. COVID-19-The impact of variable and "low normal" pulse oximetry scores on Oximetry@Home services and clinical pathways: Confounding variables?

Authors Harland N.; Greaves J.; Fuller E.
Source Nursing open; Jun 2021
Publication Date Jun 2021
Publication Type(s) Article
PubMedID 34161659
Database EMBASE
Available at Nursing open from Europe PubMed Central - Open Access
Available at Nursing open from Unpaywall
Abstract COVID-19 Oximetry@Home services have been commissioned nationally. This allows higher-risk patients with mild COVID-19 symptoms to remain at home, being supplied with a Pulse Oximeter to measure their oxygen saturation (SpO2) two to three times daily for two weeks. Patients record their readings manually or electronically which are monitored by a clinical team. Clinical decisions, using an algorithm, are based on SpO2 readings in a narrow range with 1-2 point changes potentially affecting care. In this article, we discussed the problem that multiple factors affect SpO2 readings, and that some "normal" individuals will have "low-normal" scores at the threshold of clinical management, without any known respiratory problem. We discuss the potential magnitude of this problem based on the associated literature and consider how this will have an impact on the use of the Oximetry@home services, potentially partially confounding their purpose; to reduce face-to-face medical care.

7. PIN21 The Cost-Utility of Remote Pulse-Oximeter Monitoring of COVID19 Patients

Authors Crawford S.; Kelley M.; Padula W.; Choy B.; Miano M.A.; Grosso R.; Pronovost P.J.
Source Value in Health; Jun 2021; vol. 24
Publication Date Jun 2021
Publication Type(s) Conference Abstract
Database EMBASE
Available at Value in Health from ScienceDirect Available to PHE and Local Authority staff

Available at Value in Health from Unpaywall

Abstract Objectives: As of December 2020, COVID19 has infected over 13 million Americans and killed over 275,000. Each infection surge leads to increased emergency department (ED) utilization and subsequent critical care admission for patients with acute respiratory distress syndrome (ARDS). Not all COVID19 patients necessitate a ventilator and therefore can remain at home to minimize infection spread and manage hospital capacity concerns. Remote Bluetooth-enabled pulse-oximeter monitoring of moderate-to-severely ill COVID19 patients can be used to closely monitor symptoms and trigger necessary visits to the hospital. Our objective was to analyze remote pulse-oximeter monitoring cost-effectiveness to reduce facility burden and health expenditures.
Method(s): We analyzed home-monitoring with pulse-oximetry cost-utility using a Markov model over a 3-week time horizon in daily cycles from a US health sector perspective. Cost and outcome measures were derived from real-world evidence from University Hospitals. Pulse-oximetry monitoring was implemented for patients presenting at the ED with ARDS-like symptoms but not necessitating immediate care; patients were then remotely monitored by experts for up to 4-days until recovery or a second ED visit. Additional parameters were extracted from literature. Costs (2020 U.S. dollars) and quality-adjusted life years (QALYs) were used to determine the incremental cost-effectiveness ratio (ICER) at a $100,000/QALY cost-effectiveness threshold. Model uncertainty was assessed using one-way and probabilistic sensitivity analysis.
Result(s): Results demonstrated that pulse-oximetry monitoring dominated current standard care for COVID19 patients based on reduced costs and increased QALYs. Individuals with access to remote pulse-oximetry monitoring averaged $49,176 and 0.03 QALYs, whereas standard care increased costs to $113,792 and 0.02 QALYs. Resulting ICER was not sensitive to uncertainty ranges.
Conclusion(s): Remote pulse-oximetry monitoring of symptomatic COVID19 patients increases the specificity of those requiring immediate follow-up. We recommend adoption of this technology across health systems to cost-effectively manage COVID19 volume surges, maintain patients' comfort, reduce infection spread, and simultaneously monitor multiple patients.

8. Implementation of a home monitoring system for COPD patients during the SARS-CoV-2 pandemic: A feasibility study

Authors Rydberg M.G.; McDaniel-Harper A.; Hardy K.; Burkett P.; Johnson E.; Drummond M.B.
Source American Journal of Respiratory and Critical Care Medicine; May 2021; vol. 203 (no. 9)
Publication Date May 2021
Publication Type(s) Conference Abstract
Database EMBASE
Available at American Journal of Respiratory and Critical Care Medicine from Ovid (Journals @ Ovid)
Available at American Journal of Respiratory and Critical Care Medicine from Unpaywall

Abstract RATIONALE: Remote monitoring of COPD patients has the potential to improve clinical outcomes. The ability to successfully deploy home monitoring technologies to COPD patients remotely without in-person encounters is of particular interest during the SARS-CoV-2 pandemic. We present interim results from a prospective implementation study of a home monitoring system in COPD patients at-risk for frequent acute exacerbations of COPD (AECOPD).
METHOD(S): We recruited non-hospitalized individuals aged 40-80 years with spirometryconfirmed COPD and increased AECOPD risk (one hospitalization or two outpatient AECOPD in the prior year). The home system includes: a GoHomeTM Data Collection Platform and GoSpiro spirometer (Monitored Therapeutics, Dublin, OH), and a 3230 pulse oximeter (Nonin Medical, Plymouth, MN). The tablet-based GoHomeTM has an auto-start system requiring no computer skills for operation. Eligible participants were contacted via phone, and if interested, were sent a participation kit containing informed consent and the home system. After remotely collecting ICF, participants completed device setup and baseline spirometry using Avatar coaching. At set times, the device collects responses for an automated COPD Action Plan and displays reminders for the patient to use the integrated Bluetooth spirometer and pulse oximeter. The GoSpiro measures slow vital capacity (SVC) and forced vital capacity (FVC) using an Avatar-assisted technology coach on the GoHomeTM (Figure). The Avatar coaches the patient through each measurement following ATS recommendations for instructions and coaching, followed by error identification and maneuver error correction without human intervention. Patients are engaged daily with the COPD Action Plan. Automated scores return immediate patient guidance along with appropriate clinician alerts. Results are cellular or Wi-Fi uploaded to a cloud server for realtime investigator review. Following demonstrated proficiency, daily measurements of spirometry (FVC Tuesday/Thursday, SVC all other days), daily pulse oximetry and COPD Action Plan were performed. Participant study duration was three months.
RESULT(S): To date, seven of 12 planned participants have been enrolled. All enrolled participants have successfully activated all device components and performed FVC maneuvers meeting ATS acceptability standards. All participants were able to complete collection and transmission of daily pulse oximetry and COPD Action Plan data. One participant requested study withdrawal after three weeks and six participants remain on study.
CONCLUSION(S): Deployment of a COPD home telemonitoring system platform including daily spirometry, pulse oximetry and electronic questionnaire without in-person contact is feasible. This technology may be useful in settings where in-person visits are not feasible due to patient safety, remote location or access-related issues. .

9. A virtual care model utilizing patient directed oximetry monitoring for outpatients with COVID-19: A quality improvement study

Authors Devlin M.; Nicholson M.; Ernst J.; Mrkobrada M.; Spicer E.; Dhaliwal I.
Source American Journal of Respiratory and Critical Care Medicine; May 2021; vol. 203 (no. 9)
Publication Date May 2021
Publication Type(s) Conference Abstract
Database EMBASE
Available at American Journal of Respiratory and Critical Care Medicine from Ovid (Journals @ Ovid)
Available at American Journal of Respiratory and Critical Care Medicine from Unpaywall
Abstract Background: There is a care gap for outpatients with COVID-19, with many lacking access to standardized medical care. We combined virtual clinical assessment with patient-directed oximetry to enhance clinical care of these patients. The aim of this study was to assess the role of oximetry and clinical outcomes of those enrolled in this novel clinical initiative.
Method(s): A team of General Internal Medicine, Infectious Diseases, and Respirology physicians in London, Ontario, partnered with the local public health unit (Middlesex London Health Unit) to enroll outpatients diagnosed with COVID-19. We assessed patients virtually and arranged for the same day delivery of an oximetry device to the patient's home in order to assess for hypoxemia. In this quality improvement study, we present our initial experience with the use of oximeters in virtual care and 30-day patient outcomes utilizing this novel clinical model.
Result(s): Between April 23-May 19th, 2020, we assessed and monitored 51 patients in the community with COVID-19. Of these, 47% had an oximeter delivered to their residence. A majority of patients (91%) who experienced severe dyspnea had normal oxygen saturations. Our clinical intervention resulted in 3 direct admissions to a designated COVID-19 unit at a local hospital for decompensating patients. No deaths were noted. We have characterized a number of significant outcomes that warrant further medical and allied health follow up.
Interpretation(s): We present a clinical model that supports the care and symptomatic management of patients in the community with COVID-19. Oximetry was found to primarily exclude the presence of hypoxemia in dyspneic patients, while identifying few patients with true hypoxemia. .

10. Patient-reported symptom severity and pulse oximetry in the COVID-19 remote monitoring programme in ireland

Authors Edwards C.; Costello E.; Curley M.; Smyth L.; O'Seaghdha C.; Costello R.W.; O'Reilly K.M.

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Publication Date May 2021
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Abstract Rationale: A total of 60,287 (1,267/100,000) cases of Covid-19 (SARS-CoV-2) were recorded in Ireland by 30 October 2020. An important strategy to free up in-hospital capacity was development of a remote monitoring platform to support at-home care or early discharge of lower-risk patients with mild/moderate Covid-19 symptoms.
Method(s): The monitoring platform consisted of a patient-facing app + pulse oximeter (Bluetoothconnected Nonin 3230) enabling patients to record symptoms (e.g. breathlessness, diarrhea; severity rated on a 10-point scale), temperature & oxygen saturation (SpO2). Patients were prompted to record measurement 4 times/day. Patient-recorded data was viewed in real time by their healthcare centre via a dedicated web-based monitoring portal. Criteria for remote monitoring included: Covid-19 symptoms, positive for SARS-CoV-2, young age, absence of serious concomitant conditions, need for continued observation post-discharge. Treatment centres emailed app installation instructions and supplied a pulse oximeter to their patients. Treatment centres & patients received alerts if pulse oximetry values crossed pre-defined thresholds.
Result(s): Between 13 March and 31 October 2020, 1,045 patients at 8 primary & 15 secondary care centres had used the remote monitoring platform [median duration: 13 days (interquartile range 10-23 days)]. 11 patients were admitted to hospital and 12 previously hospitalized patients were readmitted. 933 patients (89%) gave consent to use of their pseudonymised data for research. Symptoms and physiological markers of severity of infection varied considerably. 871 patients recorded breathlessness data with 53 rating severity as 6/10 and 23 as 8/10. 300 patients recorded diarrhea data with 24 rating severity as 6/10 and 6 as 8/10 (see Figure). SpO2 data were available for 907 patients. 733 patients reported SpO2 94-96%, 334 reported SpO2 92-93%and 265 patients reported SpO2 <=91% at least once during the monitoring period.
Conclusion(s): Remote monitoring of Covid-19 in appropriate patients can free up in-hospital capacity. The majority of these patients were willing to provide pseudonymised data to support research on Covid-19. .

11. Post COVID-19 remote patient monitoring following discharge from nyc hospital

Authors Copeland D.; Eisenberg E.; Shah N.A.; Powell C.A.; Edwards C.
Source American Journal of Respiratory and Critical Care Medicine; May 2021; vol. 203 (no. 9)
Publication Date May 2021
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Database EMBASE
Available at American Journal of Respiratory and Critical Care Medicine from Ovid (Journals @ Ovid)
Available at American Journal of Respiratory and Critical Care Medicine from Unpaywall

Abstract RATIONALE: Patients discharged after hospitalization for COVID-19 pneumonia are at high risk for readmission and mortality. Early in the pandemic we noted that many patients discharged after initial improvement of their COVID pneumonia were subsequently readmitted with progressive hypoxemic respiratory failure. Therefore, we implemented a remote patient monitoring program to track pulse oximetry, heart rate and dyspnea after COVID- 19 hospitalization. The goal was twofold: to optimize hospital utilization and resources by expeditiously discharging stable patients and to improve patient safety after discharge with continued close monitoring at home.
METHOD(S): Patients were eligible for 90-day remote monitoring if they were being discharged home, could access a smart phone and required supplemental oxygen during hospitalization. Enrolled patients received a Bluetooth enabled Nonin 3230 pulse oximeter and installed a mobile application provided by patientMpower, Ltd. for input of dyspnea symptoms. Patients were prompted to check oxygenation and input symptoms twice daily. Recorded data was transmitted to a monitoring portal; abnormal recordings triggered an alert; all data was reviewed by an APP (Advanced Practice Provider) and patients with alerts were contacted. Responses to alerts included change in medication regimen, adjustment of oxygen delivery, expedited follow-up visit scheduling, and emergency room referral. Remote monitoring data were reviewed at the scheduled post-discharge pulmonologist appointment.
RESULT(S): Between 4/28/20 and 11/30/20, 111 patients at Mount Sinai Hospital were enrolled in the remote monitoring program with 87 (78%) participants providing at least one entry. The mean age was 60 years (SD +/- 14) and 59% were male. The median device usage was 84 days with 64% of patients reporting an oxygen saturation <= 91% during monitoring. 53% of patients reported at least one instance of dyspnea. There were on average 46.4 alerts per month with the majority stemming from oxygen saturations <95% and 49 outreach attempts a month. Table 1 summarizes these data.
CONCLUSION(S): We describe the successful implementation of a remote monitoring program at a tertiary care center in NYC during the COVID-19 pandemic. Our subjective experience is that the ability to remotely monitor patients increased provider comfort when expediting discharges of medically stable patients. The program alerts reflected periods of worsening pulmonary status and triggered interactions that provided more continuous contact between providers and patients. Our next steps are to leverage the data from prolonged monitoring to gain insights into the recovery of COVID-19 patients and to determine factors associated with post discharge readmissions and mortality. .

12. Home spo2 monitoring of patients with covid-19: The mater cvc project

Authors Connolly S.P.; Katolo H.W.; Cronin C.; Creed M.; Lambert J.S.; Cotter A.G.; Muldoon E.G.; Sheehan G.; Coetzee H.; Sharpe A.; O'Connor E.; Farrell J.; Heeney A.; Dempsey S.; McGinty T.
Source Topics in Antiviral Medicine; Mar 2021; vol. 29 (no. 1); p. 289-290
Publication Date Mar 2021
Publication Type(s) Conference Abstract
Database EMBASE
Abstract Background: The COVID19 pandemic has necessitated innovative ways to provide safe healthcare remotely for large numbers of infected patients. We implemented a COVID Virtual Clinic (CVC) in a tertiary referral centre allowing such patients to be monitored in the community. This study describes the CVC's remote monitoring experience and explores the predictors of need for specialist intervention.
Method(s): We included all patients enrolled in the CVC at the Mater Misericordiae University Hospital, Dublin between March 1st and June 1st 2020. Patients received a Bluetooth-enabled pulse oximeter and smartphone application (Patient-M-Power) and uploaded twice-daily SpO2 readings, heart rate and dyspnoea score (1-10). A team of 2-14 healthcare providers monitored results. Abnormal or absent data triggered calls from the CVC, with assessments and/or admission as required. We collected data on demographics, calls received from/made to patients, outcomes and readmissions. Descriptive analysis of the CVC was performed as well as simple logistic regression to explore factors associated with the likelihood of readmission.
Result(s): 502 patients were included (179 (36.4%) male, median age 39 (IQR 50-3) years, 360 (73.2%) staff). Outcomes are illustrated in Figure 1. Median time in CVC was 12 days (IQR 13-10). 1902 calls were made to patients by CVC staff prompted by abnormal data: dyspnoea (41 patients, 8.2%), low SpO2 (133, 26.5%), tachycardia, (99, 19.7%), technical issues (81, 16.1%), absent results (255, 50.1%). This resulted in 45 (9%) patients requiring re-assessment and 42 (8.4%) being readmitted. Of those readmitted, 3 (7%) required critical care admission. Median length of stay was 2 (IQR 6.75-1) days. Those readmitted were more likely to be older (odds ratio [OR] per year older 1.03 (1.01, 1.05), P=0.0050, have an abnormal SpO2 (<94%, OR 5.43 [2.93, 11.1], P<0.001), a high dyspnoea score (>7, OR 4.33 (2.04, 9.3), P<0.001) and be staff (OR 6.08 (3.11, 11.87), P<0.001). Neither gender nor abnormal HR were associated with higher likelihood of readmission. 22.2% of presenting patients were hypoxic in the absence of dyspnoea, of which 70% required admission and one patient required intensive care.
Conclusion(s): We describe the largest remotely monitored cohort of COVID19 patients to date. The low frequency of readmissions and value of SpO2 monitoring and dyspnoea scores as predictors of readmission highlights the value of this model in providing safe care whilst minimising unnecessary admissions.

13. Remote oxygen monitoring for COVID-19 outpatient management

Authors Goodwin R.; Aurora T.; Gertz J.; Gong D.; Lykins J.D.
Source Academic Emergency Medicine; May 2021; vol. 28
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Publication Type(s) Conference Abstract
Database EMBASE
Available at Academic Emergency Medicine from Wiley Online Library
Available at Academic Emergency Medicine from Ovid (Journals @ Ovid)
Abstract Background and Objectives: When patients with COVID-19 are discharged home from the emergency department (ED), it is not clear whether home monitoring programs can improve outcomes such as subsequent hospital admission, intubation, or death. The purpose of this study was to determine whether a home monitoring program designed to track patient's vital signs and symptoms could improve patient outcomes.
Method(s): From March 17 through August 19 2020, we identified COVID-19 positive patients discharged from our ED. On May 15, we started Remote Oxygen Monitoring for COVID Outpatient Management (ROMCOM), a program designed to monitor high risk individuals at home. Enrollees were given a pulse oximeter and were contacted on days 2, 4, 7, 10 and 14 to inquire about symptoms and oxygen levels at rest and with exertion. Patient charts were examined and clinical, demographic, and outcome data were noted. Of particular concern was the need for intubation and mortality. The group of patients that presented before and after the initiation of the ROMCOM program were compared.
Result(s): There were 261 patients, 76 before the initiation of the ROMCOM program and 185 after the initiation of ROMCOM, who were included in our analysis. Demographics including age, gender, race, insurance status, and risk factors such as obesity were not different among the two groups. In the unmonitored group, 14 (18%) returned to the ED for further evaluation, 8 (11%) were admitted, and 5 (7%) required intubation. Although the number of subsequent ED visits and admissions were similar for the group after the initiation of the ROMCOM program (41 [22%] and 19 [10%], respectively), no patients required intubation, which was significantly different than the prior group (p = 0.002). Thirty-day mortality data were available for 42 (55%) of the patients who presented prior to ROMCOM and 84 (45%) after. There were 2 deaths (3%) observed in the before-ROMCOM group and 0 in the after-ROMCOM group (p = 0.08)
Conclusion(s): A protocol supporting close monitoring and early intervention for discharged COVID-19 positive patients has the potential to significantly impact patient outcomes such as decreased need for intubation.

14. Remote management of covid-19 using home pulse oximetry and virtual ward support

Authors Greenhalgh T.; Knight M.; Inda-Kim M.; Fulop N.J.; Vindrola-Padros C.; Leach J.
Source BMJ; Mar 2021; vol. 372
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Publication Type(s) Article
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Available at BMJ (Clinical research ed.) from BMJ Journals
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Available at BMJ (Clinical research ed.) from BMJ Journals
Available at BMJ (Clinical research ed.) from Unpaywall

15. The development and implementation of a virtual discharge ward for patients with covid-19 pneumonia: Data on the first 300 patients

Authors Maghrabi F.; Bazaz R.; Wilson E.; O'Reilly S.; Calisti G.; Richardson R.; Baxter C.; Gorsuch T.; Khan W.; Kane B.
Source Thorax; Feb 2021; vol. 76
Publication Date Feb 2021
Publication Type(s) Conference Abstract
Database EMBASE
Available at Thorax from BMJ Journals
Available at Thorax from Ovid (Journals @ Ovid)

Abstract Introduction There is little described in the current COVID-19 literature about the outcomes of patients discharged from hospital following COVID-19 pneumonia. We describe the rapid establishment of a 'virtual ward' (VW) for followup of patients with a suspected or confirmed diagnosis of COVID-19 pneumonia or pneumonitis upon hospital discharge, characteristics and outcomes for the first 300 patient referrals. Methods Admitted patients with a confirmed/suspected diagnosis of COVID-19 pneumonia/pneumonitis were referred electronically to the VW on discharge. Pulse oximeters were provided if oxygen saturations were <92%. The 'tracking board' was reviewed daily and phone calls carried out to assess patients for symptom improvement, stability or deterioration. If cause for concern was raised, same-day review for the patient at home was arranged via predetermined community pathways or patients were transferred urgently to hospital. Results The M:F ratio was 2:1 and 25% of patients were of black and minority ethnic origin. 71% of patients had at least 1 co-morbidity. 31% of patients were SARS-CoV-2 PCR negative on respiratory tract samples but had high clinical suspicion of COVID-19. 70% of patients had radiological changes on CXR/CT formally reported as being consistent with COVID-19. Median Length of stay (LOS) on the VW was 3.5 days [range 0-19], 85% of patients had a LOS 7 days. Around half (158, 53%) of patients had required oxygen during admission. Pulse oximeters were provided to 31 (10%) of patients. Outcomes are shown in figure 1. Thirty-eight (13%) patients re-attended the Emergency Department; 28 were readmitted; of these, 3 were ventilated for respiratory failure, 5 had increasing oxygen requirements and 8 had confirmed pulmonary embolism. 12 had other reasons for admission. 2 patients readmitted by the VW died, both had underlying terminal diagnoses. Conclusions To our knowledge, this is the first description of the characteristics of patients discharged from UK hospitals with COVID-19. We have demonstrated that a virtual COVID-19 ward allowed early discharge of patients, offering a safety net and reassurance for patients and clinicians at the time of discharge. Use of pulse oximeters allowed for early identification of clinical deterioration, enabling prompt readmission when required.

16. Analysis of an ambulatory care pathway for patients with COVID-19 utilising remote pulse oximetry

Authors Kyriakides J.; Khani A.; Kelly C.; Coleman R.
Source Emergency Medicine Journal; Dec 2020; vol. 37 (no. 12); p. 843
Publication Date Dec 2020
Publication Type(s) Conference Abstract
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Available at Emergency Medicine Journal from BMJ Journals
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Available at Emergency Medicine Journal from Ovid (Journals @ Ovid)
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Abstract Aims/Objectives/Background The safe discharge of COVID-19 patients from the emergency department (ED) is difficult due to uncertainties surrounding the trajectory of the disease course. The infectivity of COVID-19 also limits followup options. A novel pathway consisting of home pulse oximetry with telephone follow-up was created to facilitate safe discharge from the ED of a London district general hospital. The primary objective was to utilise home pulse oximetry to prevent hospital admission. The secondary objective was to identify those requiring further care or investigation. Methods/Design Adult patients with confirmed or suspected COVID-19 with oxygen saturations of between 90-94% who were otherwise suitable for discharge were identified. These patients were discharged from the ED with a pulse oximeter. Oxygen saturations were measured three times a day for seven days. Patients received a structured telephone consultation on days two, five and seven post-discharge from the ED, and a decision was made as to whether further clinical assessment in the ED was necessary. Results/Conclusions Of the twenty patients discharged on the pathway, 85% avoided hospital admission, whilst 15% were re-assessed and subsequently admitted to hospital. 20% of patients required re-assessment in the ED but did not require admission. Home pulse oximetry with telephone follow-up was used to prevent hospital admission in a considerable proportion of patients who would have otherwise been admitted in the absence of this pathway. Telephone follow-up effectively identified patients who required further clinical assessment. Increasing age, the presence of co-morbidities, and pulmonary infiltrates on chest radiograph were more common in the cohort who required re-assessment. This study demonstrates the potential for safe ambulation of a subgroup of patients with COVID-19, whilst identifying practical inclusion criteria which could be replicated in ambulatory units across the UK.

17. COVID-19: Pulse oximeters in the spotlight

Authors Michard F.; Shelley K.; L'Her E.
Source Journal of Clinical Monitoring and Computing; Feb 2021; vol. 35 (no. 1); p. 11-14
Publication Date Feb 2021
Publication Type(s) Editorial
PubMedID 32578070
Database EMBASE
Available at Journal of clinical monitoring and computing from SpringerLink
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Abstract From home to intensive care units, innovations in pulse oximetry are susceptible to improve the monitoring and management of patients developing acute respiratory failure, and particularly those with the coronavirus disease 2019 (COVID-19). They include self-monitoring of oxygen saturation (SpO_2) from home, continuous wireless SpO_2 monitoring on hospital wards, and the integration of SpO_2 as the input variable for closed-loop oxygen administration systems. The analysis of the pulse oximetry waveform may help to quantify respiratory efforts and prevent intubation delays. Tracking changes in the peripheral perfusion index during a preload-modifying maneuver may be useful to predict preload responsiveness and rationalize fluid therapy.

18. More on pulse oximetry for monitoring patients with COVID-19 at home

Authors Quaresima V.; Ferrari M.
Source Annals of the American Thoracic Society; Nov 2020; vol. 17 (no. 11); p. 1496
Publication Date Nov 2020
Publication Type(s) Letter
PubMedID 32866031
Database EMBASE
Available at Annals of the American Thoracic Society from Ovid (Journals @ Ovid)
Available at Annals of the American Thoracic Society from Unpaywall

19. Pulse oximetry for monitoring patients with COVID-19 at home potential pitfalls and practical guidance

Authors Luks A.M.; Swenson E.R.
Source Annals of the American Thoracic Society; Sep 2020; vol. 17 (no. 9); p. 1040-1046
Publication Date Sep 2020
Publication Type(s) Review
PubMedID 32521167
Database EMBASE
Available at Annals of the American Thoracic Society from Ovid (Journals @ Ovid)
Available at Annals of the American Thoracic Society from Unpaywall
Abstract During the ongoing coronavirus disease (COVID-19) pandemic, reports in social media and the lay press indicate that a subset of patients are presenting with severe hypoxemia in the absence of dyspnea, a problem unofficially referred to as "silent hypoxemia." To decrease the risk of complications in such patients, one proposed solution has been to have those diagnosed with COVID-19 but not sick enough to warrant admission monitor their arterial oxygenation by pulse oximetry at home and present for care when they show evidence of hypoxemia. Though the ease of use and low cost of pulse oximetry makes this an attractive option for identifying problems at an early stage, there are important considerations with pulse oximetry about which patients and providers may not be aware that can interfere with successful implementation of such monitoring programs. Only a few independent studies have examined the performance of pocket oximeters and smart phone-based systems, but the limited available data raise questions about their accuracy, particularly as saturation falls below 90%. There are also multiple sources of error in pulse oximetry that must be accounted for, including rapid fluctuations in measurements when the arterial oxygen pressure/tension falls on the steep portion of the dissociation curve, data acquisition problems when pulsatile blood flow is diminished, accuracy in the setting of severe hypoxemia, dyshemoglobinemias, and other problems. Recognition of these issues and careful counseling of patients about the proper means for measuring their oxygen saturation and when to seek assistance can help ensure successful implementation of needed monitoring programs.

20. In Response to "The Novel Use of Home Pulse Oximetry": An Australian Offer of Support

Authors Dutch M.; Knott J.
Source Academic Emergency Medicine; Aug 2020; vol. 27 (no. 8); p. 792
Publication Date Aug 2020
Publication Type(s) Letter
PubMedID 32779809
Database EMBASE
Available at Academic emergency medicine : official journal of the Society for Academic Emergency Medicine from Wiley Online Library
Available at Academic emergency medicine : official journal of the Society for Academic Emergency Medicine from Ovid (Journals @ Ovid)
Available at Academic emergency medicine : official journal of the Society for Academic Emergency Medicine from Unpaywall

21. Patients' perspectives on the use of pulse oximetry at home

Authors Joshi E.; Mann J.; Collins A.; Khor Y.; Mcdonald C.; Goodwin M.; Atkins N.
Source European Respiratory Journal; Sep 2019; vol. 54

Publication Date Sep 2019
Publication Type(s) Conference Abstract
Database EMBASE
Available at European Respiratory Journal from HighWire - Free Full Text
Abstract Although pulse oximeter possession is common among patients with respiratory diseases, their experiences with these devices are unexplored.
Aim(s): To examine knowledge, understanding and usage patterns of pulse oximeters and their impact on selfmanagement.
Method(s): Thirty participants with chronic respiratory diseases (mean age 71 years; 16 females; 60% COPD; 83% on home oxygen) were recruited and completed a structured survey.
Result(s): Pulse oximeters were purchased online (46.7%) or at a pharmacy (40%). Use was self-initiated (56.7%) or recommended by health professionals (16.7%) or family (13.4%). Sixty percent of participants used the device daily. Ninety percent of participants were confident in interpreting the oximeter reading (SpO2) although 20% felt they needed further education. Participants learnt how to interpret a pulse oximeter reading from medical professionals, pulmonary rehabilitation, the internet and through inpatient experiences. Ninety percent of participants often adjusted their activity levels or management, including through titrating oxygen flow rates, according to their measured SpO2. Low readings led participants to limit activities, to increase medications (including opiates), to increase oxygen flow rates and to perform deep breathing exercises. Most participants reported that home use of a pulse oximeter was helpful in judging their physical limitations and provided reassurance and confidence in their disease management.
Conclusion(s): Participants in this study appeared confident in their home use of pulse oximeters. Health professionals should identify patients who use pulse oximeters at home, and ensure that they are able to interpret the readings and, if appropriate, adjust management safely.

22. Can smartphone-based pulse oximeters be used for monitoring patients with chronic obstructive pulmonary disease

Authors Brillante C.; Binder A.; Luo J.; Prieto-Centurion V.
Source American Journal of Respiratory and Critical Care Medicine; 2018; vol. 197
Publication Date 2018
Publication Type(s) Conference Abstract
Database EMBASE
Abstract Background: Home pulse oximetry can allow patients with COPD on supplemental oxygen therapy to self-titrate their oxygen flow rate according to their needs, such as in the postexacerbation period. However, the accuracy of recently available "wellness" pulse oximeters and smartphone-based software pulse oximeter applications (apps) has not been previously evaluated. The objective of this study is to compare the accuracy of these wellness pulse oximeters in patients with COPD. Although developed for recreational purposes, if accurate in clinical populations, these devices could facilitate the development of interventions to manage supplemental oxygen therapy at home.
Method(s): The room air pulse oximetry (SpO_2) of COPD patients was measured using a "wellness" pulse oximeter (Walgreens C20) and three pulse oximeter apps (iCare, SHealth and Pulse oximeter). A pulse oximeter approved by the Federal Drug Administration was used as the reference standard (Nonin Onyx II). Bland-Altman analyses were performed to analyze the mean percent error ([reference standardmeasured]/ reference standard*100%) and 95% confidence interval (CI) between SpO_2 obtained by each pulse oximeter vs. the reference standard. T-tests were used to compare the difference between each pulse oximeter with the reference standard. Retail prices of the various devices were obtained from online sources.
Result(s): The 19 participants with COPD had a mean (SD) SpO_2 of 92.7 (7.2)% as measured by the reference standard. The mean percent error for the various pulse oximeters ranged from -1.8% to +5.7% (Figure). The Walgreens C20 was the most accurate device with a mean (SD) error of -0.2% (2.8%), not significantly different from the reference standard (p=0.83). The Pulse oximeter app had significantly higher measures than the reference standard (mean [SD] error +5.7% [7.0%]. The iCare and SHealth had a mean (SD) error of -3.5% (7.6%) and +1.8% (4.2%), respectively, not significantly different from the reference standard (p>0.05). However, none of the pulse oximeters were able to identify severe hypoxemia (SpO_2<=88% as measured by the reference standard) and only the SHealth and Walgreens C20 were able to identify moderate hypoxemia (SpO_2 80-94%). Commerciallyavailable pulse oximeters ranged from $0 (i.e., software available for download free of cost) to $39.99, significantly lower than the Nonin Onyx II ($350).
Conclusion(s): Commercially-available pulse oximeters have variable levels of accuracy. The Walgreens C20 had a mean error of <1%, further testing is needed prior to routine deployment in clinical settings given its inability to detect severe hypoxemia.

23. TEC4Home heart failure: Using home telemonitoring to decrease ED readmissions and clinical flow

Authors Novak Lauscher H.; Ho K.; Cordeiro J.L.; Bhullar A.; Abu Laban R.; Christenson J.; Harps H.; Hawkins N.; Karim E.; Kim Sing C.; McGavin C.; Mitton C.; Smith T.
Source Canadian Journal of Emergency Medicine; May 2018; vol. 20
Publication Date May 2018

Publication Type(s) Conference Abstract
Database EMBASE
Available at CJEM from ProQuest (Health Research Premium) - NHS Version
Available at CJEM from ProQuest (MEDLINE with Full Text) - NHS Version
Available at CJEM from Unpaywall
Abstract Introduction: Patients with Heart failure (HF) experience frequent decompensation necessitating multiple emergency department (ED) visits and hospitalizations. If patients are able to receive timely interventions and optimize self-management, recurrent ED visits may be reduced. In this feasibility study, we piloted the application of home telemonitoring to support the discharge of HF patients from hospital to home. We hypothesized that TEC4Home would decrease ED revisits and hospital admissions and improve patient health outcomes.
Method(s): Upon discharge from the ED or hospital, patients with HF received a blood pressure cuff, weight scale, pulse oximeter, and a touchscreen tablet. Participants submitted measurements and answered questions on the tablet about their HF symptoms daily for 60 days. Data were reviewed by a monitoring nurse. From November 2016 to July 2017, 69 participants were recruited from Vancouver General Hospital (VGH), St. Pauls Hospital (SPH) and Kelowna General Hospital (KGH). Participants completed pre-surveys at enrollement and post-surveys 30 days after monitoring finished. Administrative data related to ED visits and hospital admissions were reviewed. Interviews were conducted with the monitoring nurses to assess the impact of monitoring on patient health outcomes.
Result(s): A preliminary analysis was conducted on a subsample of participants (n=22) enrolled across all 3 sites by March 31, 2017. At VGH and SPH (n=14), 25% fewer patients required an ED visit in the post-survey reporting compared to pre-survey. During the monitoring period, the monitoring nurse observed seven likely avoided ED admissions due to early intervention. In total, admissions were reduced by 20% and total hospital length of stay reduced by 69%. At KGH (n=8), 43% fewer patients required an ED visit in the postsurvey reporting compared to the pre-survey. Hospital admissions were reduced by 20% and total hospital length of stay reduced by 50%. Overall, TEC4Home participants from all sites showed a significant improvement in health-related quality of life and in self-care behaviour pre-to 90 days post-monitoring. A full analysis of the 69 patients will be complete in February 2018.
Conclusion(s): Preliminary findings indicate that home telemonitoring for HF patients can decrease ED revisits and improve patient experience. The length of stay data may also suggest the potential for early discharge of ED patients with home telemonitoring to avoid or reduce hospitalization. A stepped-wedge randomized controlled trial of TEC4Home in 22 BC communities will be conducted in 2018 to generate evidence and scale up the service in urban, regional and rural communities. This work is submitted on behalf of the TEC4Home Healthcare Innovation Community.

24. A Decision Support System for Tele-Monitoring COPD-Related Worrisome Events

Authors Merone M.; Soda P.; Pedone C.; Incalzi R.A.; Capasso G.
Source IEEE Journal of Biomedical and Health Informatics; Mar 2017; vol. 21 (no. 2); p. 296-302
Publication Date Mar 2017
Publication Type(s) Article
PubMedID 28103562
Database EMBASE
Abstract Chronic Obstructive Pulmonary Disease (COPD) is a preventable, treatable, and slowly progressive disease, whose course is aggravated by a periodic worsening of symptoms and lung function lasting for several days. The development of home telemonitoring systems has made possible to collect symptoms and physiological data in electronic records, boosting the development of decision support systems (DSSs). Current DSSs work with physiological measurements collected by means of several measuring and communication devices as well as with symptoms gathered by questionnaires submitted to COPD subjects. However, this contrasts with the advices provided by the World Health Organization and the Global initiative for chronic Obstructive Lung Disease that recommend to avoid invasive or complex daily measurements. For these reasons this manuscript presents a DSS detecting the onset of worrisome events in COPD subjects. It uses the hearth rate and the oxygen saturation, which can be collected via a pulse oximeter. The DSS consists in a binary finite state machine, whose training stage allows a subject specific personalization of the predictive model, triggering warnings, and alarms as the health status evolves over time. The experiments on data collected from 22 COPD patients tele-monitored at home for six months show that the system recognition performance is better than the one achieved by medical experts. Furthermore, the support offered by the system in the decision-making process allows to increase the agreement between the specialists, largely impacting the recognition of the worrisome events.

25. Home-based overnight transcutaneous capnography/pulse oximetry for diagnosing nocturnal hypoventilation associated with neuromuscular disorders.

Authors Bauman, Kristy A; Kurili, Armando; Schmidt, Shelley L; Rodriguez, Gianna M; Chiodo, Anthony E; Sitrin, Robert G
Source Archives of physical medicine and rehabilitation; Jan 2013; vol. 94 (no. 1); p. 46-52
Publication Date Jan 2013
Publication Type(s) Journal Article
PubMedID 22964272
Database Medline
Available at Archives of physical medicine and rehabilitation from ScienceDirect
Abstract OBJECTIVETo determine the utility of home-based, unsupervised transcutaneous partial pressure of carbon dioxide (tc-Pco(2)) monitoring/oxygen saturation by pulse oximetry (Spo(2)) for detecting nocturnal hypoventilation (NH) in individuals with neuromuscular disorders.DESIGNRetrospective case series analyzed consecutively.SETTINGMultidisciplinary neuromuscular respiratory failure (NMRF) clinic at an academic institution.PARTICIPANTSSubjects (N=35, 68.6% men; mean age, 46.9y) with spinal cord injury (45.7%) or other neuromuscular disorders underwent overnight tests with tc-Pco(2)/Spo(2) monitoring. Fifteen (42.9%) were using nocturnal ventilatory support, either bilevel positive airway pressure (BiPAP) or tracheostomy ventilation (TV).INTERVENTIONSA respiratory therapist brought a calibrated tc-Pco(2)/Spo(2) monitor to the patient's home and provided instructions for data collection during the subject's normal sleep period. Forced vital capacity (FVC), body mass index (BMI), and exhaled end-tidal Pco(2) (ET-Pco(2)) were recorded at a clinic visit before monitoring.MAIN OUTCOME MEASURESDetection of NH (tc-Pco(2) ≥50mmHg for ≥5% of monitoring time). Data were also analyzed to determine whether nocturnal oxygen desaturation (Spo(2) ≤88% for ≥5% of monitoring time), FVC, BMI, or daytime ET-Pco(2) could predict the presence of NH.RESULTSNH was detected in 18 subjects (51.4%), including 53.3% of those using BiPAP or TV. NH was detected in 43.8% of ventilator-independent subjects with normal daytime ET-Pco(2) (present for 49.4%±31.5% [mean ± SD] of the study period), and in 75% of subjects with an elevated daytime ET-Pco(2) (present for 92.3%±8.7% of the study period). Oxygen desaturation, BMI, and FVC were poor predictors of NH. Only 3 attempted monitoring studies failed to produce acceptable results.CONCLUSIONSHome-based, unsupervised monitoring with tc-Pco(2)/Spo(2) is a useful method for diagnosing NH in NMRF.

26. Utility of pulse oximetry in diagnosing pneumonia in nursing home residents.

Authors Kaye, Keith S; Stalam, Malini; Shershen, Wendy E; Kaye, Donald
Source The American journal of the medical sciences; Nov 2002; vol. 324 (no. 5); p. 237-242
Publication Date Nov 2002
Publication Type(s) Evaluation Study Journal Article
PubMedID 12449443
Database Medline
Available at The American journal of the medical sciences from ScienceDirect
Available at The American journal of the medical sciences from Ovid (Journals @ Ovid)
Abstract BACKGROUNDThe differential diagnosis of acute infection in elderly nursing home patients is often difficult. This study evaluated pulse oximetry in pneumonia in this population.METHODSA case-control study was performed in a veteran's nursing home involving 2 analyses: (1) pneumonia patients (case subjects) were compared with patients with nonpulmonary infections (control subjects) at time of acute infection; (2) differences in paired values measured at time of infection versus a noninfected baseline were compared for pneumonia patients and control subjects. Vital signs including pulse oximetry were obtained routinely (at least monthly) and with acute illness.RESULTSOxygen saturations were lower in 45 pneumonia patients than in 22 patients with acute nonpulmonary infections (P < 0.001). An oxygen saturation < 94 gave a sensitivity for pneumonia of 80%, specificity of 91%, and positive predictive value of 95%. The drop in oxygen saturation from the last baseline value was greater in pneumonia patients than in control subjects (P < 0.001). The sensitivity of an oxygen saturation drop >3% from baseline for pneumonia was 73% with specificity and positive predictive values of 100%.CONCLUSIONSPulse oximetry may be very helpful in evaluating acutely infected nursing home residents. The present study suggests that in acutely infected nursing home patients, a decrease in oxygen saturation of >3% from baseline, as well as a single oxygen saturation of <94, should suggest pneumonia. A decrease from baseline of <4% or a single oxygen saturation of 94 or higher suggests that pneumonia is unlikely.

27. Exacerbations in Chronic Obstructive Pulmonary Disease: Identification and Prediction Using a Digital Health System.

Authors Shah, Syed Ahmar; Velardo, Carmelo; Farmer, Andrew; Tarassenko, Lionel
Source Journal of medical Internet research; Mar 2017; vol. 19 (no. 3); p. e69
Publication Date Mar 2017
Publication Type(s) Randomized Controlled Trial Journal Article
PubMedID 28270380
Database Medline
Available at Journal of medical Internet research from Europe PubMed Central - Open Access
Available at Journal of medical Internet research from ProQuest (Health Research Premium) - NHS Version
Available at Journal of medical Internet research from Unpaywall

Abstract BACKGROUNDChronic obstructive pulmonary disease (COPD) is a progressive, chronic respiratory disease with a significant socioeconomic burden. Exacerbations, the sudden and sustained worsening of symptoms, can lead to hospitalization and reduce quality of life. Major limitations of previous telemonitoring interventions for COPD include low compliance, lack of consensus on what constitutes an exacerbation, limited numbers of patients, and short monitoring periods. We developed a telemonitoring system based on a digital health platform that was used to collect data from the 1-year EDGE (Self Management and Support Programme) COPD clinical trial aiming at daily monitoring in a heterogeneous group of patients with moderate to severe COPD.OBJECTIVEThe objectives of the study were as follows: first, to develop a systematic and reproducible approach to exacerbation identification and to track the progression of patient condition during remote monitoring; and second, to develop a robust algorithm able to predict COPD exacerbation, based on vital signs acquired from a pulse oximeter.METHODSWe used data from 110 patients, with a combined monitoring period of more than 35,000 days. We propose a finite-state machine-based approach for modeling COPD exacerbation to gain a deeper insight into COPD patient condition during home monitoring to take account of the time course of symptoms. A robust algorithm based on short-period trend analysis and logistic regression using vital signs derived from a pulse oximeter is also developed to predict exacerbations.RESULTSOn the basis of 27,260 sessions recorded during the clinical trial (average usage of 5.3 times per week for 12 months), there were 361 exacerbation events. There was considerable variation in the length of exacerbation events, with a mean length of 8.8 days. The mean value of oxygen saturation was lower, and both the pulse rate and respiratory rate were higher before an impending exacerbation episode, compared with stable periods. On the basis of the classifier developed in this work, prediction of COPD exacerbation episodes with 60%-80% sensitivity will result in 68%-36% specificity.CONCLUSIONSAll 3 vital signs acquired from a pulse oximeter (pulse rate, oxygen saturation, and respiratory rate) are predictive of COPD exacerbation events, with oxygen saturation being the most predictive, followed by respiratory rate and pulse rate. Combination of these vital signs with a robust algorithm based on machine learning leads to further improvement in positive predictive accuracy.TRIAL REGISTRATIONInternational Standard Randomized Controlled Trial Number (ISRCTN): 40367841; http://www.isrctn.com/ISRCTN40367841 (Archived by WebCite at http://www.webcitation.org/6olpMWNpc).

28. Wearable Finger Pulse Oximetry for Continuous Oxygen Saturation Measurements During Daily Home Routines of Patients With Chronic Obstructive Pulmonary Disease (COPD) Over One Week: Observational Study.

Authors Buekers, Joren; Theunis, Jan; De Boever, Patrick; Vaes, Anouk W; Koopman, Maud; Janssen, Eefje Vm; Wouters, Emiel Fm; Spruit, Martijn A; Aerts, Jean-Marie
Source JMIR mHealth and uHealth; Jun 2019; vol. 7 (no. 6); p. e12866
Publication Date Jun 2019
Publication Type(s) Research Support, Non-u.s. Gov't Journal Article Observational Study
PubMedID 31199331
Database Medline
Available at JMIR mHealth and uHealth from Europe PubMed Central - Open Access
Available at JMIR mHealth and uHealth from ProQuest (Health Research Premium) - NHS Version
Available at JMIR mHealth and uHealth from Unpaywall

Abstract BACKGROUNDChronic obstructive pulmonary disease (COPD) patients can suffer from low blood oxygen concentrations. Peripheral blood oxygen saturation (SpO2), as assessed by pulse oximetry, is commonly measured during the day using a spot check, or continuously during one or two nights to estimate nocturnal desaturation. Sampling at this frequency may overlook natural fluctuations in SpO2.OBJECTIVEThis study used wearable finger pulse oximeters to continuously measure SpO2 during daily home routines of COPD patients and assess natural SpO2 fluctuations.METHODSA total of 20 COPD patients wore a WristOx2 pulse oximeter for 1 week to collect continuous SpO2 measurements. A SenseWear Armband simultaneously collected actigraphy measurements to provide contextual information. SpO2 time series were preprocessed and data quality was assessed afterward. Mean SpO2, SpO2 SD, and cumulative time spent with SpO2 below 90% (CT90) were calculated for every (1) day, (2) day in rest, and (3) night to assess SpO2 fluctuations.RESULTSA high percentage of valid SpO2 data (daytime: 93.27%; nocturnal: 99.31%) could be obtained during a 7-day monitoring period, except during moderate-to-vigorous physical activity (MVPA) (67.86%). Mean nocturnal SpO2 (89.9%, SD 3.4) was lower than mean daytime SpO2 in rest (92.1%, SD 2.9; P<.001). On average, SpO2 in rest ranged over 10.8% (SD 4.4) within one day. Highly varying CT90 values between different nights led to 50% (10/20) of the included patients changing categories between desaturator and nondesaturator over the course of 1 week.CONCLUSIONSContinuous SpO2 measurements with wearable finger pulse oximeters identified significant SpO2 fluctuations between and within multiple days and nights of patients with COPD. Continuous SpO2 measurements during daily home routines of patients with COPD generally had high amounts of valid data, except for motion artifacts during MVPA. The identified fluctuations can have implications for telemonitoring applications that are based on daily SpO2 spot checks. CT90 values can vary greatly from night to night in patients with a nocturnal mean SpO2 around 90%, indicating that these patients cannot be consistently categorized as desaturators or nondesaturators. We recommend using wearable sensors for continuous SpO2 measurements over longer time periods to determine the clinical relevance of the identified SpO2 fluctuations.

29. Accuracy of a portable pulse oximeter in monitoring hypoxemic infants with cyanotic heart disease.

Authors Harris, Bronwyn U; Stewart, Sarah; Verma, Archana; Hoen, Helena; Stein, Mary Lyn; Wright, Gail; Ramamoorthy, Chandra
Source Cardiology in the young; Aug 2019; vol. 29 (no. 8); p. 1025-1029
Publication Date Aug 2019
Publication Type(s) Comparative Study Journal Article Observational Study
PubMedID 31304897
Database Medline
Available at Cardiology in the young from ProQuest (Health Research Premium) - NHS Version
Available at Cardiology in the young from ProQuest (MEDLINE with Full Text) - NHS Version
Abstract OBJECTIVEInfants with single ventricle physiology have arterial oxygen saturations between 75 and 85%. Home monitoring with daily pulse oximetry is associated with improved interstage survival. They are typically sent home with expensive, bulky, hospital-grade pulse oximeters. This study evaluates the accuracy of both the currently used Masimo LNCS and a relatively inexpensive, portable, and equipped with Bluetooth technology study device, by comparing with the gold standard co-oximeter.DESIGNProspective, observational study.SETTINGSingle institution, paediatric cardiac critical care unit, and neonatal ICU.INTERVENTIONSnone.PATIENTSTwenty-four infants under 12 months of age with baseline oxygen saturation less than 90% due to cyanotic CHD.MEASUREMENTS AND RESULTSPulse oximetry with WristOx2 3150 with infant sensors 8008 J (study device) and Masimo LCNS saturation sensor connected to a Philips monitor (hospital device) were measured simultaneously and compared to arterial oxy-haemoglobin saturation measured by co-oximetry. Statistical analysis evaluated the performances of each and compared to co-oximetry with Schuirmann's TOST equivalence tests, with equivalence defined as an absolute difference of 5% saturation or less. Neither the study nor the hospital device met the predefined standard for equivalence when compared with co-oximetry. The study device reading was on average 4.0% higher than the co-oximeter, failing to show statistical equivalence (p = 0.16). The hospital device was 7.4% higher than the co-oximeter and also did not meet the predefined standard for equivalence (p = 0.97).CONCLUSIONBoth devices tended to overestimate oxygen saturation in this patient population when compared to the gold standard, co-oximetry. The study device is at least as accurate as the hospital device and offers the advantage of being more portable with Bluetooth technology that allows reliable, efficient data transmission. Currently FDA-approved, smaller portable pulse oximeters can be considered for use in home monitoring programmes.

30. Reliability of Home Nocturnal Oximetry in the Diagnosis of Overlap Syndrome in COPD.

Authors Lajoie, Annie-Christine; Sériès, Frédéric; Bernard, Sarah; Bernard, Emmanuelle; Santaolalla, Carlos Javier Egea; Abad Fernández, Araceli; Maltais, François; Lacasse, Yves
Source Respiration; international review of thoracic diseases; 2020; vol. 99 (no. 2); p. 132-139
Publication Date 2020
Publication Type(s) Journal Article
PubMedID 31995805
Database Medline
Available at Respiration; international review of thoracic diseases from Ovid (Journals @ Ovid)
Abstract BACKGROUNDChronic obstructive pulmonary disease (COPD) and sleep apnea are common conditions and often coexist. The proper diagnosis of sleep apnea may affect the management and outcome of patients with COPD.OBJECTIVETo determine the accuracy of home nocturnal oximetry to distinguish between nocturnal oxygen desaturation related to COPD alone or to sleep apnea in patients with moderate-to-severe COPD who have significant nocturnal hypoxemia with cyclical changes in saturation.METHODSThis study involved a comparison of home nocturnal oximetry and laboratory-based polysomnography (PSG) in patients with moderate-to-severe COPD considered for inclusion in a trial of nocturnal oxygen therapy. All of the patients had significant nocturnal oxygen desaturation (defined as ≥30% of the recording time with a transcutaneous arterial oxygen saturation <90%) with cyclical changes in saturation suggestive of sleep apnea.RESULTSPSG was obtained in 90 patients; 45 patients (mean age = 68 years, SD = 8; 71% men; mean forced expiratory volume in 1 s [FEV1] = 50.6% predicted value, SD = 18.6%; data from 41 patients) fulfilled the criteria for sleep apnea (mean apnea-hypopnea index = 32.6 events/h, SD = 19.9) and 45 patients (mean age = 69 years, SD = 8; 87% men; mean FEV1 predicted value 44.6%, SD = 15%) did not (mean apnea-hypopnea index = 5.5 events/h, SD = 3.8). None of the patients' characteristics (including demographic, anthropometric, and physiologic measures) predicted the diagnosis of sleep apnea according to PSG results.CONCLUSIONThe diagnosis of sleep apnea in patients with moderate to severe COPD cannot rely on nocturnal oximetry alone, even when typical cyclical changes in saturation are seen on oximetry tracing. When suspecting an overlap syndrome, a full-night, in-laboratory PSG should be obtained.

31. Pulse Oximetry Screening for Critical Congenital Heart Disease after Home Birth and Early Discharge.

Authors Narayen, Ilona C; Blom, Nico A; Bourgonje, Marjolein S; Haak, Monique C; Smit, Marrit; Posthumus, Fennie; van den Broek, Annique J M; Havers, Hester M; te Pas, Arjan B
Source The Journal of pediatrics; Mar 2016; vol. 170 ; p. 188

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PubMedID 26746119
Database Medline
Available at The Journal of pediatrics from ScienceDirect Available to PHE and Local Authority staff
Available at The Journal of pediatrics from Ovid (Journals @ Ovid)
Available at The Journal of pediatrics from Unpaywall

Abstract OBJECTIVESTo assess the feasibility of pulse oximetry (PO) screening in settings with home births and very early discharge. We assessed this with an adapted protocol in The Netherlands.STUDY DESIGNPO screening was performed in the Leiden region in hospitals and by community midwives. Measurements were taken ≥ 1 hour after birth and on day 2 or 3 during the midwife visit. Primary outcome was the percentage of screened infants with parental consent. The time point of screening, oxygen saturation, false positive (FP) screenings, critical congenital heart defects (CCHDs), and other detected pathology were registered.RESULTSIn a 1-year period, 3625 eligible infants were born. Parents of 491 infants were not approached for consent, and 44 refused the screening. PO screening was performed in 3059/3090 (99%) infants with obtained consent. Median (IQR) time points of the first and second screening were 1.8 (1.3-2.8) and 37 (27-47) hours after birth. In 394 infants with screening within 1 hour after birth, the median pre- and postductal oxygen saturations were 99% (98%-100%) and 99% (97%-100%). No CCHD was detected. The FP prevalence was 1.0% overall (0.6% in the first hours after birth). After referral, important noncritical cardiac and other noncardiac pathology was found in 62% of the FP screenings.CONCLUSIONSPO screening for CCHD is feasible after home births and very early discharge from hospital. Important neonatal pathology was detected at an early stage, potentially increasing the safety of home births and early discharge policy.

32. Can overnight portable pulse oximetry be used to stratify obstructive sleep apnea risk in infants? A correlation analysis.

Authors Ehsan, Zarmina; He, Shan; Huang, Guixia; Hossain, Md M; Simakajornboon, Narong
Source Pediatric pulmonology; Aug 2020; vol. 55 (no. 8); p. 2082-2088
Publication Date Aug 2020
Publication Type(s) Journal Article
PubMedID 32501635
Database Medline
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Abstract INTRODUCTIONThere is limited evidence on the accuracy of oximetry in the evaluation of infant obstructive sleep apnea (OSA). We aimed to determine the utility of overnight oximetry to stratify infants at risk for OSA, to determine urgency for definitive screening with an overnight in-laboratory polysomnogram (PSG).METHODSRetrospective single-institution cohort study of infants undergoing PSG and a separate overnight oximetry over an 8-year period. Correlations, using oximetry in both in-hospital (attended) or at-home (unattended) settings, for ODI410 (decrease in oxygen saturation ≥ 4% from baseline, duration ≥ 10 seconds) and ODI40 (duration > 0 second) with the obstructive apnea-hypopnea index (AHIo) were obtained. The area under the curve was calculated, and sensitivity and specificity values have been presented as receiver operating characteristic curves.RESULTSThirty-eight infants were included. The mean (SD) age (months) was 5.7 (3.9) at diagnostic PSG and 5.5 (3.7) at the time of oximetry. The mean AHIo for the entire cohort was 6.7 (6.2). The mean (SD) ODI40 was 8.6 (9.0) and the mean (SD) ODI410 was 5.4 (5.1).The correlation between ODI and AHIo was statistically significant for the cohort (ODI40 vs. AHIo [r = .59, P < .001] and ODI410 vs AHIo [r = .55, P = .0003]). Using an ODI40 cutoff of 3, the sensitivity, specificity, negative predictive value and positive predictive value for diagnosing OSA was: 86%, 40%, 50%, and 80% respectively for an AHIo greater than 2, and 100%, 35%, 100%, and 58% respectively for an AHIo greater than or equal to 5.CONCLUSIONThere is a significant positive correlation between the ODI4 obtained from oximetry and the AHIo obtained from PSG in infants at risk for OSA. An ODI40 greater than 3 may be useful to stratify infants at risk for moderate to severe OSA when used in attended (in-hospital) or unattended (in-home) settings.

33. Effectiveness of telemonitoring integrated into existing clinical services on hospital admission for exacerbation of chronic obstructive pulmonary disease: researcher blind, multicentre, randomised controlled trial.

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Abstract OBJECTIVETo test the effectiveness of telemonitoring integrated into existing clinical services such that intervention and control groups have access to the same clinical care.DESIGNResearcher blind, multicentre, randomised controlled trial.SETTINGUK primary care (Lothian, Scotland).PARTICIPANTSAdults with at least one admission for chronic obstructive pulmonary disease (COPD) in the year before randomisation. We excluded people who had other significant lung disease, who were unable to provide informed consent or complete the study, or who had other significant social or clinical problems.INTERVENTIONSParticipants were recruited between 21 May 2009 and 28 March 2011, and centrally randomised to receive telemonitoring or conventional self monitoring. Using a touch screen, telemonitoring participants recorded a daily questionnaire about symptoms and treatment use, and monitored oxygen saturation using linked instruments. Algorithms, based on the symptom score, generated alerts if readings were omitted or breached thresholds. Both groups received similar care from existing clinical services.MAIN OUTCOME MEASURESThe primary outcome was time to hospital admission due to COPD exacerbation up to one year after randomisation. Other outcomes included number and duration of admissions, and validated questionnaire assessments of health related quality of life (using St George's respiratory questionnaire (SGRQ)), anxiety or depression (or both), self efficacy, knowledge, and adherence to treatment. Analysis was intention to treat.RESULTSOf 256 patients completing the study, 128 patients were randomised to telemonitoring and 128 to usual care; baseline characteristics of each group were similar. The number of days to admission did not differ significantly between groups (adjusted hazard ratio 0.98, 95% confidence interval 0.66 to 1.44). Over one year, the mean number of COPD admissions was similar in both groups (telemonitoring 1.2 admissions per person (standard deviation 1.9) v control 1.1 (1.6); P=0.59). Mean duration of COPD admissions over one year was also similar between groups (9.5 days per person (standard deviation 19.1) v 8.8 days (15.9); P=0.88). The intervention had no significant effect on SGRQ scores between groups (68.2 (standard deviation 16.3) v 67.3 (17.3); adjusted mean difference 1.39 (95% confidence interval -1.57 to 4.35)), or on other questionnaire outcomes. Conclusions In participants with a history of admission for exacerbations of COPD, telemonitoring was not effective in postponing admissions and did not improve quality of life. The positive effect of telemonitoring seen in previous trials could be due to enhancement of the underpinning clinical service rather than the telemonitoring communication.TRIAL REGISTRATIONISRCTN96634935.FUNDINGThe trial was funded by an NHS applied research programme grant from the Chief Scientist Office of the Scottish government (ARPG/07/03). The funder had no role in study design and the collection, analysis, and interpretation of data and the writing of the article and the decision to submit it for publication. NHS Lothian supported the telemonitoring service and the clinical services.

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#	Database	Search term	Results
1	EMBASE	"PULSE OXIMETER"/	4573
3	EMBASE	("monitoring oxygen saturation*").ti,ab	67
4	EMBASE	"OXYGEN SATURATION"/	59561
5	EMBASE	(home).ti,ab	340315
6	EMBASE	"CORONAVIRUS DISEASE 2019"/	143181
7	EMBASE	("chronic obstructive pulmonary disease" OR COPD).ti,ab	120284
8	EMBASE	"HEART FAILURE"/	256837
9	EMBASE	"HEART DISEASE"/	113928
10	EMBASE	"CONGENITAL DISORDER"/	80126
11	EMBASE	"NEWBORN DISEASE"/	21939
12	EMBASE	("neonatal abnormalit*").ti,ab	110
13	EMBASE	("silent hypoxia").ti,ab	28
14	EMBASE	("earl* presentation").ti,ab	2035
15	EMBASE	("reduce* hospital admission*").ti,ab	949
23	EMBASE	(1 OR 3 OR 4)	62724
24	EMBASE	(6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15)	717486
25	EMBASE	(5 AND 23 AND 24)	509
26	EMBASE	25 [DT 2000-2021]	503
27	Medline	("pulse oximeter").ti,ab	2465
28	Medline	("monitor* oxygen saturation").ti,ab	81
29	Medline	("oxygen saturation").ti,ab	28443
30	Medline	(home OR telemonitoring OR remote).ti,ab	315278
31	Medline	"SARS-COV-2"/	78287

32	Medline	"PULMONARY DISEASE, CHRONIC OBSTRUCTIVE"/	43831
33	Medline	"HEART FAILURE"/	127352
34	Medline	"CORONARY DISEASE"/	131620
35	Medline	("heart disease").ti,ab	162390
36	Medline	"CONGENITAL, HEREDITARY, AND NEONATAL DISEASES AND ABNORMALITIES"/	890
37	Medline	"CONGENITAL ABNORMALITIES"/	34940
40	Medline	("silent hypoxia").ti,ab	23
38	Medline	("reduce* hospital admission*").ti,ab	508
39	Medline	("earl* presentation*").ti,ab	1383
41	Medline	(utility).ti,ab	222117
42	Medline	(27 OR 28 OR 29)	29828
43	Medline	(31 OR 32 OR 33 OR 34 OR 35 OR 36 OR 37 OR 40 OR 38 OR 39 OR 41)	749675
44	Medline	(30 AND 42 AND 43)	167
45	Medline	44 [DT 2000-2021]	163